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Arthroplasty-cervical

ID: AGS26/237
P0001: Sex-based differences in outcomes of cervical disc arthroplasty: a propensity-matched cohort study of a large national database

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Introduction: Cervical disc arthroplasty (CDA) is increasingly used to treat cervical disc disease, yet sex-based differences in postoperative outcomes remain underexplored. This study sought to long-term outcomes in males and females undergoing CDA using a propensity score-matched analysis. **Material and Methods:** A retrospective analysis was performed using the TriNetX US Collaborative Network, including 4,381 female and 4,381 male patients undergoing CDA. Propensity score matching was conducted matched by age (46.9 ± 10.4 vs 47 ± 10.6 years, p = 0.8) cervical pathology (e.g. myelopathy, radiculopathy), and baseline chronic comorbidities (e.g. diabetes mellitus, obesity). Outcomes included additional cervical fusion or disc arthroplasty at any level following the index procedure, opioid use, epidural/trigger point injections, repeat advanced imaging, physical therapy evaluations, and CDA removal or revision. All outcomes were assessed from 1-day post-index surgery. Opioid use, PT/OT, and injections were measured up to 2 years after the index surgery. Bonferroni-adjusted significant level was utilized due to multiple comparisons ($p < 0.008$). To explore the relative contributions of demographic variables and comorbidities, a post hoc multivariable Cox proportional hazards analysis was performed. **Results:** Females were more likely to undergo CDA removal or revision (1.2% versus 0.6%; Odds Ratio 1.98 [95% CI: 1.2 to 3.1], p = 0.003). Within 2 years after surgery, females demonstrated higher rates of opioid use (75.7% vs. 71.1%, Odds Ratio 1.27 [95% CI: 1.2 to 1.4], $p < 0.001$), and non-significant difference in PT/OT evaluations (30.9% vs. 28.3%, p = 0.009). There were no significant differences in rates of pain management injections, repeat imaging, additional fusion or CDA after the index procedure. Female sex was independently associated with a significantly higher hazard of revision or removal compared to male sex (HR 1.66 [95% CI: 1.1 to 2.6], p = 0.03). Osteoporosis was found to be the strongest independent predictor (HR 5.11 [95% CI: 2.0 - 13.1], p = 0.001) of revision or removal of CDA. **Conclusion:** In this large, age-matched cohort, female patients demonstrated more CDA removal or revision and more prevalent use of postoperative opioid prescriptions. In post hoc analysis, osteoporosis was identified to be the strongest predictor, which may suggest that although it is being recognized preoperatively (given the ICD diagnosis), it may still affect outcomes after CDA. Future studies should investigate the current epidemiology and efficacy of osteoporosis treatment prior to arthroplasty. It is also important to recognize inherent limitations given the nature of the database utilized (including low granularity of data and dependence on ICD/CPT coding).

ID: AGS26/250
P0002: Imaging of cervical spine motion: a review of current modalities and metrics

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Introduction: Accurate assessment of cervical spine motion is critical for understanding spinal biomechanics, diagnosing instability, evaluating surgical outcomes, and selecting or monitoring motion-preserving interventions such as cervical disc arthroplasty (CDA). Traditional flexion-extension radiographs remain the most widely used technique due to their accessibility and low cost, yet they provide only gross angular measurements, are prone to variability, and offer little information on intervertebral motion quality. Advances in imaging technology now allow for higher-precision, multi-planar, and even three-dimensional motion tracking, promising deeper biomechanical insight and potentially earlier detection of pathological changes. However, these modalities differ markedly in accuracy, radiation exposure, cost, and clinical feasibility. A clear synthesis of their relative strengths, limitations, and ideal use cases is needed to guide both research and clinical adoption. **Material and Methods:** A literature search was conducted in PubMed using key terms addressing techniques of cervical spine motion analysis. Only peer-reviewed English-language studies involving human or cadaveric models and published between 2000 and 2025 were included. **Results:** Seventeen studies were included, spanning static radiography, AI-enhanced radiography, dynamic and model-based fluoroscopy, quasi-static MRI, ultrasound, and radiostereometric analysis (RSA). Static radiographs offer basic end-range assessment but fail to capture true intervertebral motion. AI tools improve reproducibility by automating landmark detection. Dynamic fluoroscopy and biplanar model-based tracking provided high-fidelity motion analysis with millimetric accuracy. RSA enabled precise implant micromotion tracking but required invasive markers. Kinematic MRI integrated soft tissue evaluation with upright posture imaging while ultrasound enables radiation-free outpatient monitoring. **Conclusion:** While advanced motion analysis tools provide more precise insights into cervical biomechanics than static imaging, their routine use will require standardized protocols and proven cost-effectiveness. Advancing the field will depend on methodological harmonization and close collaboration across disciplines.

ID: AGS26/409
P0003: Regression of anterior cervical disc-osteophyte complex following artificial disc replacement

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Introduction: Cervical disc arthroplasty (CDA) has gained popularity as a suitable alternative to ACDF for treatment of anterior cervical compressive pathologies. Regression of anterior cervical disc osteophyte complex after CDA is a less commonly recognized and understood radiological finding, one which was previously only described following fusion. The aim of this study is to describe the regression of anterior cervical disc osteophyte complex following CDA, and discuss its potential clinical significance. **Material and Methods:** A retrospective review of 50 patients (122 levels) who underwent CDA with a minimum of 2-year follow up was conducted. Baseline characteristics, clinical presentation, perioperative details, and postoperative details were collected. Radiological parameters included pre and postoperative global cervical alignment, segmental range of motion, protrusion of cervical disc-osteophyte complex at each vertebral level. Presence of implant subsidence, peri-implant fractures, and heterotopic ossification were also recorded. **Results:** Regression of anterior cervical disc osteophytes was observed in 92 levels (75%) at 3-month postoperatively, 75 levels (61%) at 1-year postoperatively, and 40 levels (33%) at 2-year postoperatively. Mean osteophyte size significantly decreased from immediate postoperative period up to 1-year follow-up ($p < 0.005$), with no significant difference in osteophyte size between 1 and 2-year follow-up. Range of motion of C2-7 and operated functional spinal unit improved throughout all 3 follow-up timepoints. Heterotopic ossification was observed up to 35 levels (28%) at 2-year follow-up. **Conclusion:** Regression of anterior cervical disc-osteophyte complex following CDA suggests stress distribution and restoration of movement in the cervical spine, and may be a useful predictor of satisfactory functional and radiological outcomes.

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P0004: Three-or-more-level cervical disc arthroplasty versus multilevel ACDF: a systematic review and meta-analysis of clinical, radiological, and safety outcomes

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Introduction: The comparative effectiveness of cervical disc arthroplasty (CDA) versus anterior cervical discectomy and fusion (ACDF) for three-or-more-level cervical degenerative disease remains unclear. CDA offers motion preservation, but data at ≥ 3 levels are limited. The aim of this study was therefore to systematically review and critically appraise the literature comparing multilevel CDA with ACDF in degenerative cervical spine disease. By assessing clinical,

radiological, and perioperative outcomes, this review seeks to clarify whether CDA may offer a viable alternative to fusion in this complex subgroup of patients. **Material and Methods:** A systematic review and meta-analysis were performed following PRISMA guidelines. PubMed, Embase, CENTRAL, Scopus, and Web of Science were searched for studies comparing ≥ 3-level CDA and ACDF. Outcomes included NDI, mJOA, VAS neck/arm, segmental and global ROM, cervical lordosis (CL), sagittal vertical axis (SVA), T1 slope, perioperative metrics, complications, and revisions. Random-effects models generated pooled mean differences (MD), risk ratios (RR), and 95% confidence intervals (CI). **Results:** Five retrospective studies (n = 17,529; CDA 3,025; ACDF 14,504) were included. Both groups improved similarly in NDI (MD 1.68, 95% CI -1.48 to 4.83; p = 0.30), mJOA (MD 0.40, 95% CI -0.77 to 1.50; p = 0.49), and VAS neck/arm (p > 0.1). Segmental ROM was better preserved with CDA (MD 10.22°, 95% CI -3.28 to 23.73; p = 0.14). Operated-level lordosis increased (CDA MD -5.55°, p < 0.0001; ACDF MD -5.57°, p = 0.0018), and global CL improved (CDA MD -5.04°, p = 0.03; ACDF MD -4.25°, p = 0.024). SVA and T1 slope were unchanged (all p > 0.05). Operative time was similar; blood loss was slightly higher for CDA (MD 23.2 mL, 95% CI 6.9-39.41; p = 0.005). Overall complications favoured CDA (RR 0.67, 95% CI 0.54-0.84), with lower rates of dysphagia (p = 0.0005), wound complications (p = 0.007), infection (p = 0.03), instrumentation failure (p = 0.01), ED visits (p < 0.0001), readmissions (p = 0.0005), and revisions (p = 0.01); posterior revisions were more frequent after ACDF (0.9% vs 0.5%, p = 0.04). **Conclusion:** In ≥ 3-level cervical surgery, CDA and ACDF achieve comparable symptom relief and alignment. CDA preserves motion and reduces early complications and revisions, supporting its selective use in multilevel degenerative disease.

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P0005: Biomechanical principles of cervical disc arthroplasty: a systematic review of implant design and clinical implications

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Introduction: Cervical disc arthroplasty (CDA) has emerged as a motion-preserving alternative to fusion for degenerative disc disease. While implant designs vary substantially in their biomechanical principles, a comprehensive analysis of how these design features influence clinical outcomes remains lacking. **Material and Methods:** We systematically evaluated 15 clinical and biomechanical studies (2010-2023) comparing CDA devices across three themes: (1) Kinematics & Constraint, (2) Materials & Wear, and (3) Load distribution patterns. Data included range of motion (ROM), wear rates and presence of adjacent segment disease (ASD). **Results:** Constrained designs reduce facet strain but increase adjacent-segment stress, while unconstrained devices replicate native motion at the cost of higher facet loads. Viscoelastic implants offer load dampening but lack long-term osseointegration data. Key trade-offs include material durability (metal-on-polymer vs. metal-on-metal) and fixation methods (keel vs. spike). **Conclusion:** Current CDA designs present fundamental biomechanical trade-offs between motion preservation, facet protection, and adjacent segment unloading. No single implant optimizes all parameters, highlighting the need for: (1) patient-specific design selection based on individual anatomy and biomechanics, (2) advanced materials to address wear and fixation challenges, and (3) long-term studies of next-generation viscoelastic devices. These findings provide a framework for surgeons to evaluate implant designs based on their biomechanical principles.

Keywords: cervical disc arthroplasty, implant biomechanics, adjacent segment disease, motion preservation

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P0006: Long-term clinical and radiological outcomes of multilevel cervical disc arthroplasty

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Introduction: Cervical disc arthroplasty (CDA) has been recognized as a popular option for cervical radiculopathy or myelopathy. Single-level CDA has shown high clinical and radiological efficacy. However, the results of multi-level CDA are contradictory. The purpose of the study is to report our minimum 5-year clinical and radiographic outcomes, as well as complications of the multi-level CDA with cervical disk herniation. **Material and Methods:** Sixty-eight cases underwent CDA between 2012 and 2020. Of those, sixty-one patients (89.7%) had surpassed the minimum 5-year follow-up

and were included in the retrospective study (n = 33 two-level and n = 28 three-level). Clinical and radiological data were obtained preoperatively, at 1-year and 78 (65;89) months postoperatively. Outcome measures collected and included neck and arm pain, quality of life, intraoperative and postoperative complications and revision rates. Additionally, cervical lordosis, segmental mobility, heterotopic ossification, index and adjacent segment degeneration were analyzed. **Results:** VAS, NDI and SF-36 scores showed significant improvement compared to baseline. From preoperatively to minimum 5 years postoperatively, mean NDI decreased from 64.8 to 11.9, mean neck pain decreased from 65.1 to 2.7, mean arm pain decreased from 72.2 to 1.3, mean PCS increased from 21.7 to 43.6, and mean MCS increased from 28.3 to 45.6. Patient satisfaction exceeded 89% 5 years after surgery. The average ROM of the operated, upper and lower adjacent segments increased significantly at the final FU. The IDH (intervertebral disc height) of the index level had a tendency to significantly increase. The IDH of adjacent levels were not significantly affected by the surgery. Mean cervical lordosis was increased at the final follow-up. Three patients after two-level CDA and n = 28 five patients after three-level CDA demonstrated minimal radiographic adjacent segment degeneration (ASD), but no patient had symptomatic ASD requiring reoperation. Heterotopic ossification was detected in 73/150 (48.7%) operative segments. Four (6.5%) patients (three patients after two-level CDA and one patient after three-level CDA) underwent secondary surgery. **Conclusion:** This study suggests that multilevel CDA is a safe and effective treatment for patients with cervical disk herniation at a minimum 5 years postoperatively.

ID: AGS26/1464
P0007: Deviation of spinous processes in the adult cervical spine

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Introduction: During arthroplasties, where midline placement of the artificial disc is crucial for proper biomechanics, some surgeons may use the spinous processes (SPs) as directly visualized intraoperative guides or as confirmation for accurate midline disc placement through fluoroscopy. However, previous studies and clinical practice have shown that the SPs of the cervical spine can have varying degrees of offset from true midline, although none have directly evaluated this in detail. This study aims to investigate the lateral and angular deviation of cervical SPs to determine their utility as midline markers in spine surgery. **Materials and Methods:** Adult patients who visited a university-affiliated academic medical center between December 2020 and February 2024 were included if they had available preoperative CT scans of the cervical spine prior to disc surgery with hardware placement. Patients were excluded if they had previous hardware, underwent prior surgery that involved trauma to or removal of any SP, or had CT evidence of ossification of the posterior longitudinal ligament. The angle of SP deviation was measured by determining the angle between an anteroposteriorly drawn midline through the vertebral body and a line drawn from the anterior canal to the tip of the SP. For lateral deviation, the distance between the vertebral midline and a parallel line connected to the SP tip was measured. The uncinate processes were used to adjust for any rotation in the image. The two-sample t-test was used to compare results between relevant demographic groups. This study was approved by an institutional review board (HS-23-00758). **Results:** Of 62 patients who met inclusion criteria, the average age was 60.7 years, with 64.5% males. The average angular deviation from midline for each cervical level was 2.94˚ for C3, 3.52˚ for C4, 3.50˚ for C5, 4.31˚ for C6, and 3.53˚ for C7. The average lateral deviation from midline for each level was 1.38 mm for C3, 1.56 mm for C4, 1.67 mm for C5, 2.37 mm for C6, and 2.51 mm for C7. C7 was found to have the largest variation between individuals both for angular deviation (SD = 2.86˚) and for lateral deviation (SD = 2.52 mm), and C3 showed the smallest variation in both angular deviation (SD = 2.06˚) and in lateral deviation (SD = 1.03 mm). There were no significant differences at any level for angular deviation or lateral deviation when results were compared between sexes ($p > 0.05$ for all). **Conclusion:** In adults, there is marked variability in the orientation and position of the cervical SPs both within and between patients, with C3 having the smallest variability and C7 having the greatest variability between individuals. As such, the cervical SPs, especially C6 and C7, are not reliable indicators of vertebral midline from an operative standpoint. In conclusion, in spine procedures such as disc arthroplasty, the SPs should not be considered as reliable indicators of vertebral midline when gauging proper artificial disc placement and positioning.

ID: AGS26/1484
P0008: Rising adoption of off-label three-level cervical disc replacement: trends and predictors

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Introduction: Anterior cervical discectomy and fusion (ACDF) remains the standard of care for multilevel cervical

pathology but carries increased risk of pseudarthrosis and adjacent segment disease, which may necessitate reoperation. Cervical disc replacement (CDR) with its motion-preserving properties has demonstrated advantages over ACDF for one- and two-level procedures, yet three-level CDR remains off-label and understudied. This study aims to evaluate national utilization trends and identify predictors of three-level CDR. **Material and Methods:** Patients undergoing three-level CDR or ACDF from 2015 to April 2023 were identified in the PearlDiver national database via CPT codes. Patients with trauma, malignancy, or infection were excluded. Primary outcomes included annual utilization trends for three-level CDR and ACDF. Percent change in utilization was calculated annually by comparing to the previous year and by comparing each year to 2015. Secondary outcomes compared demographic and procedural characteristics between cohorts. Multivariable logistic regression was performed to identify independent predictors of undergoing three-level CDR, adjusting for age, gender, and Elixhauser Comorbidity Index (ECI). **Results:** Among 82,458 included patients, 3,986 (4.8%) underwent three-level CDR and 78,472 (95.2%) underwent three-level ACDF. CDR patients were younger (50.0 vs 58.7 years, $p < 0.001$), more likely male (47.5% vs 45.8%, p-0.028), had fewer comorbidities (ECI 3.29 vs 4.73, $p < 0.001$), and higher household incomes ($84,959 vs $78,521, $p < 0.001$). Three-level CDR utilization increased 197.9% from 2015 to 2022, with an average annual growth rate of 18.8%. In 2015, three-level CDR accounted for 1.84% of all three-level anterior cervical procedures, rising to 6.13% by 2022. In contrast, three-level ACDF utilization declined from 2015 to 2018 and plateaued thereafter. Multivariable analysis identified independent predictors of three-level CDR, including age < 40 years (aOR 3.47), male gender (aOR 1.14), cervical radiculopathy diagnosis (aOR 1.27), outpatient surgery (aOR 3.71), Midwest (aOR 1.19) or West region (aOR 2.32), higher education level (aOR 1.46), surgery by an orthopaedic surgeon (aOR 1.75), commercial insurance (aOR 1.65), and household income > $75,000 (aOR 1.42) (all $p < 0.001$). **Conclusion:** Off label three-level CDR utilization has grown markedly since 2015. Its use is associated with younger, healthier, and socioeconomically advantaged patients, while older patients and those with public insurance are more likely to undergo ACDF. These findings highlight emerging disparities in access to this motion-preserving surgery, which may provide added benefit in younger patients. The rapid growth and socioeconomic disparities underscore the urgent need for prospective studies and regulatory review to guide coverage policies and ensure equitable access to this evolving surgical option.

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P0009: The outpatient migration of cervical disc arthroplasty: national trends in medicare volume and payments between 2016 and 2022

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Background Context: Cervical disc arthroplasty (CDA) has gained popularity as a motion-preserving alternative to anterior cervical discectomy and fusion (ACDF) for treating cervical degenerative disc disease. As outpatient spine surgery expands, little is known about how Medicare reimbursement for CDA varies across settings, provider types, and geographic regions. The purpose of our study is to evaluate national trends in Medicare utilization and reimbursement for CDA, comparing inpatient and outpatient settings, provider types, and geographic regions. **Methods:** This retrospective study utilized CMS Medicare Part A and Part B claims filed from 2016 and 2022 for Medicare beneficiaries undergoing single or multilevel CDA. Procedures were identified using Healthcare Common Procedure Coding System (HCPCS) and Medicare Severity Diagnosis Related Group (MS-DRG) codes. In Medicare B datasets, CPT code 22856 was used to identify single level and 22858 for multilevel add-ons. In Medicare part A, MS-DRG code 581 was to use to identify inpatient claims. Primary outcomes were annual procedural volume and mean inflation-adjusted Medicare reimbursement by setting, provider type, region, and rural-urban classification. Inflation-adjusted payments and procedure counts were analyzed using descriptive statistics, linear regression, ANOVA, and t-tests. Subgroup comparisons included region, provider type, and core-based statistical area (CBSA) classification. Statistical significance was set at the $P < 0.05$ level. **Results:** Outpatient single-level CDA volume increased by 1,016% from 2016 to 2022, while inpatient CDA volume decreased by 90.3%. Outpatient reimbursement for single-level CDA rose from $1,459 to $3,143 ($p = 0.011$) and multilevel add-ons declined from $470 in 2017 to $397 in 2022 (15% decrease; $p = 0.029$). On the other hand, inpatient

reimbursement increased from $24,956 to $32,679 (p = 0.025). Regional and rural-urban variation was observed, with the West consistently demonstrating higher reimbursement and volume for both outpatient and inpatient CDA. Reimbursement was significantly higher in ASCs than surgeon-only claims ($11,869.58 vs. $1,219.28; p < 0.001), and in inpatient settings compared to surgeons ($28, 132.00 vs. $1,219.28; p < 0.001). **Conclusion:** CDA procedure is more commonly being performed the outpatient setting, a pattern that matches general spine surgery trends. This outpatient shift is multifactorial and involves the increase in safety, policy changes, and decrease in overall operational costs in ambulatory surgical centers compared to those in hospitals. However, there is marked differences in Medicare reimbursement across provider types and regions. This matches the disparities associated with other spine procedures. Low reimbursement rates in more rural communities may dissuade CDA-capable outpatient facilities from offering it and thus provide a barrier to patients. These findings underscore the importance of setting-specific reimbursement policy in promoting access and value in spine surgery.

ID: AGS26/1963
P0009.1: Morbi-mortality of prevascular anterior cervical spine approach in multilevel disc replacement: a retrospective analysis of 3-4 level vs. 1-2 level surgeries in an academic cohort.

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Introduction: The prevascular anterior cervical approach via cervicotomy is a well-established technique for the treatment of cervical spine disorders. While 1- to 2-level anterior cervical disc replacement is well-documented, some patients with multi-level discopathies may require 3- to 4-level disc surgeries. The objective of the present study is to compare the epidemiology of complications associated with 1-2 level versus 3-4 level anterior cervical spine surgeries. Our hypothesis was that the morbi-mortality of prevascular anterior cervical spine approach in multilevel disc replacement 3-4 Level was not higher than 1-2 level surgeries. **Material and Methods:** In December 2024, we conducted a retrospective monocentric study on patients included in an academic cohort who underwent cervical total disc replacement (cTDR) surgery for cervical discopathy using the prevascular anterior approach and with a minimum follow-up of one year. Intraoperative parameters recorded were the number of discectomies performed, type of cTDR used, total time of surgery, total operative time, intraoperative blood loss, and need for transfusion. Perioperative complications, including vascular, esophageal, or laryngeal injuries, as well as neurological symptoms, were also documented. Postoperative assessment included length of hospital stay, hematologic parameters (hemoglobin and hematocrit levels at postoperative days 0, 1, and discharge), need for transfusion, hemoglobin drop, and estimated blood loss. Additionally, rehospitalization and approach-related complications persisting at one year were evaluated. **Results:** Demographic characteristics of both groups were statistically comparable. The 3- or 4-level group had a significantly longer operative duration (112.8 ± 27.1 min vs. 72.9 ± 19.9 min, p < 0.001) and operating room occupancy time (213.3 ± 31.6 min vs. 162.2 ± 31.8 min, p < 0.001). No intraoperative complications or blood transfusions were recorded in either group. Hemoglobin decreases during hospitalization did not significantly differ between groups (2.3 ± 6.8 g/dl vs. 1 ± 1.04 g/dl, p = 0.28). Postoperative complications were rare and comparable. **Conclusion:** Apart from the longer operative duration, no significant differences were observed between the two groups. Anterior cervical surgery at 3–4 levels appears to be a reliable and effective approach, with rare complications comparable to those observed in 1–2 level surgeries.

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P0009.2: Mid-Term Clinical and Radiological Outcomes of Multi-Level Cervical Total Disc Replacement Using Prodisc-C Vivo: A Single-Center Retrospective Cohort Study.

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Introduction: Cervical degenerative disc disease (cDDD) is a progressive condition influenced by aging and mechanical stress, presenting as axial neck pain, radiculopathy, myelopathy, or a combination thereof. It is a leading cause of disability worldwide. Management follows a stepwise approach, beginning with conservative treatment—education, activity modification, medications, and interventional pain management. When non-surgical interventions fail, surgery is indicated to alleviate symptoms, prevent further structural deterioration, and improve quality of life. Anterior cervical discectomy and fusion (ACDF) has been the gold standard for decades; however, total disc replacement (TDR) has emerged as a promising alternative. The Prodisc-C Vivo (Centinel Spine, USA) has shown favorable safety and efficacy profiles in treating symptomatic cDDD. Nonetheless, concerns remain regarding heterotopic ossification (HO) and adjacent segment disease

(ASD). We hypothesized that strict surgical protocol and patient selection would result in favorable outcomes with multi-level cervical TDR (cTDR) using the Prodisc-C Vivo. **Material and Methods:** In August 2025, we conducted a retrospective single-center study of patients undergoing cTDR with Prodisc-C Vivo via a cervical anterior pre-vascular approach. Inclusion criteria included cervicobrachial neuralgia due to cDDD, refractory to ≥6 months of conservative treatment, and ≥1 year of postoperative follow-up. Clinical and radiological data were collected preoperatively and at 1, 2, and 5 years postoperatively. Evaluated outcomes included VAS-Neck, VAS-Arm, Neck Disability Index (NDI), segmental lordosis, range of motion, incidence of HO, ASD, and complication/reoperation rates. **Results:** A total of 57 patients were included (29 female [51%], 28 males [49%]; mean age 50 ± 8.7 years; mean BMI 25.2 ± 3.7 kg/m^2). Procedures included: 13 one-level, 27 two-level, 13 three-level, and 4 four-level cTDR. VAS-Neck improved from 6.28 ±1.5 pre-op to 1.6 ±1.2 post-op, 0.14 ±0.5 at 1 year, 0.25 ±7.5 at 2 years, and 1.6 ±1.8 at 5 years ($p< 0.05$). VAS-Arm improved from 6.61 ±1.2 pre-op to 0.5 ±1 post-op, 0.3 ±0.9 at 1 year, 0.35 ±0.9 at 2 years, and 1.5 ±2.8 at 5 years ($p< 0.05$). NDI improved from 23.04 ±5.3 pre-op to 11.06 ±3 post-op, 2.76 ±2.5 at 1 year, 2.86 ±3 at 2 years, and 6.8 ±8.8 at 5 years ($p< 0.05$). Segmental lordosis improved from -3.2° pre-op to 15.9° at 1 year, 11.4° at 2 years, and 9.1° at 5 years ($p< 0.05$). Range of motion decreased from 43.7° pre-op to 36.9° at 1 year, 41° at 2 years, and 39° at 5 years. Cranial ASD was 0% at 1 year, 14% at 2 years, and 30% at 5 years. HO incidence at final follow-up was 25%, with high-grade (III-IV) HO in 10%. There were no vascular, neurological, or implant-related complications. One patient underwent reoperation for adjacent segment syndrome at 4 years postoperatively. **Conclusion:** This study confirms the hypothesis that multi-level cTDR using Prodisc-C Vivo provides favorable mid-term clinical and radiological outcomes, with significant improvements in pain and function, low complication and reoperation rates, and acceptable rates of HO and ASD up to 5 years. Strict surgical technique and careful patient selection are key factors in achieving successful outcomes.

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P0010: Five-year prospective analysis of cervical viscoelastic total disc replacement: clinical and radiographic outcomes in a Jamaican population

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Introduction: Cervical degenerative disc disease leads to axial pain, radiculopathy, and myelopathy when conservative care fails. Fusion is effective but sacrifices motion and can accelerate adjacent segment degeneration. Viscoelastic total disc replacement was designed to preserve motion through elastic load sharing and to reproduce near-physiologic kinematics. Evidence from Caribbean health systems is limited. This prospective series reports medium term clinical and radiographic outcomes after viscoelastic cervical disc replacement in a Jamaican cohort, with attention to pain relief, disability, segmental motion, fixation stability, and heterotopic ossification observed on delayed imaging. **Materials and Methods:** Consecutive patients with symptomatic degenerative cervical disc disease and imaging correlation underwent single or multilevel viscoelastic cervical disc replacement at a single center. Inclusion required failure of nonoperative management. Exclusion included instability, osteoporosis, or prior fusion at the index level. Clinical endpoints were Neck Disability Index and Visual Analogue Scale for neck and arm pain. Radiographic review assessed implant position, migration, subsidence, segmental range of motion on flexion extension radiographs, and heterotopic ossification grading on follow up imaging. Patients were followed at standard intervals through two and five years, with extended radiographic review available to eight years in selected cases. Descriptive statistics summarized outcomes over time. **Results:** Six patients underwent fourteen level arthroplasty across C3 to C7. Five were female and one was male, mean age 53 years. Mean intraoperative blood loss was 41.7 mL. All patients were discharged within forty-eight hours. Neck Disability Index improved from a preoperative mean of 67.3 to 16 at two years, with durable improvement at five years. Visual Analogue Scale for pain improved from 9.5 preoperatively to 1.8 at two years and remained improved at five years. No revision procedures were required. One patient experienced a traumatic event with anterior translation that did not require surgery and resolved without loss of fixation. Delayed imaging showed heterotopic ossification in some treated levels, including high grade changes in selected segments. Inventory limitations at the time led to occasional size mismatch and anterior overhang; these placement issues did not compromise implant stability or clinical recovery in this series. **Conclusion:** Viscoelastic cervical disc replacement provided sustained pain relief, disability reduction, and segmental motion preservation in this Jamaican cohort at five

years. Implants remained stable without migration, and no revision procedures were necessary. Heterotopic ossification was observed on late imaging but did not adversely affect fixation or the favorable clinical course. These outcomes support viscoelastic arthroplasty as a motion preserving option where fusion is undesirable and provide early regional data relevant to practice in resource constrained settings.

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P0011: Outcome of three levels prefilled cervical interbody fusion without plates after anterior cervical discectomy

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Backgrounds: Prefilled Cervical interbody fusion by synthetic bone without plate Facilitates the retention of physiological lordosis and cervical spine stability in patients who have undergone cervical discectomy by anterior approach, a secure and efficacious treatment for disc herniation or spondylosis. Several spine specialists advocate the incorporation of a plate system to boost outcomes. According to literature findings, surgery involving three levels results in reduced fusion rates. **Patient & Methods:** Sixty-three person with cervical radicular pain and nine with myelopathy underwent anterior discectomy and fusion with prefilled or (Impregnated) cervical cages by anterior approach between July 2012 and June 2022 were included in the study without using plate systems. There was a total of 72 individuals, comprising of 48 males and 24 females, whose average age amounted to 54.33 years, falling within a range of 33 to 73 years, In variable hospitals of Erbil city. All cases took (an MRI), and 35 among them also took a C-Scan for preoperative assessment. **Results:** All cases exhibited improvement in radiculopathy following surgery. However, myelopathy persisted in only three patients. After 12 months, 96% of patients demonstrated the fusion of surgically treated discs, as confirmed by an X-ray of the cervical spine region. Cervical lordosis was reinstated in nearly all patients who had lost it prior to the operation. No complications stemming from cage extrusion were reported and there were no instances of symptomatic pseudarthrosis. **Conclusions:** The inclusion of impregnated interbody fusions serves to impart a load-sharing capability and enhance spinal stability, thereby resulting in augmented segmental stiffness. This, in turn, leads to similar fusion rates as those elicited by bone grafts, even in cases of cervical degenerative disease spanning three levels.

Keywords: Cervical disc, Anterior discectomy, cervical intervertebral body cage fusion

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P0012: Cervical disc replacement in cervical myelopathy: clinical insights from a retrospective study

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Introduction: The role of cervical disc replacement in radiculopathy is well established. However, its application in management of cervical spondylotic myelopathy (CSM) remains unclear. The objective of this study was to evaluate the neurological and functional outcomes of cervical disc replacement in patients with CSM. **Material and Methods:** We conducted a retrospective observational study of 15 consecutive patients (mean age 48.1 ± 9.4 years; 11 males, 4 females) who underwent single or two-level cervical disc replacement for CSM between January 2010 and January 2024. Diagnosis was based on clinical findings and MRI evidence of cord compression. Outcomes were assessed using the modified Japanese Orthopaedic Association (mJOA) score, Neck Disability Index (NDI), and Visual Analog Scale (VAS) for neck-pain at baseline, 6 weeks, 6 months, 1 year post-operatively. **Results:** Out of 15 patients, 14 patients underwent single level CDR, and 1 patient underwent a two-level CDR. Mean mJOA improved from 11.7 ± 1.0 to 15.7 ± 1.0 at 12 months ($p < 0.05$). NDI scores decreased from 25.0 ± 1.8 at baseline to 7.8 ± 0.6 at 12 months. VAS-neck pain improved from 5 to 2. No neurological deficit or complications were observed. All patients demonstrated significant improvement in neurological and functional outcomes. **Conclusion:** Cervical disc replacement is a safe, effective option in selected CSM patients, providing neurological recovery, pain relief, functional improvement, and motion preservation.

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P0013: Feasibility of one to four level cervical viscoelastic total disc replacement in an emerging country: a pilot study

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Introduction: Cervical total disc replacement aims to preserve motion and reduce the burden of adjacent segment degeneration associated with fusion. Traditional articulating devices can develop heterotopic ossification and non-physiologic kinematics. Viscoelastic total disc replacement seeks to address these limitations by incorporating an elastic core that shares load and allows controlled motion. Evidence for multilevel use in emerging health systems remains limited. This pilot study reports feasibility and two-year outcomes for one to four level viscoelastic cervical arthroplasty. **Materials and Methods:** Six consecutive patients with symptomatic degenerative disc disease underwent viscoelastic total disc replacement at one to four levels between C3 and C7. Outcomes included Neck Disability Index, Visual Analogue Scale for neck and arm pain, and segmental range of motion on flexion extension radiographs. Radiographic review assessed implant position, stability, and the presence of heterotopic ossification. Patients were evaluated at standard intervals to twenty four months. Nonparametric statistics assessed change from baseline with significance at $p < 0.05$. **Results:** Fourteen implants were placed across the cohort of six patients ($n = 6$). Mean intraoperative blood loss was 41.7 mL. All patients were discharged within forty-eight hours and reported early symptom relief. No intraoperative or postoperative complications occurred, and no revision procedures were required during follow-up. At two years, Neck Disability Index improved from 67.3% to 16% ($p < 0.001$), and Visual Analogue Scale improved from 9.5 to 1.83 ($p = 0.013$). Segmental motion was preserved at all treated levels. Radiographs showed stable implant positioning without heterotopic ossification, osteolysis, or migration. **Conclusion:** Single and multilevel viscoelastic cervical arthroplasty was feasible and effective in this pilot series, with significant improvement in pain and disability, preserved motion, and no adverse radiographic findings through two years. These results justify larger studies and longer follow up to define durability and comparative effectiveness against fusion in multilevel disease.

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P0014: Non-tobacco nicotine dependence is associated with higher rates of hospitalizations following cervical disc arthroplasty surgery

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Introduction: Symptomatic cervical radiculopathy and myelopathy have historically been treated with the anterior cervical discectomy and fusion (ACDF) procedure, which has reliably achieved decompression and stabilization of the cervical spine. However, pseudoarthrosis and iatrogenic adjacent segment disease associated with fusion procedures remain significant complications, resulting in increasing interest in motion-preserving procedures, including cervical disc arthroplasty (CDA). The association between non-tobacco nicotine dependence (NTND) and complications following CDA has yet to be explored. The goal of this study is to examine the association between NTND and the incidence of adjacent segment disease, heterotopic ossification, implant failure, revision surgery, dysphagia, post-operative infections, and other perioperative complications in patients undergoing CDA. **Material and Methods:** TriNetX, a global health research network, was queried from 2004-2024 for patients undergoing single or multi-level CDA (CPT 22856, 22858) and who had documented pre-operative nicotine dependence (ICD10 F17) excluding cigarette, chewing tobacco, and other tobacco product dependence (ICD10 F17.21, F17.22, F17.29). Analysis included chi-squared tests with a control cohort propensity score matched for age, sex, race, smoking, diabetes, BMI, and uremia. The control cohort had coded negative history of nicotine use or dependence (ICD10 Z87.981, F17). Outcomes of interest were DVT, emergency department (ED) visits, inpatient hospitalization, opioid abuse, PE, sepsis, surgical site infection, and wound complications within 90 days, and pseudoarthrosis, adjacent segment disease, dysphagia, heterotopic ossification, implant failure, and revision within 2 years post-operation. **Results:** A total of 514 patients with NTND were compared to propensity matched controls. After matching, patients were 45.6 ± 10 years old, 50% male, 77% white, 12% diabetic, and 38%

obese. Pre-operative NTND was significantly associated with increased odds of inpatient hospitalization (OR 1.70, CI 1.02-2.83) within 90 days, and pseudoarthrosis (OR 3.34, CI 1.68-6.66). Odds of DVT, PE, post-operative SSI, wound complications, ED visits, inpatient hospitalization, sepsis, adjacent segment disease, implant failure, dysphagia, heterotopic ossification, revision surgery, and opioid abuse within 2 years were not significant. **Conclusion:** This cohort study of patients undergoing CDA found that those with a history of NTND had higher rates of pseudoarthrosis and inpatient hospitalizations compared to those with no history of nicotine use. These findings suggest that NTND may significantly impact rates of postoperative complications leading to hospitalization and pseudoarthrosis following CDA, and further prospective research is needed to confirm these results and explore the underlying mechanisms.

ID: AGS26/2807
P0015: Beyond fusion: cervical disc arthroplasty for traumatic cervical disc herniation - A case series

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Introduction: Traumatic disc herniations often result from acute injuries, such as motor vehicle accidents, falls, or sports-related trauma, leading to sudden displacement of disc material that compresses neural structures. The traditional gold standard for surgical management is anterior cervical discectomy and fusion (ACDF). Cervical disc replacement (CDR), also known as cervical arthroplasty, has emerged as a motion-preserving alternative to fusion, which is designed to maintain segmental mobility while addressing neural compression. Theoretically, CDR can minimize the potential for future adjacent-segment diseases. Currently, CDR is primarily used for degenerative diseases. Herein, we report two cases of traumatic cervical disc herniation treated with CDR. **Material and Methods:** This study presents two case reports of patients who underwent cervical disc replacement (CDR) for traumatic cervical disc herniation. The cases were selected from a single institution's surgical database, Primaya Hospital Bekasi Timur, Indonesia. All surgical procedures were performed by two spine surgeons. We used CDR ROTAIO® in both patients. We evaluated the alignment and range of motion of the patients. **Results:** The first case is a 32-year-old female patient was injured in a traffic accident with cervical disc herniation and facet tear at level C5-C6. The patient complained of axial pain with a visual analog scale (VAS) 7-8. There was no radiculopathy or myelopathy. The alignment before surgery was kyphotic with C2-C7 alignment using Harrison's method of 5.608°-C5-C6 alignment of 5.742°. We used a CDR ROTAIO® with a height of 5 mm, width of 15 mm, and depth of 13 mm. Post surgery C2-C7 alignment improve to 7.29° and C5-C6 to 3.31°. The postoperative range of motion (ROM) was 46.91°. Postoperatively, there was no pain or complications. The mJOA score improved from 16 to 17, and the NDI score improved from eight to zero. The second case was a 31-year-old male patient who was injured while playing basketball and presented with cervical disc herniation at C4-5 and C5-6. The patient complained of axial pain with a VAS 6-7. There was radiculopathy with dermatomal C5 on both sides. The alignment before surgery was normal with a C2-C7 alignment of 16.8°. We used a CDR ROTAIO® with a height of 5 mm, width of 15 mm, and depth of 13 mm for C4-5, and a height of 5 mm, width of 17 mm, and depth of 13 mm for C5-6. Postoperatively, there was no pain or complications. The mJOA score improved from 15 to 18, and the NDI from nine to zero. **Conclusion:** Cervical disc replacement is a viable option for traumatic cervical disc herniation with intact facets. In this report, there was an improvement in the clinical and radiological findings. Further studies and long-term follow-up are required.

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P0016: Revision cervical disc arthroplasty and cutibacterium acnes infection: a systematic review

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Introduction: Cervical disc arthroplasty (CDA) is commonly performed as an alternative to fusion in selected patients. While outcomes are generally favourable, concerns regarding implant longevity and revision surgery are emerging. Though the indications for such revisions is multifactorial, the concern of deep prosthetic infection always is at the forefront. Evidence suggests Cutibacterium acnes (C. acnes) as overwhelmingly the most common single organism cultured in revision spine surgery. This slow growing, gram-positive anaerobic bacillus is low-virulence cutaneous commensal and has been commonly implicated in shoulder and spine infections. However, its prevalence in revision CDA specifically is not well documented. This study aims to review the current literature to understand the clinical relevance of C. acnes infection in revision CDA. **Methods:** PubMed database search was undertaken to identify all articles till date in English language on human populace assessing revision CDA cases associated with C. acnes infection with positive tissue cultures. References mentioned in these articles were also

studies to identify additional relevant publications. Study characteristics, clinical presentation, intra-op findings and management strategies were analysed. **Results:** 8 relevant studies (3 case series and 5 case reports) depicted 19 patients collectively where CDA revisions demonstrated C. acnes positive tissue cultures. Majority of the revisions involved the M6-C (Orthofix, Lewisville, Texas) disc replacement prostheses. Presentation ranged from early postoperative pain and radiculopathy to more commonly pain, dysphagia or implant loosening several years after implantation. Intraoperative findings included periprosthetic collections, osteolysis, granulomatous inflammation, and frank purulence in some cases. Microbial diagnosis required prolonged tissue cultures and sometimes confirmation with 16S ribosomal RNA (rRNA) molecular sequencing. Management generally consisted of implant removal and conversion to anterior cervical decompression and fusion, supplemented with prolonged (12 week) postoperative poly-antibiotic therapy. Outcomes were favourable, with resolution of presenting symptoms in most cases. However, the distinction between true infection, low-grade contamination, and inflammatory/foreign body reaction remains unclear. **Conclusion:** Positive tissue cultures for C. acnes are an increasingly concerning finding in revision CDA, often presenting with a slow, subtle course, absence of acute inflammatory features and associated with significant bone loss. Surgeons should maintain a high index of suspicion for this indolent anaerobic microbial infection in cases of delayed CDA failure. Multicentre prospective studies are needed to better understand the under-recognised burden of C. acnes infection in revision CDA.

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P0017: Hybrid cervical reconstruction with artificial disc replacement and ACDF: a retrospective review

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Introduction: Artificial disc replacement (ADR) is an innovative procedure typically reserved for discogenic pain with preserved range of motion, whereas anterior cervical discectomy and fusion (ACDF) is favored for instability or deformity. The function of ADR in correcting subluxation and reducing spinal cord compression is controversial. Data comparing functional outcomes and sagittal alignment after hybrid constructs remains limited. The objective of this review is to evaluate clinical outcomes and radiographic alignment following hybrid cervical reconstruction compared with traditional ACDF. **Material and Methods:** We retrospectively reviewed patients who underwent hybrid reconstruction (ADR + ACDF) at 3 institutions. Collected data included patient-reported outcomes (visual analog scale [VAS] for pain, Neck Disability Index [NDI]) and radiographic measures. Global cervical lordosis (C2-C7 Cobb angle) was measured on neutral lateral radiographs pre- and postoperatively. In a subset, segmental Cobb angles were measured on flexion-extension radiographs to assess the range of motion (ROM). Paired t-tests were used to compare pre- and postoperative outcomes. **Results:** We included 14 patients with complete clinical and radiographic data (CT, MRI, and X-ray). Mean VAS neck scores improved from 5.4 to 1.86 ($p < 0.01$), and mean NDI decreased from 45.43 to 21.43 ($p < 0.01$). Global cervical lordosis improved significantly from $0.84° \pm 12.09°$ preoperatively to $14.2° \pm 6.6°$ postoperatively ($p < 0.05$). Segmental analysis demonstrated preserved motion at ADR levels (5-8° ROM) with expected loss of mobility at ACDF levels (< 2°). No major complications or reoperations were observed. **Conclusion:** Hybrid cervical constructs provide significant improvement in pain, disability, and cervical lordosis, while preserving motion at ADR levels. Segmental analysis demonstrates predictable loss of mobility at fused levels with redistribution of motion across the construct. Our results support the role of hybrid surgery in multilevel cervical reconstruction and call for further studies with larger cohorts and long-term follow-up. Limitations include a small sample size and heterogeneity in follow-up duration.

ID: AGS26/3360
P0018: Mechanical retrieval findings of simplify ceramic-on-polymer cervical disc arthroplasty device: early analysis of six explants

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Introduction: Cervical disc arthroplasty (CDA) has been introduced as an alternative to anterior cervical discectomy and fusion (ACDF), with the intent of preserving motion and reducing adjacent segment disease. A newer design incorporating PEEK endplates with titanium plasma-spray coating and a zirconia-toughened alumina ceramic core was developed to minimize imaging artifact and metal wear. Short term clinical results have been positive. To date, there have been few reports from retrieval analysis. The purpose of this study was to characterize the early mechanical retrieval findings of this ceramic-on-polymer CDA device. **Material and Methods:** Six CDA devices were explanted during revision

surgery in three patients within a seven-month period. All explants were subjected to gross inspection, microbiological swabbing and culture with pathological reports, and light microscopy was used to categorize surface wear. Scanning electron microscopy (SEM) was further employed to assess high-resolution surface morphology, coating separation, polymer phase striations, and the presence of embedded particulate debris. **Results:** The average time from index surgery to explant was 23 ± 5 months. Across the six devices retrieved demonstrated polishing and linear surface scratching of the ceramic core (6/6,100%), consistent with repetitive articulation in vivo. Delamination of the titanium plasma spray coating from the PEEK endplates was present in all devices (6/6, 100%), ranging from focal flaking to broad areas of separation at the bone implant interface. Furthermore, core microcracking was identified in a single device (1/6, 16.7%), and visible fine subsurface fissures were confirmed with microscopy. Gross ceramic fractures were observed in multiple devices, with discrete fracture lines traversing load-bearing regions of the core. Upon further inspection, SEM revealed additional wear phenomena including areas of partial bony incorporation on endplate surfaces, phase striations within the polymer consistent with stretch-induced deformation, and striated wear tracks across the articulation. Lastly, evidence of third-body wear was present on all surfaces for all devices, with metallic debris embedded in the PEEK and fine ceramic particles distributed across the articulation zone. **Conclusion:** Overall, this retrieval analysis of CDA was unique as it demonstrated early and consistent mechanical compromise. When compared traditional CDAs, these findings were not consistent with prior retrievals, instead its unique hydrophobic behavior and tarnishing phenomena specific to this design. Therefore, further studies are required to clarify such mechanisms and for future designs for CDA devices.

ID: AGS26/3375
P0019: Thirteen in vivo failure mechanisms of the M6-C unconstrained viscoelastic cervical disc arthroplasty

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Introduction: The M6-C cervical disc (Orthofix Medical Inc.) is an unconstrained viscoelastic cervical disc arthroplasty (CDA) implant designed to replicate the morphology and biomechanics of the natural disc, with the goal of preserving motion and reducing the risk of adjacent segment degeneration. Despite these theoretical advantages, long-term durability in clinical use has been reported with variable success. This study analyzed retrieved M6-C devices through microscopic examination, with emphasis on surface wear, fixation integrity, and previously unreported modes of degradation. **Material and Methods:** Six patients undergoing revision surgery primarily for unresolved pain had thirteen M6-C devices explanted. The cohort included three patients with single-level, two with two-level, and one with four-level CDA. Explants were catalogued and examined using light microscopy and high-resolution scanning electron microscopy (SEM). Surfaces were analyzed for fixation stability, metallic debris, burnishing, scratching, annulus fiber disruption, intergranular corrosion, pitting, and cracking. **Results:** The mean age at revision surgery was 48.0 ± 8.8 years. All 13 explants (100%) exhibited mechanical wear, with burnishing and linear scratching most pronounced along the articulating core and peripheral sheath. Polymeric sheath damage was present in 11 devices (84.6%), ranging from localized thinning to complete rupture, while annulus fiber disruption was identified in 8 (61.5%). Fixation fin deformation was seen in 7 devices (53.8%), and endplate separation in 6 (46.2%), often accompanied by loosening at the implant-bone interface. Delamination occurred in 5 devices (38.5%), frequently associated with metallic debris deposition (38.5%). Pitting and intergranular corrosion were observed in 3 devices (23.1%), affecting the metallic fixation elements. Several explants demonstrated multimodal failure, with combinations of sheath rupture, fin deformation, and particulate debris distributed across multiple surfaces. **Conclusion:** M6-C retrievals demonstrated consistent surface wear, sheath disruption, and fixation compromise, with additional novel evidence of intergranular corrosion. These findings suggest unique vulnerabilities of unconstrained viscoelastic CDA and underscore the importance of continued retrieval surveillance to inform future design improvements.

ID: AGS26/156
P0019.1: Surface carburized 3D printed Ti-6Al-4V biomimetic porous motion-preserving artificial cervical vertebra and its initial clinical application

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Introduction: The general surgical treatment of cervical spondylotic myelopathy is anterior decompression and fusion, which has significant effect. But the non physiological compensatory movement after surgery may accelerate the degeneration of adjacent segments. Our team successfully developed a 3D printed Ti-6Al-4V biomimetic porous motion-preserving artificial cervical vertebra implant. The prothesis would not only restores the anatomical stability of the operation area, but also retained the physiological and motion functions of the corresponding segments, which can effectively avoid the risk of potential secondary operation. However, the inherent wear resistance of Ti-6Al-4V material is

poor, and the prosthesis will fail due to excessive wear in a short time after implantation. **Material and Methods:** The object of this study was 3D printed Ti-6Al-4V movable artificial cervical vertebra. (1) The surface ceramic modification of 3D printed Ti-6Al-4V was carried out by using glow plasma hydrogen-free carburizing technology, to optimize the process by characterize and analyze the properties of the samples treated with different parameters. (2) Using spine and joint motion simulator to carry out friction experiment of the prothesis, the surface ceramicized titanium alloy was used as the joint ball, and the joint sockets made of the same material and ultra-high molecular weight polyethylene were respectively matched. (3) Suitable patient were chosen to implant the artificial cervical vertebra, evaluating the short-term efficacy and in-vivo service performance of the prosthesis. **Results:** (1) A layer of TiC ceramics was formed on the surface of the samples after carburizing, and the surface hardness was nearly 3 times higher than that before treatment. (2) After 5 million cycles, for the self-matching joint, the total wear rate of the ball and socket (0.160 ± 0.004 mm3/Mc) was an order of magnitude lower than that of commercial artificial cervical intervertebral discs, for the titanium-polyethylene pair, the wear rate (8.00 + 0.06 mg/Mc) was 8 times larger than that of commercial artificial cervical disc CoCrMo/UHMWPE. (3) Clinical case of anterior cervical subtotal resection + 3D printing movable artificial cervical vertebra implantation had been completed. The clinical manifestations were disappeared after operation. Imaging examination showed that the position of the prosthesis was normal and the motion of the surgical area was preserved. No serious complications occurred. **Conclusion:** Carburizing technology can improve wear resistance of the 3D printed Ti-6Al-4V movable artificial cervical vertebra without changing the biocompatibility. (2) The tribological study of the joint machine showed that, for the titanium alloy self-matching pair, the total wear rate was much lower than that of commercial artificial cervical intervertebral discs. When paired with polyethylene, the joint socket was damaged by the hard TiC ceramic layer, and severe wear and plastic deformation occurred. (3) Clinical application showed that anterior decompression + surface ceramic movable artificial cervical vertebra implantation achieved significant short-term curative effect while retaining the physiological motion function of the operating area, which was a useful innovation and exploration for the surgical treatment of single-segment cervical vertebral diseases.

ID: AGS26/360
P0019.2: A Self-developed 3D Printed Anatomical Biomimetic Cervical Artificial Disc Prosthesis for Single-level Cervical Spondylosis

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Introduction: To investigate the safety and clinical efficacy of a new cervical artificial disc prosthesis in the treatment of single-level cervical spondylosis. Material and Methods: The clinical data of 40 patients with single-level cervical spondylosis who underwent 3D printed anatomical bionic cervical disc replacement at our hospital from January 2022 to July 2024 were analyzed retrospectively. There were 16 males and 24 females, aged (45±8) years old (range: 28 to 58 years). The surgical segment was located at C3-4 level in 6 cases, C4-5 level in 10 cases, C5-6 level in 20 cases, and C6-7 level in 4 cases. The clinical and radiographic outcomes were recorded and compared before surgery, 3 months after surgery, and 12 months after surgery. The clinical assessments included JOA, NDI and VAS. Imaging assessments included range of motion (ROM) of cervical spine, subsidence and migration of the prosthesis. **Results:** All patients underwent the operation successfully and were followed up for more than 12 months. Compared with preoperative score, the JOA score, NDI and VAS were significantly improved after surgery (all $P < 0.05$). There was no statistically significant difference in the ROM of the surgical segment compared with that before surgery and at 1 month and 12 months after surgery. The prosthesis subsidence was (0.26± 0.13) mm (range: 0.18 to 0.50 mm) at 12-month postoperatively. The migration of prosthesis at 12-months postoperatively were (0.71±0.20) mm (range: 0.44 to 1.08 mm). **Conclusion:** The 3D printed anatomical biomimetic cervical artificial disc replacement has a good early clinical effect in the treatment of one-level cervical spondylosis, which can maintain the mobility of the cervical spine while achieving good stability.

ID: AGS26/1261
P0019.3: Surface carburized 3D printed Ti-6Al-4V biomimetic porous motion-preserving artificial cervical vertebra and its initial clinical application.

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Introduction: The general surgical treatment of cervical spondylotic myelopathy is anterior decompression and fusion, which has significant effect. But the non physiological compensatory movement after surgery may accelerate the degeneration of adjacent segments. Our team successfully developed a 3D printed Ti-6Al-4V biomimetic porous motion-preserving artificial cervical vertebra implant. The prothesis would not only restores the anatomical stability of the operation area, but also retained the physiological and motion functions of the corresponding segments, which can effectively avoid the risk of potential secondary operation. However, the inherent wear resistance of Ti-6Al-4V material is

poor, and the prosthesis will fail due to excessive wear in a short time after implantation. Material and Methods: The object of this study was 3D printed Ti-6Al-4V movable artificial cervical vertebra. (1) The surface ceramic modification of 3D printed Ti-6Al-4V was carried out by using glow plasma hydrogen-free carburizing technology, to optimize the process by characterize and analyze the properties of the samples treated with different parameters. (2) Using spine and joint motion simulator to carry out friction experiment of the prothesis, the surface ceramicized titanium alloy was used as the joint ball, and the joint sockets made of the same material and ultra-high molecular weight polyethylene were respectively matched. (3) Suitable patient were chosen to implant the artificial cervical vertebra, evaluating the short-term efficacy and in-vivo service performance of the prosthesis. **Results:** (1) A layer of TiC ceramics was formed on the surface of the samples after carburizing, and the surface hardness was nearly 3 times higher than that before treatment. (2) After 5 million cycles, for the self-matching joint, the total wear rate of the ball and socket (0.160 ± 0.004 mm3/Mc) was an order of magnitude lower than that of commercial artificial cervical intervertebral discs, for the titanium-polyethylene pair, the wear rate (8.00 ± 0.06 mg/Mc) was 8 times larger than that of commercial artificial cervical disc CoCrMo/UHMWPE. (3) Clinical case of anterior cervical subtotal resection + 3D printing movable artificial cervical vertebra implantation had been completed. The clinical manifestations were disappeared after operation. Imaging examination showed that the position of the prosthesis was normal and the motion of the surgical area was preserved. No serious complications occurred. **Conclusion:** (1) Carburizing technology can improve wear resistance of the 3D printed Ti-6Al-4V movable artificial cervical vertebra without changing the biocompatibility. (2) The tribological study of the joint machine showed that, for the titanium alloy self-matching pair, the total wear rate was much lower than that of commercial artificial cervical intervertebral discs. When paired with polyethylene, the joint socket was damaged by the hard TiC ceramic layer, and severe wear and plastic deformation occurred. (3) Clinical application showed that anterior decompression + surface ceramic movable artificial cervical vertebra implantation achieved significant short-term curative effect while retaining the physiological motion function of the operating area, which was a useful innovation and exploration for the surgical treatment of single-segment cervical vertebral diseases.

ID: AGS26/1728
P0019.4: Scheme selection and curative effect analysis of cervical spine revision surgery

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Introduction: To summarize the indications, methods, curative effects and complications of revision surgery for cervical spine, and to provide some basis for surgical treatment. **Material and Methods:** A total of 27 patients who underwent cervical revision surgery in our hospital from 2020 to 2023 were reviewed, and the epidemiological data, the type of the first surgery, the way of revision surgery and the complications were summarized and analyzed. JOA score was used to evaluate postoperative pain and nerve function recovery. The indications for cervical revision surgery were classified into four categories: adjacent segment disease, infection, endoplant failure, and non-infectious complications. According to the first surgical approach, the patients were divided into three groups: anterior approach group, posterior approach group, anterior and posterior combination group. **Results:** The mean age of patients was 48 years (52% were male). Adjacent segment disease was observed in 59% of patients (16 cases), secondary surgery due to infection was performed in 19% of patients (5 cases), and endoplant failure occurred in 3 cases (11%). 63% of patients in the anterior and 80% in the posterior groups were treated with the same approach as in the initial surgery. In the combined anterior and posterior group, 67% of revision procedures were performed via the posterior approach. The early complication rate was 3%. Six patients (22%) had excellent outcomes, 11 patients (40%) had good outcomes, 8 patients (30%) had satisfactory outcomes, and 2 patients (7%) had poor outcomes. No patients were lost to follow-up. No radiographic failure of the implant after revision or the need for re-surgical revision was found. **Conclusion:** Cervical spine revision surgery requires careful preoperative planning and requires high professional level of the surgeon. In this study, more than half of the patients obtained good surgical results, and nearly 1/3 of the patients were satisfied with the surgical results. The incidence of surgery-related complications was lower than expected. For some complex cases, it is recommended to refer them to our hospital or other medical institutions of the same level for diagnosis and treatment.

Arthroplasty-lumbar

ID: AGS26/489
P0020: Clinical and radiographic outcomes after one-level lumbar total disc arthroplasty: single surgeon's experience

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Introduction: Lumbar Total Disc Arthroplasty (TDA) has shown satisfactory clinical outcomes with low complications and reoperations rates and provides a better surgical alternative to fusion. **Objectives:** To evaluate the clinical and radiographic outcomes of one-level TDA for lumbar degenerative

disc diseases (DDD) in patients with a minimum follow-up of 6 months. **Material and Methods:** A total of 81 patients who reported at least 6 months of follow-up results after one-level lumbar TDA were included. Data was collected and analyzed from patients who received TDA for symptomatic lumbar DDD between January of 2018 and July of 2024. A total of 81 patients (38male, 43female) with mean age of 43.8 ± 10.6 years (range 19-64) were included in this report. The follow-up period ranged from 6 months to 6 years (average 13.2 months). 2 patients had 1-level TDA at the L3-L4 level, 16 at the L4-L5 level, and 63 at the L5-S1 level. Recorded data: patient demographics, Visual Analogue Scale, Oswestry Disability Index, complications, reoperations, blood loss and time of procedure. Radiographic measurements included a segmental range of motion, device migration, subsidence and Heterotopic Ossification (HO). Patients were examined preoperatively and at 6,12,24-months postoperatively, then yearly. The last follow-up data was used for analysis. **Results:** Postoperatively, all outcome measure scores (VAS and ODI) immediately improved and these improvements were maintained with statistical significance at all follow-up periods including the last follow-up visits, reaching maximal improvement 2 years postoperative. Patients demonstrated significant improvements in VAS scores from 6.7 to 1.8 and from 44.2% to 10.2% for ODI scores at the last follow-up. The percentage of improvement was documented with an average of 74.9%. The reoperation rate was 1.2% (1/81) with one reoperation at the L5-S1 level due to a non-spontaneous subsidence at the L5 inferior endplate. We did not observe any device migration or severe HO (grades 3 or 4). The final segmental range of motion was well-maintained in monosegmental TDA patients. The average blood loss was 37 cc (range of blood loss 15-125 cc), and the average time of procedure was 39 minutes (range 26-67 minutes). **Conclusion:** This study reveals that lumbar TDA semiconstrained prosthesis is a safe and effective treatment for chronic back pain caused by DDD. It effectively results in pain relief and an improvement in quality of life and showed successful outcomes. Patients had significant improvement and maintained reduction in patient-reported outcome over time, and low rates of index revision and reoperation.

ID: AGS26/525
P0021: Lumbar disc arthroplasty and implant migration/dislocation: a systematic review of patterns, risk factors, and surgical outcomes

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Introduction: Lumbar disc arthroplasty (LDA) preserves spinal motion and may reduce adjacent segment degeneration compared with fusion. Despite advances in design and techniques, complications such as implant migration, subsidence, and dislocation do remain, and it could threaten vascular and neurologic structures. This review summarizes patterns, risk factors, and surgical outcomes of LDA migration/dislocation. **Materials and Methods:** A systematic search of MEDLINE, Embase, Scopus, Web of Science, and Cochrane Central was performed. Studies reporting migration or dislocation after LDA were included; non-English reports, cadaveric studies, and studies without event-specific outcomes were excluded. Data extracted included device type, level, timing/direction of migration, risk factors, management, and outcomes. **Results:** Twenty studies (case reports, small series, cohort analyses) were included, reporting various devices. Though the reported migration/dislocation rates ranged between 3-6% but they were clinically significant. Early complication (< 3 months) were anterior dislocations often due to anterior placement or undersizing; polyethylene inlay escape was also reported. Late complications included subsidence and posterior migration associated with endplate violation. Risk factors included malposition, undersizing, high mechanical shear at L5 -S1, poor bone quality, inadequate endplate preparation, and trauma. Treatment involved fusion with or without explantation. Fusion-only strategies yielded comparable outcomes in selected cases, while explantation carried higher perioperative morbidity, particularly due to vascular risk from the anterior approach. **Conclusion:** Implant migration/dislocation after LDA is rare but clinically significant. Prevention requires meticulous technique, appropriate sizing, and endplate preparation. Revision should be individualized: fusion alone is often sufficient for contained events, whereas anterior escape with vascular threat necessitates urgent explant and stabilization.

ID: AGS26/574
P0022: Lumbar disc arthroplasty periprosthetic fractures: systematic review and a proposed classification system

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Introduction: Total disc arthroplasty (TDA) of the lumbar spine is an advanced surgical option for symptomatic lumbar discogenic pain, with clinical outcomes comparing favorably to arthrodesis. With any form of arthroplasty, periprosthetic fractures are a potentially catastrophic complication. This study aims to systematically review existing literature on cases

of periprosthetic fractures in lumbar TDA, and propose a novel classification system to guide management of periprosthetic fractures in lumbar TDA. **Material and Methods:** A systematic review of cases of periprosthetic fractures in lumbar TDA in existing literature (PubMed, Google Scholar) was conducted as according to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) recommendations. The included articles must have reported on a periprosthetic fracture from a lumbar TDA. **Results:** In total, 7 articles were identified with 9 cases of periprosthetic fractures in lumbar TDA found. Out of the 9, 2 cases occurred intra-operatively while the rest were post-operative complications. Sudden pain was the primary presenting complaint. All fractures involved the vertebrae adjacently above or below the artificial disc, except for one instance of a L3 burst fracture when the TDA was performed at the L4-L5 level. All fractures involved were exclusively in either the pedicles, or the vertebral body. Time of discovery of the fractures ranged from intra-operatively, to a year post-operatively. **Conclusion:** We propose a classification system of periprosthetic fractures in lumbar TDA that range in terms of stability and determines management. Type A fractures include incomplete pedicle fractures, and endplate subsidence without implant migration. Type B fractures are a progression of Type A fractures, and involve endplate fractures resulting in implant migration. They can be unstable and will require fusion with or without implant removal. Type C fractures are vertical sagittal plane fractures, most commonly related to keel cuts. They are potentially unstable without good keel fixation. Type D fractures are coronal plate fractures of the vertebral body, pedicles or pars. These are unstable and will require fusion. Further validation of our proposed classification system with larger patient samples is warranted to evaluate further its effectiveness at guiding management of periprosthetic fractures in lumbar TDA.

ID: AGS26/918

P0023: Long-term clinical and radiological effectiveness of the M6-L total disc replacement: a retrospective single-center study

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Introduction: Previous studies have confirmed the successful long-term clinical and radiological outcomes of lumbar total disk replacement (TDR). However, there are no long-term follow-up reports for the M6-L TDR. The purpose of the study is to report our minimum 7-year clinical and radiographic outcomes, as well as complications of the M6-L disk prostheses in railway workers with lumbar disk herniation causing back and radicular pain (LDH). **Material and Methods:** Ninety-seven cases underwent TDR using the M-6 L artificial disc between 2012 and 2017. Of those, eighty-six patients (88.6%) had surpassed the minimum 7-year follow-up and were included in the retrospective study. Clinical and radiological data were obtained preoperatively, at 1-year and 106 (90;139) months post-operatively. Outcome measures collected included back and leg pain, quality of life, intraoperative and postoperative complications and revision rates. Additionally, lumbar lordosis, segmental mobility, heterotopic ossification, index and adjacent segment degeneration were analyzed. **Results:** VAS, ODI and SF-36 scores showed significant improvement compared to baseline. 78 patients (90.7%) had a successful outcome, as defined by the FDA. The average ROM of the operated, upper and lower adjacent segments increased significantly at the final FU. The IDH (intervertebral disc height) of the index level had a tendency to significantly increase. The IDH of adjacent levels were not significantly affected by the surgery. Mean lumbar lordosis was increased at the final follow-up. Intra-operatively, a vena cava tear occurred in 3 patients. Of all the male patients, four cases of retrograde ejaculation were observed. At the last follow-up, 3 patients complained of low back pain (VAS greater than 50 mm), leg pain (VAS greater than 20 mm) and the ODI score greater than 20 points. There were no cases that required revision surgery due to implant failure. Five patients demonstrated minimal radiographic adjacent segment degeneration (ASD), but no patient had symptomatic ASD requiring reoperation. Heterotopic ossification was detected in 35/86 (40.7%) operative segments, including 19/86 (22.1%) segments with class I HO, 12/86 segments (13.9%) with class II, 3/86 (3.5%) segments with class III, and 1/86 (1.2%) with a class IV (fused segment). At the last follow-up period, 75/86 (87.2%) patients went back to their original work, and 8/86 (9.3%) patients changed jobs, with 3/86 (3.5%) patients unable to return to work. **Conclusion:** This study suggests that lumbar TDR using M-6 L is a safe and effective treatment for radicular and back pain caused by LDH at a minimum 7 years post-operatively. We found that the prosthesis retained its functionality in the long-term postoperative period and was associated with good clinical and radiological results with a minimal incidence of complications.

ID: AGS26/1011
P0024: Robot-assisted total posterior facet arthroplasty for lumbar spinal stenosis: a single-center experience

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Introduction: Lumbar spinal canal stenosis often results in pain and functional impairment. Conventional surgical management has relied on decompression alone or combined with fusion, both of which carry long-term risks such as postoperative instability and adjacent segment disease (ASD). Posterior lumbar arthroplasty with facet replacement offers a motion-preserving alternative, aiming to mitigate ASD risk and reduce revision rates. The Total Posterior Spine (TOPS) system is a novel facet replacement prosthesis that provides dynamic, multiaxial stabilization across all three spinal columns while maintaining physiologic motion. Although prior studies have demonstrated the safety and efficacy of the TOPS device implantation, evidence regarding robotic assistance in this procedure remains limited. Robotic assistance may enhance the accuracy of pedicle screw placement, optimize device positioning, and shorten operative time. This study aimed to report preliminary clinical experience with robot-assisted TOPS system implantation, focusing on perioperative metrics, patient outcomes, and the safety of robotic integration. **Material and Methods:** We retrospectively reviewed all patients who underwent robot-assisted TOPS device implantation between April 2024 and August 2025 at a single center. The primary outcome was implant-related complications. Secondary outcomes included operative duration, estimated blood loss, symptomatic improvement, reoperations, and new or worsening neurological deficit. **Results:** Eight patients with degenerative lumbar stenosis and facet arthropathy were included. All patients presented with low back pain and radiculopathy. Median age was 69.5 years (interquartile range [IQR]: 65.2-72.5), and four patients (50%) were female. One patient (12.5%) was treated at L1-L2, one (12.5%) at L2-L3, four (50%) at L3-L4, and two (25%) at L4-L5. Median operative time was 160 minutes (IQR: 126.7 -176), with a median estimated blood loss of 175 mL (IQR: 150 -200). No intraoperative complications occurred, including screw misplacement or the need for repositioning. Median hospital stay was 3 days (IQR: 2.2 -3.7). At a median follow-up of 7 months (IQR: 3 -11), all but one patient (87.5%) reported symptomatic improvement. No patient required reoperation or experienced implant-related complications such as device malfunction, migration, or screw loosening. One patient developed a new postoperative unilateral lower extremity sensorimotor deficit, and another had an asymptomatic seroma detected on follow-up MRI. Neither complication was attributed to robotic assistance or the TOPS implant. **Conclusion:** Robot-assisted implantation of the TOPS device appears safe, technically feasible, and efficacious for patients with degenerative lumbar stenosis. Robot assistance enabled accurate screw placement without the need for intraoperative adjustments, eliminated the need for conversion to fusion, and was associated with low morbidity and favorable clinical and radiographic outcomes. Future prospective studies with larger cohorts and longer follow-up are warranted to validate these findings and assess the long-term durability of outcomes.

ID: AGS26/1037
P0025: Lumbar disc arthroplasty is associated with favourable economic and perioperative outcomes versus lumbar fusion for single-level degenerative disc disease: a systematic review and economic analysis

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Introduction: The purpose of this study was to compare the economic and perioperative outcomes of lumbar disc arthroplasty (LDA) versus lumbar fusion for the surgical management of single-level degenerative disc disease (DDD). Additionally, we evaluated the methodological quality of existing literature using the Quality of Health Economic Studies (QHES) instrument to assess the rigor of economic reporting in spine surgery. **Material and Methods:** We conducted a systematic review in accordance with PRISMA guidelines. A comprehensive search of PubMed, Embase, and Cochrane CENTRAL identified comparative studies published between 2005 and 2025 reporting cost-related outcomes for one-level LDA and lumbar fusion. Inclusion criteria required full-text English articles reporting direct or indirect hospital costs, payer costs, reimbursements, or relative value units (RVUs). Data extraction included revision, readmission, complication rates, operative time, blood loss, transfusion rates, and length of stay (LOS). Methodological quality was assessed using the 16-item QHES instrument. **Results:** Nine studies encompassing over 850,000 patients met inclusion, though economic outcomes were reported inconsistently across them. Of the five studies evaluating direct hospital costs, four demonstrated significantly lower costs for LDA. All studies reporting hospital charges found LDA to be less expensive, with savings ranging from 15% to over 50%. Studies assessing reimbursement and RVUs showed lower physician payments for LDA, but these differences did not

offset overall system-level savings. Perioperatively, LDA was associated with shorter LOS (2.9 vs. 5.1 days in the largest dataset), fewer complications (3.6% vs. 8.0%), and reduced transfusion rates. Readmission and revision burdens were variable, with some studies favoring LDA and others showing no difference. Methodological quality was moderate, with QHES scores ranging from 31.3% to 62.5%; common deficiencies included lack of sensitivity analyses, unclear time horizons, and absence of formal cost-effectiveness modeling. **Conclusion:** For single-level DDD, LDA is associated with significant perioperative and economic benefits compared to lumbar fusion, including lower direct hospital costs, shorter hospital stays, and fewer complications. Despite lower physician reimbursement, system-level savings favor LDA. Adoption, however, remains constrained by patient selection criteria, surgical complexity, and implant longevity concerns. Current evidence is limited by heterogeneity in cost reporting and moderate methodological rigor, underscoring the need for prospective, standardized cost-effectiveness studies incorporating quality-adjusted life years and long-term follow-up.

ID: AGS26/1146
P0026: Lumbar disc replacement: motion preservation and hybrid surgery in contemporary anterior lumbar spine practice

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Introduction: Surgical management of symptomatic lumbar degenerative disc disease (DDD) and low-grade spondylolisthesis recalcitrant to appropriate non-operative treatment, includes both fusion and motion-preserving options. While anterior lumbar interbody fusion (ALIF) is widely used, lumbar total disc replacement (TDR) remains a motion-preserving surgery for select cases and select lumbar segments that is well established in the literature. Hybrid constructs combining TDR and fusion is considered in multilevel disease, particularly when pathology and treatment goals vary across segments. This study presents real-world prospectively collected outcomes of all patients undergoing ALIF, TDR, or hybrid anterior lumbar surgery from a single surgeon's practice. **Materials and Methods:** Eighty-one patients underwent anterior-based surgery for either isolated DDD or DDD with associated spondylolisthesis. Procedures included ALIF (n = 40), TDR (n = 21), and hybrid surgery (n = 20). TDR was only performed in lumbar segments with pure DDD and no radiographic instability. Hybrid surgery was used predominantly in cases with mixed pathology - typically DDD at one level and low-grade spondylolisthesis at another. ALIF was performed in both DDD and spondylolisthesis cases. Clinical outcomes were assessed using VAS (back and leg), ODI, and RMDQ scores up to 24 months. Operative time and blood loss were also recorded. Data was primarily inputted in REDCap and analysis was done on SPSS. **Results:** TDR patients were younger (mean age 37.8 vs. 48.4 for ALIF, $p < 0.01$), and procedures were associated with shorter operative times (97 ± 23 min) and less blood loss (96 ± 118 mL) compared to ALIF ($p < 0.05$). The heterogeneity in follow-up duration (longest:shortest = x:y months) reflects real world assessment. All three groups showed significant improvements across all outcome measures at each follow-up point ($p < 0.001$). Hybrid surgery achieved similar improvements in pain and function, though with higher operative demands (170 ± 78 min, 213 ± 173 mL EBL), reflecting the complexity of multilevel intervention. Complication rates were low and similar between groups. **Discussion:** A single surgeon practise removes confounders associated with surgical techniques and system issues related to multi-centric studies. ALIF, TDR, and hybrid approaches all led to meaningful clinical improvement in patients with lumbar DDD and/or low-grade spondylolisthesis. Hybrid constructs offer a flexible solution in cases with mixed pathology, enabling a pragmatic approach to treatment that matches the pathology and treatment goals. A baseline audit system for complex spinal reconstruction has been established to track the same surgeon's practise temporally, with capacity for data-transfer to larger registry's or global databases with appropriate approvals.

ID: AGS26/1526
P0027: A recent increasing national trend in lumbar disc arthroplasty

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Introduction: Lumbar fusion has long been the gold standard for operative treatment of lumbar degenerative disc disease. However, lumbar fusion inherently limits spinal motion, thereby increasing risk of adjacent segment disease and pseudarthrosis. Mirroring the development of cervical disc arthroplasty (CDA), lumbar disc arthroplasty was introduced to preserve spinal motion, decreasing the risk of adjacent segment disease and eliminating the risk of pseudarthrosis. Prior studies have demonstrated decreasing LDA utilization trends until 2017. This study aims to investigate more recent

yearly national trends of LDA utilization. **Material and Methods:** Patients undergoing LDA from 2010 to April 2023 were identified in the PearlDiver national database via ICD-9/10 and CPT codes. Primary outcome included annual utilization trends of LDA, with CDA as a comparator. Temporal trends were analyzed using annual percent change from the prior year and percent change from 2010. Secondary outcomes compared demographic characteristics between two LDA cohorts from 2010 to 2016 and 2017 to 2023. Continuous variables were compared using Welch's t-tests and discrete variables using Chi-square tests. **Results:** From 2010 to April 2023, 4388 patients underwent LDA while 42,773 patients underwent CDA. In 2010, there were 471 LDA cases. Initially, LDA utilization decreased by 60% from 2010 to 2014 and then plateaued between 2014 and 2017, reaching a nadir of 188 cases in 2017. After 2017, LDA utilization steadily increased to 517 cases in 2022, an overall increase of 9.8% from 2010. In contrast, there were 1100 CDA cases in 2010 with steady increase until 2019 followed by a plateau to 2022, with an overall increase of 316% over time. When compared to 2010-2016, patients who underwent LDA in 2017-2023 were older (43.5 vs 41.8 years), had more comorbidities (ECI 3.24 vs 1.84), had higher education rates (16.3% vs 8.2%), and shorter length of stay (2.17 vs 2.71 days) (all $p < 0.001$). The percentage of patients paying with commercial insurance increased (87.0% vs 89.1%, $p = 0.04$) and more procedures were performed as outpatient surgeries (13.4% vs 30.7%, $p < 0.001$). **Conclusion:** Lumbar disc arthroplasty utilization reached a nadir in 2017 with subsequent steady increases to 2022, demonstrating an overall increase of 10%. Notably, LDA is increasingly performed in patients with more comorbidities, while hospital length of stay has decreased and outpatient adoption has increased. This highlights advances in perioperative management and surgical safety and emphasizes the now expanding role of this motion-preserving lumbar surgery.

ID: AGS26/3173
P0028: Polyethylene core luxation in the Prodisc-L lumbar prosthesis: diagnostic and therapeutic challenges

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Introduction: Lumbar total disc replacement (TDR) with devices such as Prodisc-L is an established treatment of lumbar disc disease aiming to restore disc height and biomechanics while preserving segmental mobility. Although overall complication rates are low, polyethylene insert dislocation represents a rare but serious event that may cause disabling pain and necessitate complex revision surgery. Its mechanisms and risk factors remain incompletely understood. The aim of this work is to discuss the diagnostic and therapeutic challenges of this complication, illustrated by four clinical cases. **Methods:** We retrospectively reviewed three patients who developed polyethylene insert dislocation following Prodisc-L implantation. Clinical presentation, radiological features, surgical management, and outcomes were analyzed. **Results:** All patients presented with recurrent lumboradicular pain several years after the index procedure. Diagnosis was established by radiographic signs including malalignment of the polyethylene marker, prosthetic plate asymmetry, and iatrogenic spondylolisthesis. With the exception of one case, all patients required revision surgery. Due to severe facet arthropathy or anatomic constraints, conversion to fusion was performed rather than revision arthroplasty. **Discussion:** Polyethylene insert dislocation appears to be multifactorial. Potential contributors include long-term polyethylene wear or creep, traumatic events, excessive posterior loading during extension, and sagittal imbalance (e.g., high sacral slope, Roussouly type 4). Insufficient prosthetic lordosis, particularly with low-angle implants at L5 -S1, may further predispose to posterior shear forces. Preventive strategies rely on careful patient selection, optimization of implant alignment, and the use of prostheses with adequate lordosis in patients with high sacral slope. **Conclusion:** Polyethylene insert dislocation after lumbar TDR is a rare but distinctive complication, recognizable through characteristic clinical and radiographic findings. Surgical revision -most often conversion to fusion -remains the standard management. Awareness of risk factors and meticulous preoperative planning are essential to improve prevention, ensure timely diagnosis, and optimize surgical outcomes.

Keywords: Degenerative disc disease (DDD), Lumbar Total disc replacement (lTDR), Lumbar Disc Replacement Dislocation, Lumbar Disc Revision, ProDisc-L.

Basic science

ID: AGS26/62
P0029: Technical insights and implications of thoracolumbar spine and neural tissue harvesting in recently deceased organ donors: a direct anterior approach integrated into multi-organ procurement protocols

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Introduction: High-quality human spinal tissue is essential for biomechanical, cellular, and translational spine research. However, standardized harvesting protocols that ensure both anatomical integrity and compatibility with routine multi-organ procurement procedures are lacking. This study describes a novel anterior approach for thoracolumbar spine harvesting that addresses these limitations. **Materials and Methods:** A direct anterior retroperitoneal technique was used to harvest thoracolumbar spinal columns including spinal cord, dorsal root ganglia (DRGs), and posterior elements en bloc within 1-2 hours after aortic cross-clamping. Targeted osteotomies were performed, and anatomical integrity was verified radiographically. Specimens underwent same-day processing to preserve biological viability of intervertebral discs, facet joints, and native cell populations. **Results:** The technique was applied in over 340 cadaveric donors, with a mean harvesting time of approximately 30 minutes. All specimens retained gross anatomical integrity, and radiographic analysis confirmed alignment and completeness. High cellular viability was consistently observed, supporting use in multiple experimental contexts. **Conclusion:** This anterior spinal harvesting method is safe, reproducible, and efficient. It can be seamlessly integrated into standard multi-organ donation workflows without disrupting reconstruction or logistics, offering a valuable protocol for obtaining viable and anatomically intact human spinal tissue for research purposes.

ID: AGS26/399
P0030: Trabecular and cortical bone mineral density in human vertebrae: comparison of frozen and thawed states with qCT

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Introduction: Bone mineral density (BMD) is a key determinant of skeletal strength, relevant in many disciplines. Freezing is widely used to preserve cadaveric bone, but its effect on BMD remains controversal. This study assessed whether a vBMD is altered in frozen versus thawed state of human vertebral bodies measured by quantitative computed tomography (qCT). **Material and Methods:** Thirty-three human vertebrae (14 C7, 9 Th1, 10 Th2) were stored at -20 °C. Trabecular and cortical vBMD were measured in the frozen state (-15 to -20 °C) using qCT with a calibration phantom. After thawing overnight at room temperature, identical scans were performed. Paired t-tests and Pearson correlation coefficients compared frozen and thawed values. **Results:** One trabecular specimen was excluded as an outlier. Mean trabecular volumetric bone mineral density (vBMD) was 154.68 mg Ca-HA/ml (frozen) vs. 148.93 mg Ca-HA/ml (thawed), mean difference -5.74 mg Ca-HA/ml ($p = 0.164$). Cortical vBMD was 219.56 mg Ca-HA/ml (frozen) vs. 219.90 mg Ca-HA/ml (thawed), mean difference 0.34 mg Ca-HA/ml ($p = 0.948$). Correlations between frozen and thawed values were strong ($r = 0.89$ trabecular; $r = 0.94$ cortical). **Conclusion:** A single freeze-thaw cycle at -20 °C does not significantly alter cortical or trabecular vBMD in human vertebral bodies measured by qCT. These results support the measurement of BMD of frozen specimens, minimizing handling and avoiding unnecessary thawing in research and forensic settings.

ID: AGS26/435
P0031: Pre-surgical plasma proteomics improve prediction of post-surgical outcomes for degenerative cervical myelopathy

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Introduction: Plasma proteins are promising targets for biomarker discovery in DCM due to the ease of obtaining biospecimens, the potential for repeated sampling, and objective quantification. Plasma protein biomarkers have shown strong potential for prognostication in spinal cord disorders such as traumatic spinal cord injury and multiple sclerosis. There are limited data on the role of plasma proteomics for prognostication in degenerative cervical myelopathy (DCM). The objective of this study was to determine if plasma protein biomarkers can independently prognosticate outcomes for DCM and whether these biomarkers improve model performance when added to existing clinical and imaging prognosticators. **Material and Methods:** Patients clinically diagnosed with DCM and scheduled to undergo decompressive surgery were prospectively enrolled from July 2022 to February 2025. Plasma neuronal and inflammatory proteins ($n = 126$) were quantified before surgery using ultrasensitive NULISA immunoassay. Outcome at three months post-surgery was categorized as achievement of minimum clinically important difference (MCID) for modified Japanese Orthopedic Association (mJOA) and Short Form 36 Physical Component Summary (SF36 PCS) score. Pre-surgical clinical (age, sex, duration of symptoms, baseline disability) and imaging (T2-weighted intramedullary hyperintensity) were also collected. Predictive models were constructed using three feature sets: (1) biomarkers only, (2) clinical and imaging only, and (3) a combined biomarker-clinical-imaging panel. Data-driven feature selection was performed using Elastic Net

logistic regression to rank biomarkers by absolute coefficients. The optimal number of features was determined using a 1 - standard error rule for each model. Logistic regression model performance was assessed with out-of-fold predictions to compute AUC, and 95% bootstrap confidence intervals. **Results:** A total of 58 patients (mean age 61.9 ± 11.2 years, 60.3% (n = 35) male) with follow-up MCID data were included. Mean duration of preoperative symptoms was 41.9 months ± 61.9 months. Based on baseline mJOA severity, 25.9% were classified as mild (n = 15), 48.3% as moderate (n = 28), and 25.8% as severe (n = 15). Pre-surgical MRI data was available in 53 patients, of whom 15 (28.3%) had intramedullary T2-weighted hyperintensity. MCID was achieved for mJOA and SF36 PCS in 33 (56.9%) and 28 (48.3%) patients respectively. For predicting patients achieving the MCID for mJOA after surgery, plasma proteomic biomarker panels significantly outperformed clinical-imaging models (AUC 0.77 vs AUC 0.52, +49.2%, p = 0.009). Addition of plasma biomarkers to the clinical-imaging model significantly improved prognostic accuracy (AUC 0.9 vs AUC 0.52, +74.3%, p < 0.001). For predicting patients achieving the MCID for SF 36 PCS after surgery, plasma proteomic biomarker panels outperformed clinical-imaging models (AUC 0.83 vs AUC 0.66, +24.8%, p = 0.08). Addition of plasma biomarkers to the clinical-imaging model significantly improved prognostic accuracy by (AUC 0.85 vs AUC 0.66, +28.6%, p = 0.009). **Conclusion:** Pre-surgical plasma protein biomarkers accurately predict clinically meaningful improvement in function and quality of life at three months after surgery. Blood-based biomarkers significantly improve existing clinical-imaging prognostic models for DCM and show potential as novel prognostic tools for DCM.

ID: AGS26/522
P0032: POSTN/TGF-β1 positive feedback loop promotes mechanical stress-mediated hypertrophy of the ligamentum flavum via the PI3K/Akt signaling pathway

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Introduction: Lumbar spinal canal stenosis (LSCS) is a common degenerative spinal disorder often caused by hypertrophy of the ligamentum flavum (LFH). Thickening of the ligamentum flavum leads to compression of the spinal cord and nerve roots, resulting in pain and functional impairment. Although mechanical stress is considered a key factor in ligamentum flavum hypertrophy, its molecular mechanisms remain incompletely understood. This study aims to investigate the role of periostin (POSTN) in LFH, particularly how the POSTN/TGF-β1 positive feedback loop regulates the PI3K/Akt signaling pathway, with the goal of providing new theoretical insights for the monitoring, prevention, and treatment of this condition. **Material and Methods:** This study began with proteomic analysis and single-cell RNA sequencing (scRNA-seq) of ligamentum flavum samples collected from patients undergoing decompressive surgery to identify differentially expressed proteins (DEPs) associated with LFH. Subsequently, in vitro experiments involved applying mechanical stretch to ligamentum flavum cells to simulate in vivo conditions, examining the expression changes of POSTN and TGF-β1 under mechanical stress, and assessing their activation of the PI3K/Akt signaling pathway. Techniques such as qRT-PCR, Western blot, and immunofluorescence were used to evaluate the expression levels of fibrosis markers (e.g., COL1A2, COL3, and α-SMA). Finally, in vivo experiments utilizing a bipedal standing mouse model were conducted to validate the role of POSTN in LFH. **Results:** Proteomic and scRNA-seq analyses revealed significantly elevated POSTN expression in the LFH group compared to the non-LFH group. In vitro experiments demonstrated that mechanical stress upregulated the expression of POSTN and TGF-β1 in ligamentum flavum cells, subsequently activating the PI3K/Akt signaling pathway and increasing the expression of fibrosis markers (COL1A2, COL3, and α-SMA). Additionally, it was confirmed that POSTN and TGF-β1 form a positive feedback loop in ligamentum flavum cells, with POSTN amplifying the profibrotic effects of TGF-β1. Further in vivo experiments validated the critical role of POSTN in LFH: mice injected with recombinant POSTN protein exhibited significant characteristics of ligamentum flavum hypertrophy, whereas inhibition of POSTN markedly slowed the fibrotic process. **Conclusion:** This study is the first to reveal the important role of POSTN in ligamentum flavum hypertrophy, particularly through the POSTN/TGF-β1 positive feedback loop promoting fibrosis via the PI3K/Akt signaling pathway. This finding provides new insights into the molecular mechanisms of LFH and suggests that POSTN may serve as a novel target for monitoring and treating lumbar spinal canal stenosis. Future research should further explore the potential of POSTN-specific inhibitors in clinical applications and evaluate their efficacy in preventing and treating ligamentum flavum hypertrophy.

ID: AGS26/538
P0033: Spinal cord injuries and acute myeloid leukemia share convergent transcriptomic pathways

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Introduction: Spinal cord injury (SCI) triggers complex cellular and molecular responses that critically influence

recovery, yet the underlying mechanisms remain incompletely characterized. Understanding these pathways is essential for developing predictive biomarkers and therapeutic strategies. Comparative omics approaches have the potential to uncover conserved molecular programs across distinct disease contexts, revealing novel insights into injury response and opportunities for drug repurposing. Acute myeloid leukemia (AML), a hematologic malignancy with well-characterized proliferative and stress-response programs, may share overlapping pathways with SCI, particularly in cellular stress, DNA repair, and immune signaling. Leveraging similarities between these conditions could accelerate therapeutic discovery for SCI by drawing on existing oncology drug pipelines. **Material and Methods:** Transcriptomic data from peripheral blood and injury-site samples collected from a cohort of SCI patients (n = 38) were analyzed, identifying differentially expressed genes (DEGs) relative to healthy controls. To account for generalized trauma effects, non-SCI trauma controls were also included. SCI transcriptomic signatures were then compared with publicly available AML datasets, including 27 primary patient samples and 46 AML cell lines (three of which had duplicate experiments), to identify shared molecular features. Analyses encompassed differential expression testing, pathway enrichment, gene set enrichment analysis (GSEA), and network analysis to pinpoint key hub genes and potential therapeutic targets. Hub gene druggability was further evaluated using publicly available databases, highlighting candidates with existing or investigational therapeutics. **Results:** We identified 53 genes significantly upregulated in both SCI and AML, after controlling for healthy and non-SCI trauma controls. These included critical cell cycle regulators (BUB1, CCNB1, TOP2A), DNA repair proteins (POLQ, FANCB), and immune modulators (CD6, LCK). Pathway enrichment highlighted convergent biological processes, including mitotic regulation, DNA damage response, and immune signaling. Network analysis revealed hub genes (BUB1, CCNB1, KIF14) with high connectivity and potential druggability. Several of these hubs overlap with AML signatures, suggesting conserved cellular stress and proliferation programs between SCI and AML. Importantly, these shared hubs indicate the potential for cross-disease drug repurposing, whereby therapeutics developed for hematologic malignancies could be evaluated as modulators of SCI pathology, potentially improving neurological outcomes and recovery trajectories. **Conclusion:** This integrative omics study identifies shared transcriptomic networks between SCI and AML, revealing conserved mechanisms of cellular stress, proliferation, and immune regulation. By highlighting hub genes with translational potential, our findings provide a framework for prognostic biomarker development and targeted therapeutic interventions. Importantly, cross-disease analyses suggest that existing AML-targeted therapeutics could be repurposed for SCI, offering a novel approach to accelerate translational research in trauma care. Overall, these results advance our mechanistic understanding of SCI pathophysiology, establish a comparative omics framework for investigating shared disease biology, and point toward actionable strategies to improve patient outcomes through targeted molecular interventions.

ID: AGS26/566
P0034: Evaluating frailty and epigenetic tests for predicting complications following ASD surgery

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Introduction: Chronologic age (CA) is a traditional risk factor for adult spinal deformity (ASD) surgery, but emerging data suggest frailty and epigenetic age (EA) may better reflect biological vulnerability. This study evaluates various aging metrics as predictors of perioperative complications. **Material and Methods:** ASD patients undergoing ≥ 7-level fusion or 3-column osteotomy were enrolled and monitored for 30-day complications. Blood was collected on surgery day to assess DNA methylation in peripheral blood mononuclear cells (PBMC). EA was calculated using Horvath's DNAmAge, Levine's DNAmAge (LevD), and Levine's PhenotypicAge (LevP). Frailty was measured using the Edmonton Frailty Index (EFI). The predictive value of each metric - including the differences between CA and EA - was assessed using univariate and multivariate models. **Results:** 40 surgical ASD patients were enrolled. 23 (57.5%) were revisions. 29 patients (72.5%) received all-posterior and 11 (27.5%) underwent anterior-posterior surgery. 10 (25%) received a three-column osteotomy and average levels fused was 11.5. Complications were pulmonary emboli (N = 2), death (N = 1), reoperation for dehiscence (N = 1), altered mental status (N = 6), and acute kidney injury (N = 5). There were no 30-day readmissions. Univariate analysis revealed that CA, EFI, DNAmAge, LevP, LevD did not predict complication rates (all p-values > 0.1). However, CA-DNAmAge (p = 0.015), CA-LevP (p = 0.033), and CA-LevD (p = 0.045) all demonstrated a predictive value. The multivariate model revealed that CA-DNAmAge was the only significant predictor of complication rate (p = 0.029). Odds ratio (OR) of CA- DNAmAge was 1.03, meaning a 3% increase in complication rate for every year that DNAmAge was greater than CA. **Conclusion:** Frailty indices and age metrics, including chronological and epigenetic age, do not predict postoperative complications in ASD patients. However, the gap between chronological and epigenetic age (DNAmAge) may aid risk assessment. Future studies should use larger datasets and advanced models to refine these findings and improve patient risk stratification.

ID: AGS26/705
P0035: Impact of prognostic nutritional index in neuromuscular vs early-onset scoliosis surgery

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Introduction: Early-onset scoliosis (EOS) and neuromuscular scoliosis (NMS) represent distinct clinical entities with different perioperative challenges. Nutritional and immunological status, reflected by the prognostic nutritional index (PNI), may influence postoperative outcomes in these patients. Our aim in this study is to compare perioperative characteristics and outcomes between EOS and NMS patients undergoing scoliosis surgery, and to evaluate the association of PNI with hospital stay. **Material and Methods:** A retrospective analysis was conducted on 49 patients who underwent surgery for scoliosis (27 NMS, 22 EOS). Demographic, radiological, and perioperative variables were recorded, including PNI, blood loss, hospital stay, complications, and transfusion requirement. Group comparisons were performed using t-test, Mann-Whitney U, and chi-square tests. Correlations were assessed with Spearman's test. **Results:** The NMS group was significantly older (13.7 ± 2.9 vs. 8.4 ± 2.6 years, $p < 0.001$) and had higher preoperative Cobb angle (75.1° vs. 58.3°, $p < 0.001$). Hospital stay was longer in NMS patients (13.4 vs. 6.2 days, $p < 0.001$). Pelvic tilt (63.0% vs. 22.7%, $p = 0.005$), complications (37.0% vs. 9.1%, $p = 0.024$), and transfusion requirement (63.0% vs. 31.8%, $p = 0.030$) were also more frequent in the NMS group. PNI did not differ significantly between groups (44.6 vs. 43.1, $p = 0.174$). In the overall cohort, no correlation was found between PNI and hospital stay ($r = -0.011$, $p = 0.940$). However, in the NMS subgroup, PNI showed a significant negative correlation with length of stay ($r = -0.415$, $p = 0.031$). **Conclusion:** Compared with EOS, NMS patients undergoing scoliosis surgery exhibited higher morbidity, longer hospitalization, and greater transfusion requirements. While overall PNI levels were similar, lower PNI was associated with prolonged hospital stay in NMS patients, suggesting its potential role as a prognostic factor in this subgroup.

ID: AGS26/827
P0036: Impact of rod diameter, material, and surface texture on screw-rod gripping capacity in spinopelvic fixation: a biomechanical study

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Introduction: Spinopelvic fixation is critical in adult spinal deformity surgery, yet mechanical failure rates range from 4.5-38%. Failure often involves the screw-tulip-rod interface, where rod diameter, composition, and surface texture may affect fixation strength. However, the combined biomechanical effects of these variables remain understudied. This study aimed to evaluate the influence of rod diameter, material, and surface texture on axial gripping capacity (AGC) of the screw-rod interface. **Methods:** Axial gripping capacity tests were performed in accordance with ASTM F1798-21 using porous fusion/fixation screws (iFuse Granite, SI-Bone). Rods of 5.5 mm and 6.0 mm diameter were tested in cobalt-chrome (CoCr) and titanium (Ti) with three finishes: grit blast, bead blast, and anodized bead blast. Maximum AGC was defined as the peak load within 1.5 mm of displacement; ultimate AGC (UAGC) within 5 mm. Ten trials per condition were performed. A two-way ANOVA with Bonferroni correction evaluated effects of diameter and material/surface combinations ($\alpha = 0.05$). **Results:** Each tested variable significantly affected AGC ($p < 0.001$). Independent of material or finish, 6.0 mm rods had significantly higher AGC than 5.5 mm (2518.0 ± 30.9 N vs. 2091.1 ± 30.9 N; $p < 0.001$). Among material/finish groups, bead-blasted Ti rods produced the highest AGC (2776.0 ± 61.9 N for 5.5 mm; 2910.3 ± 61.9 N for 6.0 mm), while anodized bead-blast Ti rods yielded the lowest (1656.6 ± 61.9 N and 2076.8 ± 61.9 N, respectively). CoCr grit-blast rods outperformed bead-blast CoCr. UAGC trends mirrored AGC, with minor differences in select comparisons. Pairwise comparisons are in Figures. **Discussion:** Rod diameter, material, and surface finish each significantly influenced gripping capacity. Larger diameters consistently improved fixation, but surface finish strongly modulated outcomes within each material. Bead-blasted Ti rods provided the highest fixation strength, while anodized bead-blast Ti rods performed worst. Among CoCr rods, grit-blast outperformed bead-blast, reinforcing that surface texture can alter performance even within a single material class. These findings emphasize that rod selection should consider both size and finish, as optimization at the screw-rod interface may reduce mechanical failure in spinopelvic constructs. These findings demonstrate that implant design choices-particularly rod diameter and surface finish-impact the screw-rod interface. Optimizing rod properties may reduce mechanical failure and improve outcomes for patients undergoing spinopelvic fixation.

ID: AGS26/835
P0037: Evaluating the role of preoperative coagulation testing before posterior spinal fusion in AIS: is laboratory measurement still necessary?

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Introduction: Preoperative laboratory testing, including coagulation profiles such as prothrombin time (PT), is routinely conducted before posterior spinal fusion (PSF) for adolescent idiopathic scoliosis (AIS). However, the clinical relevance of mild abnormalities in PT remains uncertain. This study aims to evaluate the impact of elevated PT values on intraoperative bleeding, need for transfusion in AIS patients undergoing PSF. **Material and Methods:** A retrospective analysis was conducted on AIS patients undergoing PSF in Alder Hey Children's hospital, categorized into two groups based on preoperative PT values: Group 1 (Elevated PT) and Group 2 (Normal PT). Comparative analysis was performed to assess differences in blood loss (BLEEDING), transfusion requirements, Mann-Whitney U and chi-square tests were used due to non-normal distribution of most variables. **Results:** A total of 76 patients were analyzed (38 per group). Group 1 had significantly higher PT values (mean 12.20 vs. 10.89, $p < 0.0001$). Despite this, no significant differences were observed in intraoperative blood loss (mean 217.7 ml vs. 200.1 ml, $p = 0.97$) or transfusion rates ($p = 1.0$). **Conclusion:** Routine preoperative PT testing may not be predictive of bleeding risk or transfusion need in AIS patients undergoing PSF. The findings suggest that mildly elevated PT values are not associated with adverse surgical outcomes. Prospective studies are needed to refine preoperative assessment protocols and avoid unnecessary delays or concerns over mild coagulation abnormalities.

ID: AGS26/I130
P0038: Real-time AI object detection in spine endoscopy: development and validation using spine scope videos

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Introduction: Endoscopic spine surgery relies on precise identification and differentiation of anatomical structures. To support this, we developed an AI-based object detection model capable of accurately distinguishing structures in spine scope videos. **Material and Methods:** This multicenter study included 112 patients undergoing spine endoscopic surgery. Videos were analyzed by extracting one frame per 300 frames, resulting in a diverse dataset. Patients were divided into training and validation cohorts in a 4:1 ratio. Key anatomical structures were annotated in the extracted frames to create a labeled dataset for training. Model performance was evaluated using Intersection over Union (IoU) to measure the overlap between predicted and ground-truth regions, along with Mean Average Precision (mAP) for classification within detected regions. **Results:** The model achieved an average IoU of 0.753 and mAP of 0.857 across the validation dataset, indicating its ability to accurately localize and classify key anatomical structures. Multicenter data enhanced the model's generalizability across diverse imaging conditions. **Conclusion:** The proposed AI model successfully distinguishes anatomical structures in spine scope videos with high accuracy. By focusing on region-specific classification and precise localization, the model demonstrates its potential for enhancing surgical navigation and reducing intraoperative errors. Further research will explore real-time deployment in clinical settings.

ID: AGS26/I170
P0039: Development and impact of an AI-assisted model for spinal radiograph interpretation: enhancing accuracy and efficiency of mSASSS assessment

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Introduction: The modified Stoke Ankylosing Spondylitis Spinal Score (mSASSS) is the gold standard for assessing structural progression in ankylosing spondylitis (AS), but manual scoring is time-consuming and subject to inter-observer variability. We developed and externally validated an end-to-end deep learning model for automated mSASSS scoring and evaluated its clinical utility in a paired crossover reader study. **Material and Methods:** A convolutional neural network with a ResNet-UPerNet backbone was trained on 1,159 radiographs (877 cervical, 282 lumbar) comprising 13,908 annotated vertebral corners from 823 AS patients. External validation was performed on 100 independent radiographs. Automated scoring performance was evaluated using accuracy, F1-score, Cohen's κ, and intraclass correlation coefficient (ICC). To assess clinical utility, two orthopedic surgeons scored the same 100 cases under two conditions (human-only vs AI-assisted hybrid) in a randomized crossover design. Primary endpoints were mean absolute error (MAE) reduction and reading time difference. **Results:** The segmentation network achieved mean IoU of 93.7% (cervical) and 96.7% (lumbar). Automated mSASSS scoring reached 83.5% exact grade-match accuracy, $\kappa = 0.72$, and ICC = 0.963 with a mean absolute error of 2.4 ± 3.1 points. In the reader study, hybrid scoring significantly reduced per-case MAE ($\Delta = 0.36$ points, 95% CI 0.22-0.50, $p < 0.001$, $dz = 0.55$) and shortened reading time by (1.63 minutes, 95% CI 1.44-1.82, $p < 0.001$, $dz = 1.65$), with higher corner-level accuracy (84.7% vs 79.2%, $p < 0.001$). **Conclusion:** This end-to-end AI model enables automated, accurate, and reproducible mSASSS scoring. When integrated into a hybrid reading workflow, it improves observer agreement, enhances per-corner accuracy, and significantly reduces interpretation time, supporting its potential for routine clinical implementation.

ID: AGS26/1181
P0040: Estimation of spinal curvature using Chest X-ray and generative models: a deep learning approach to Cobb angle prediction

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Introduction: Whole-spine radiographs are not routinely obtained in all clinical settings, and spinal deformities are often detected incidentally on chest X-rays. If spinal curvature could be estimated from chest radiographs, it would serve as a useful screening tool. This study aimed to estimate the Cobb angle using chest X-ray images and generative deep learning models. **Material and Methods:** A total of 534 single-channel chest X-ray images (160×128 resolution) were collected and preprocessed via standard augmentation techniques (rescaling, cropping, contrast/brightness tuning, and flipping). A Variational Autoencoder (VAE) was first trained in a self-supervised manner using masked autoencoding. Its encoder and decoder weights were then transferred to initialize a Generative Adversarial Network (GAN) model for outpainting tasks. The GAN generated extended images for scoliosis visualization, and Cobb angles were measured and compared to ground truth annotations.. **Results:** The self-supervised VAE outperformed the vanilla VAE with a lower FID score (240.06 vs. 251.31) and higher Inception Score (1.67 vs. 1.54), suggesting improved generation quality. The GAN model achieved a FID score of 130.91 for outpainted chest X-ray images. The average difference in Cobb angle estimation between real and generated images was 2.25°, indicating high accuracy and clinical feasibility. **Conclusion:** Chest X-rays augmented with generative models can be used to approximate spinal curvature with clinically acceptable error. This approach has potential to support scoliosis screening or follow-up in settings where full-spine imaging is unavailable.

ID: AGS26/1300
P0041: Evaluation of students perception between using live or cadaveric animal model for endoscopic surgery training: a cross-sectional study

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Introduction: Simulation on living tissue bridges the gap between inert/virtual trainers and cadaver labs by exposing trainees to bleeding, haemostasis and real-time complication management-skills considered essential for modern endoscopic spine surgery. Porcine and ovine columns are particularly valued for their anatomical compatibility, yet ethical, logistic and anatomical caveats persist. This study explored how postgraduate endoscopy students perceive the educational value, realism and limitations of animal models within a competency-based curriculum. **Methods:** We conducted a cross-sectional, anonymised survey of postgraduate spine-surgery students after institutional ethics approval. The 12-item questionnaire captured prior exposure, frequency of use, perceived usefulness, realism, challenges and confidence gains for both in-vivo and cadaveric models. Categorical responses were summarised as counts and percentages in R 4.2. **Results:** Thirty-four students completed the survey (response rate 100 %). Although 73 % had some previous contact with animal models, only 30 % had practised more than twice. In-vivo models were judged "useful" or "very useful" by 90 % of respondents, and 91 % felt they adequately simulate human endoscopic procedures; the chief difficulties were controlling the surgical environment and managing animal reactivity (both 21 %). Cadaveric specimens were also rated useful/very useful by 79 %, but half lamented the absence of physiological response and 33 % cited difficulty executing precise movements. When forced to choose a single platform, two-thirds (66 %) favoured in-vivo models for greater realism. Notably, every participant reported that either model increased their confidence, and 64 % said it "greatly" did so. **Conclusion:** Animal laboratories remain a highly valued, confidence-building component of endoscopic-spine training programmes. Trainees perceive in-vivo models as more realistic, yet acknowledge cadaveric advantages in anatomical visualisation and animal-welfare considerations. Integrating both platforms - while addressing technical and ethical challenges - appears essential for a balanced, high-fidelity curriculum.

ID: AGS26/1307
P0042: Nutritional optimization with vitamins D3 and K2 as a strategy to prevent implant-associated complications

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Introduction: The widespread use of implants in spinal surgery, particularly interbody devices and pedicle screw systems, has significantly improved treatment outcomes. However, implant-related complications such as screw loosening, cage migration, and pseudarthrosis remain clinically important challenges. Bone mineral density (BMD) and vitamin D status are key determinants of implant stability, yet deficiency of vitamin D is highly prevalent in Eastern Europe. Combined vitamin D3 and K2 supplementation may provide additional benefits for bone quality and fusion stability, but clinical evidence in spinal surgery remains limited. The aim was to evaluate the relationship

between vitamin D status, bone mineral density, and the risk of implant-associated complications in patients undergoing spinal fusion, and to assess the role of postoperative vitamin D3 and K2 supplementation in improving outcomes. **Materials and Methods:** A retrospective single-center cohort study was conducted at the Romodanov Neurosurgery Institute (Kyiv, Ukraine) from January 2023 to December 2024. A total of 250 patients (18-81 years) who underwent thoracolumbar stabilization with pedicle screws and/or interbody cages were analyzed. Baseline assessments included demographics, BMI, serum 25-(OH)D3, and BMD (measured via CT, HU scale at L1). Patients were stratified into three groups: (1) normal vitamin D levels requiring no correction (NNC), (2) patients with deficiency receiving vitamin D3 and K2 supplementation (SRD), and (3) patients with deficiency but untreated (NNT). Implant-related complications were classified using original radiological grading systems for screw loosening and cage migration. Statistical analyses included regression modeling and correlation testing. **Results:** Vitamin D deficiency (< 20 ng/ml) or insufficiency (20-29 ng/ml) was identified in more than 70% of patients, with a strong correlation between serum 25-(OH)D3 and BMD (r = 0.68). Younger patients with normal vitamin D demonstrated significantly higher BMD and lower complication rates. After four months of supplementation, all patients in the SRD group achieved normal 25-(OH) D3 levels. BMD showed a modest but consistent increase in the SRD group, while it declined in untreated patients. At six months, the risk of pedicle screw loosening was reduced by 69.8% (OR 0.30), and cage migration by 56.2% (OR 0.44) in the SRD group compared to untreated patients. At 12 months, reductions reached 85.1% for screw loosening (OR 0.15) and 64.7% for cage migration (OR 0.35). Most complications in untreated patients required revision surgery, while those in supplemented patients were mild, non-progressive, and did not necessitate reoperation. **Conclusions:** Postoperative correction of vitamin D deficiency with combined D3 and K2 supplementation significantly improves bone quality dynamics, reduces implant-associated complications, and enhances fusion stability. These results suggest that the adaptive response of bone to implantation, supported by nutritional optimization, is more important than absolute BMD values alone. Combined vitamin D3 and K2 therapy should be considered an effective adjunct to spinal fusion surgery, particularly in populations with endemic vitamin D deficiency.

ID: AGS26/1325
P0043: What exactly are we looking at? A validation study for abul cranial shift phenomenon

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Introduction: The Abul Cranial Shift (ACS) phenomenon was first described by Abul et al. in 2023 as a novel entity observed in patients with adolescent idiopathic scoliosis (AIS). This phenomenon refers to the association between the thoracolumbar transitional vertebra and L5 sacralization in the context of AIS. In the present study, we investigated the prevalence of this phenomenon in individuals with adolescent idiopathic scoliosis as well as in the healthy population. **Material and Methods:** Radiographic data were retrospectively analyzed from three cohorts: 493 patients who had undergone surgical treatment for adolescent idiopathic scoliosis (AIS), 493 control subjects, and 328 patients who were either conservatively managed or are currently under follow-up for scoliosis or kyphosis. Standard full-spine standing radiographs (orthoradiograms) were independently evaluated by two observers, each performing two separate assessments with a six-week interval between sessions. The following parameters were examined: presence of thoracolumbar transitional vertebrae, presence of a C7 transverse process, presence or absence of rib remnants at T12, rib count, and the presence of sacralized lumbar vertebrae. Intraobserver and interobserver correlation coefficients were calculated to assess reliability. Statistical significance was set at $p < 0.05$. **Results:** The prevalence of Abul Cranial Shift (ACS) was found to be 17% (84/493) in the surgically treated AIS group and 14% (73/493) in the control group. Intraobserver agreement coefficients ranged from 0.501 to 0.735, whereas interobserver agreement coefficients ranged from 0.576 to 0.595. **Conclusion:** Although the Abul Cranial Shift (ACS) has been described in adolescent idiopathic scoliosis (AIS), it is evident that variations in spinal alignment also exist within the normal population. Recognition of ACS is important in the preoperative planning of AIS surgery in order to prevent potential level selection errors during the procedure. Furthermore, given its presence in the normal population, the potential associations of ACS with other spinal deformities remain an open field for future investigation.

ID: AGS26/2408
P0044: CALM1 polymorphism in degenerative cervical myelopathy of the Indian cohort

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Introduction: Degenerative cervical myelopathy (DCM)- often termed cervical spondylotic myelopathy- is the most com-mon cause of spinal cord injury in adults, arising from age-related degenerative changes in the spine. Genetic susceptibility may modulate which individuals develop myelopathy under these mechanical stresses. *Calmodulin-1 (CALM1)* is a gene encoding calmodulin, a key calcium-binding protein involved in cartilage maintenance and neural signalling, and CALM1 variants have been implicated in degenerative joint disease. We hypothesized that a CALM1 polymorphism could influence DCM risk. **Material and Methods:** In this pilot case-control study, 48 DCM patients

(with imaging-confirmed cervical spondylotic cord compression) {males (n = 42, 84.36%), females (n = 6, 12.76%)}with cervical disc anterolisthesis (degenerative), chronic neck pain (> 3 months duration), and/or quadriparesis with positive bilateral Babinski's sign, and 57 controls (with imaging- no significant degenerative changes in the disc) {males (n = 47, 82.45%), females (n = 10, 17.54%)} with acute neck pain (< 3months dura-tion), cervical spondylosis or acute traumatic spine injuries were recruited from an Indian population. This design aimed to distinguish genetic factors specific to degenerative pathology. All participants underwent Sanger sequencing of the CALM1 gene to identify polymorphisms. The primary variant analyzed was a common single-nucleotide polymorphism (SNP) in CALM1's regulatory region. Genotype and allele frequencies were compared between DCM cases and controls using Fish-er's exact test, and odds ratios (OR) with 95% confidence intervals (CI) were calculated. No formal sample size calculation was performed due to limited prior data, as this study was exploratory. **Results:** The cases group primarily exhibited three new intronic variations (NG_013338.1: g.11552G > A, NG_013338.1:g.5361T > C, and NG_013338.1: g.11731G > A of the CALM1 gene). Among these, NG_013338.1: g.11731G > A was significantly associated with DCM, with an odds ratio of 0.43 (p-value = 0.0117). In silico (i.e., using computer-based prediction models) analysis revealed that these intronic variations changed the splicing regulatory elements, which could impact gene expression. The CALM1 risk-allele frequency was similar in DCM patients (27.1%) and controls (14.0%, OR = 0.43, 95% CI 0.2-1.35; p = 0.012). No other *CALM1* coding variants showed significant case-control association. Rou-tine laboratory parameters (e.g., calcium profiling, serum Vitamin B12 levels) were comparable between groups, suggesting no metabolic confounders. **Conclusion:** In this Indian cohort, *CALM1* polymorphism was not significantly associated with degenerative cervical myelopathy. The variant's effect, if any, appears to be of low pathogenicity. These findings, while preliminary, provide novel population-specific data and highlight the importance of further research. This pilot study lays the groundwork for larger studies to elucidate genetic contributions to DCM, underscoring that CALM1 and similar variants merit continued investiga-tion as hypothesis-generating candidates.

ID: AGS26/2504
P0045: A new self-assessment score for simulation in spine surgery at low cost with learning curve at the operating room

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Introduction: Surgical simulation improves surgical skills through repetitive standardized exercises. Cadaver labs or computerized simulators used for surgical training are costly and there is a lack of access for most of the spine surgeons. The goal of this pilot study was to define a new self-assessment score evaluating spine surgery procedures in simulation, and to correlate it with the learning curve at the operating room. **Material and Methods:** Simulation (S) and operative (O) groups were defined. Data of one spine fellow were prospectively collected during 9 months. 5 basic spine procedures (microdiscectomy, freehand pedicle screw insertion, decompressive laminectomy, dural repair and cervical anterior discectomy) were assessed. A mark /6 for each following topic regarding anatomy recognition, accuracy of the procedure, estimated speed, ability to self-criticize and correct, and procedure time with its quartile's mark, lead to a topic score /30. Self-confidence and self-progression were assessed on /10 each. Thus, with doubling and adding all these scores, a final score was obtained /100. Learning curve cumulative sum (LC-CUSUM), comparison and correlation studies were performed. Average run length (ARL) was estimated when the scores were upon a mean value. Cumulative costs in United States Dollars (USD) were also collected. **Results:** 50 procedures were performed, 25 in each group. For groups S and O, mean topic scores were 19.6/30 vs. 20.2/30 respectively, p = 0.57. Average self-assessment scores were 11.0/20 vs. 11.5/20 respectively, p = 0.51. The mean S and O final scores were 61.0/100 vs. 63.3/100 respectively, p = 0.52. There was no correlation between S and O overall and detailed scores, $p > 0.05$, except for the time mark ($p < 0.01$). A learning curve effect was observed after an ARL of 14 procedures in simulation and of 17 in operative conditions, at 6 months, with a strong correlation in LC-CUSUM between the groups ($p < 0.01$). Overall costs of the simulation training were 250 USD. **Conclusion:** The described self-assessment score of spine surgery simulation showed good preliminary results with a strong correlation of the learning curve at the operating room. Costs were low and the model adequate for spine fellowship training. Further studies on larger samples are needed to confirm these results.

ID: AGS26/3054
P0046: Enhanced fusion and safety profile of a novel rhBMP-2-containing biphasic ceramic putty in a sheep lumbar interbody fusion model

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Introduction: This pivotal ovine lumbar interbody fusion study evaluated the safety and efficacy of an injectable ceramic-based bone graft containing rhBMP-2, compared with iliac crest autologous bone graft (ICBG). Spinal fusion is commonly performed to treat various pathological spinal conditions. An ideal graft should possess both osteoinductive and osteoconductive properties. The ceramic-based bone graft consists of rhBMP-2 bound within the micropores of a β-TCP/HA composite, enabling slower and more gradual release than rhBMP-2 delivered on an absorbable collagen sponge (ACS). **Material and Methods:** Ninety-six skeletally mature female sheep underwent single-level lumbar interbody fusion at L3-L4 using PEEK cages. Each animal received either ICBG or the rhBMP-2/ceramic composite graft at 0.2, 0.4, or 2.0 mg/cc. At 30, 90, 180, and 365 days postoperatively, radiographic (uCT/CT), histomorphometric, biomechanical (manual palpation), histopathological, and clinical pathology evaluations were conducted. Local and systemic safety was qualitatively and quantitatively assessed according to ISO 10993-6 and ISO 10993-11. **Results:** uCT analyses showed rhBMP-2 dose-dependent improvements in fusion, with the high-dose group achieving 100% complete fusion at both 180 and 365 days. Low- to mid-dose groups showed comparable fusion rates to ICBG (50-66.7%) at 365 days. Histomorphometry revealed progressive new bone formation in all groups without significant intergroup differences at 180 or 365 days. Histopathology showed more mature trabecular bone in the rhBMP-2 groups from day 180 onward, and manual palpation confirmed fusion in most animals by day 180. Local reactions were mild, and no systemic toxicity was observed. Residual graft material degraded markedly within 90 days and remained stable (steady state) at the local site thereafter. **Conclusion:** The injectable ceramic-based bone graft containing rhBMP-2 demonstrated fusion outcomes comparable or superior to ICBG while enhancing bone quality and bridging in a dose-dependent manner and maintaining a favorable safety profile. These findings support this graft as a safe and effective alternative to autograft bone for spinal fusion and provide a basis for future clinical studies.

ID: AGS26/3310
P0047: Assessment of osteogenesis on three-dimensionally printed titanium implants with complex surface topography

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Introduction: With current advancements in additive manufacturing technology, implant surface modifications can aid in osseointegration. Surface characteristics in the macro, micro and nanoscale ranges allow for texturized surfaces designed to guide bone formation through the cellular response thereby optimizing osteoconductivity. Osteoblastic differentiation favors a micro-roughness while cellular adhesion is enhanced by nano-roughness. Investigation of surface roughness complexity in vitro can predict bony ongrowth in vivo. The purpose of this study is to evaluate the response of mesenchymal stem cells to titanium implants with different surface morphology (roughness). We hypothesize that there is an ideal range of roughness that will best promote both cellular adhesion and proliferation towards bony ongrowth. **Material and Methods:** Titanium coupons were three dimensionally printed with varying surface roughness (smooth, very fine, fine, medium, rough, and very rough) and cultured with human mesenchymal stem cells for a total of 7 days. Six surfaces of increasing roughness were selected for this study. Cell lysate and media were collected and assayed for viability and via ELISA for cell signaling indicators of progression toward osteocyte differentiation such as osteocalcin, interleukins (IL) 1b, 6, 8, and 10, BMPs 2, 4, and 7, and vascular endothelial growth factor (VEG-F). Fluorescent microscopy and DNA quantification were used to determine cell viability. Cell morphology and attachment to the titanium surface were imaged using scanning electron microscopy (SEM). **Results:** Cell viability tests showed that cells were able to grow on all surfaces, yet performed best on surfaces with mid-range roughnesses. Electron microscopy showed cellular attachment and communication on all samples except smooth, and at a greater amount in the medium to rough range. Osteocalcin expression was measured on all surfaces, suggesting cellular differentiation towards bone formation. BMP2, BMP4, and BMP7 were all measured for all surfaces, suggesting angiogenesis. Live/dead immunofluorescence imaging showed high viability on all surfaces. **Conclusion:** Cellular attachment and biological response are necessary for osteoblast differentiation and bone formation. Current 3D printing technology allows for the production of implants with surface morphology that optimizes an osteopromotive biological response. The results of our study can hopefully further our understanding of the specific characteristics that optimize bone formation for implants.

ID: AGS26/422
P0047.1: Outweighting Spine Surgery: the Impact of Bariatric Surgery on Spinal Health.

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Introduction: Low back pain and reduced mobility are common in patients with morbid obesity. Meta-analyses have demonstrated worse surgical outcomes and higher complication rates in obese individuals undergoing spinal surgery. This study aims to evaluate the impact of weight loss through bariatric surgery on spinal health, assessing both radiological and clinical outcomes. **Material and Methods:** Fifty patients with morbid obesity (mean BMI: 44.8 kg/m2 ± 4.6 ranging from 35.9 to 54.2) underwent bariatric surgery (sleeve gastrectomy or gastric bypass) between October 2020 and April 2023 were enrolled. Clinical assessment included properative and 1-year postoperative lumbar and leg pain using the Visual Analog Scale (VAS), as well as disability using the Oswestry Disability Index (ODI), along with long cassette and flexion-extension X-rays to measure pelvic, lumbar, and global sagittal alignment parameters. Change in health-related quality of life (RQoL) and sagittal alignment were analyzed using paired statistical tests (t-test or Wilcoxon, as appropiated). **Results:** The mean age at the time of the bariatric surgery was 40 ± 10 year-old, with 65.3% of patients being female. The average weight loss was 36.6 ± 14.9 kg (ranging from 11 to 75 kg). Clinical Outcomes Preoperatively, the median ODI was 16 (IQR 3 to 40) with 57.1 % of patients reporting minimal disability (ODI <20) and 35% reporting severe disability (ODI >40). In term of pain, 33% reported elevated back pain (VAS >7) and 37% reported elevated leg pain, with 16% reporting both. At one-year postoperatively, ODI improved significantly overall (median ΔODI= -8 IQR -3 to -23) as well as within each group of disability (all $p<0.05$), with the greatest reductions in those with higher baseline ODI. Notably, only 18.2% of patients with preoperative ODI >40 remained above this threshold after surgery, while 45.5% improved to a level similar to the general population (ODI: 8.8 ± 6). Back and leg pain also showed significant reductions (both $p<0.001$). Among patients with elevated pain preoperative, respectively 31% and 44% reported minimal or no back and leg pain (VAS<3) post-operatively. Weight loss was significantly correlated with improvements in back and leg pain ($r=0.35$ and 0.41 respectively; both $p<0.05$). Radiological Findings At baseline, degenerative spinal changes were common: 46% had disc degeneration, 24% spondylolisthesis (isthmic or degenerative), and 14% presented degenerative scoliosis. Spinal alignment demonstrated minimal deviation from asymptomatic population (PI-LL: -1.2 ± 9.1; TPA: 12.1° ± 7.1). Preoperative pelvic tilt (17.0° ± 7) was slightly elevated compared to normal populations, though not statistically significant. Postoperatively, kyphosis increased significantly, suggesting global spinal relaxation. **Conclusion:** Obesity is not synonym of back pain or disability, but patients with severe back pain and high disability present significant improvement of their quality of life following bariatric surgery. Weight loss via bariatric surgery (or GLP-1 receptor agonists) may significantly reduce the need for spinal surgery in obese individuals. While sagittal alignment remains largely unchanged, obesity seems to accelerate degenerative processes associated with the aging cascade. Obesity is not synonym of back pain or disability, but patients with severe back pain and high disability present significant improvement of their quality of life following bariatric surgery. Weight loss via bariatric surgery (or GLP-1 receptor agonists) may significantly reduce the need for spinal surgery in obese individuals. While sagittal alignment remains largely unchanged, obesity seems to accelerate degenerative processes associated with the aging cascade.

Biomechanics

ID: AGS26/116
P0048: Relationship between postoperative variation of adjacent segment three-dimensional kinematics and postoperative PI-LL in patients with degenerative lumbar scoliosis

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Introduction: This study investigated the variation in pre- and post-operative range of motion (ROM) in adjacent segments in patients with degenerative lumbar scoliosis (DLS) following posterior lumbar interbody fusion (PLIF). **Material and Methods:** Eight patients with symptomatic DLS were analysed using a biplane radiographic imaging system while adopting different postures. Synchronised biplane radiographs from L1 to S1 and the motions of each vertebra were acquired pre- and post-operatively. Six degrees-of-freedom (DOF) of kinematic data were compared between different postoperative pelvic incidence-lumbar lordosis (PI-LL) groups (group A: PI-LL=−10°∼10°; group B: PI-LL=10°∼20°). **Results:** After surgery, the axial rotational movement (primary rotation) during flexiong-extension, bending and torsion in the first adjacent segment at L3-4 decreased significantly in three patients (8.14 ± 2.78 vs 15.13 ± 6.71; 8.36 ± 5.59 vs 9.08 ± 3.57; 5.07 ± 0.56 vs 9.25 ± 5.06). At this level, the torsion around crania-caudal (CC) axis during bending (1.48 ± 1.01 vs 7.05 ± 5.84, $p < 0.05$) and flexion around mediolateral (ML) axis and bending rotation around anterioposterior (AP) axis during torsion decreased postoperatively (6.37 ± 6.01 vs 13.83 ± 8.12, 4.53 ± 1.97 vs 13.06 ± 6.65; $p < 0.05$, $p < 0.05$). After surgery, in L1-2 segment, translation along the ML direction decreased during bending (3.69 ± 2.12 vs 14.76 ± 7.99, $p < 0.05$). In the adjacent L5-S1 segment, primary flexed rotation around ML axis increased in group B postoperatively during flexion-extension, but decreased in group A (6.08 ± 1.17 vs −13.41 ± 2.99, $p < 0.05$). Coupled flexed rotation around ML axis decreased showed the opposite trend during bending (−10.76 ± 5.51 vs 18.12 ± 39.83, $p < 0.05$).

Conclusion: Postoperative coupled motion at the adjacent segment decreased, which indicates an improved balance of the spinal order compared to before the surgery. However, primary motion changed according to the location of the upper instrumented vertebrae. Our results indicate postoperative PI-LL values between 10° and 20° were associated with lower coupled motion and higher primary motion at L5-S1.

ID: AGS26/325
P0049: The skiving phenomenon in spinal bone drilling: influence of drill parameters on accuracy and clinical implications

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Introduction: Spinal interbody fusion is performed in more than 250,000 cases annually in the United States, with pedicle screw fixation considered the most stable dorsal anchorage. Precise placement of implants is essential, as misplacement can result in vascular or neurological injury. A major challenge during bone drilling is the skiving phenomenon, where the drill bit slips along the curved cortical surface before penetration, leading to malpositioning, thermal damage, or even revision surgery. This study systematically investigates the influence of drilling parameters on skiving to derive recommendations for clinical practice and autonomous drilling systems. **Material and Methods:** Drilling trials were performed on standardized artificial bone blocks (Sawbones®, Sweden) using a CNC milling/drilling machine (FP4A, DECKEL AG, Germany). Parameters tested included rotational speed (1000, 2000 rpm), feed rate (6-120 mm/min), and entrance angle (90°, 75°, 60°, 45°). Three drill bit designs were evaluated: a standard surgical drill, a centering drill, and a milling cutter. Each drilling attempt was recorded from two perspectives and analyzed using OpenCV-based tracking algorithms and MATLAB to quantify deviations from the desired entry point. Skiving was defined as a deviation > 0.5 mm. **Results:** In total, 65 drillings were performed, of which 61 were analyzable. Skiving occurred in 58% of cases, with a mean deviation of -1.11 ± 1.24 mm (x-direction) and 0.44 ± 0.36 mm (y-direction). At 90° entry, no significant drift was observed, while reduced entrance angles markedly increased skiving. At 75°, 75% of trials showed drift, and at 60° all trials demonstrated significant deviation (maximum −5.04 mm, 1.65 mm). At 45°, standard drills failed to penetrate the cortex. Higher feed rates correlated with increased drift, while higher rotational speed (2000 rpm) slightly reduced downward but not lateral skiving. Among drill types, the centering drill performed best at moderate angles, while the milling cutter proved unsuitable. **Conclusion:** Bone drilling accuracy is strongly influenced by entrance angle, feed rate, and drill bit design. Perpendicular drilling minimizes skiving, while oblique entry angles significantly increase deviation. Lower feed rates improve accuracy but prolong drilling times. Although higher rotational speeds provide more stable trajectories, they must be balanced against risks of thermal osteonecrosis. For clinical practice, perpendicular entry, use of pilot indentations, and guidance sleeves are recommended to minimize skiving and improve pedicle screw placement accuracy. These findings also provide a foundation for developing control algorithms in autonomous bone drilling systems

ID: AGS26/455
P0050: Navigated vs. non-navigated thoracolumbar pedicle screws: implications on biomechanical stability including the costovertebral joint

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Introduction: Instabilities and injuries of the thoracolumbar spine often require surgical stabilization. A standard procedure is dorsal instrumentation using pedicle screws and rigid rods as a fixateur interne. The placement of the screws is a challenging procedure due to the proximity to neurovascular structures. Navigation systems are gaining popularity and are used more frequently to minimize the risk of injury and increase the screw accuracy. Pedicle screws show high biomechanical stability. However, this stability varies due to different factors such as screw-pedicle-ratio, bone density and distance to pedicle cortex. The aim of this study was to analyze the biomechanical stability of navigated and non-navigated thoracolumbar pedicle screws depending on screw accuracy. **Material and Methods:** Four fresh-frozen human specimens underwent percutaneous dorsal instrumentation from T6 to L3 using pedicle screws. A 3D-navigation system (NAV) was used unilaterally, and fluoroscopy (2D) was used contralaterally. Screw accuracy was evaluated according to the Gertzbein and Robbins classification (Grades A-E). Screws graded A and B (perforations < 2 mm) were considered accurate. Additionally, screws located in the costovertebral joint with a screw-pedicle ratio > 1.0 were considered as accurate (Grade CV). The spine was removed from the specimens, and the individual vertebral bodies were prepared to the bone. The vertebral bodies were placed into a 3D-printed mole and fixed using a polyol-isocyanate solution (ratio 1:1). Subsequently, force controlled cyclic loading and unloading were applied. Cyclic loading of the screws started at a bending moment of 0.5 Nm and was increased up to 2.5 Nm in 0.5 Nm increments. The screws were subjected to 100 cycles at each loading level at approximately 0.1-0.2 Hz, resulting in a total of 500 cycles per screw. Afterwards the screws underwent testing of pullout force. **Results:** A total of 52 thoracic and 23 lumbar pedicle screws (n = 75) were tested regarding pullout force. Five screws were excluded from testing due to mechanical failure of the pedicles.

Of the 75 screws, 67 (89%) were rated as accurate (Grade CV or higher) and eight as inaccurate (Grade C or lower). Statistical analysis of screw accuracy showed a significant difference between navigation and fluoroscopy (p = 0.005*). There was no statistical significance in the overall comparison of optimally (NAV: median = 791.5 N; 2D: median = 798.5 N; Overall: median = 798.5 N) and suboptimally rated screws (NAV: median = 290.5 N; 2D: median = 238.0 N; Overall: median = 238.0 N; p = 0.06). The pullout force of thoracic screws placed intrapedicularly (918.19 ± 576.59 N) was significantly higher compared with screws placed in the costovertebral joint (515.95 ± 461.72 N; p = 0.008*). **Conclusion:** This study demonstrated differences in pullout force regarding pedicle screw position. In terms of biomechanical stability, screws placed in the costovertebral joint showed significantly lower pullout forces than fully intrapedicular screws, regardless of perforation. Regarding biomechanical stability screw placement in the costovertebral joint should be avoided.

ID: AGS26/979
P0051: Biomechanical evaluation of titanium versus carbon fiber-reinforced polyetheretherketone composite implants for spine tumor surgery: a finite element study

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Introduction: The management of spinal tumors remains surgically complex, often necessitating durable instrumentation to achieve stability. Traditionally, titanium alloys have been the predominant material used in spinal oncology implants. However, carbon fiber-reinforced composites have recently gained attention as a promising alternative. These implants provide several potential advantages, including radiolucency that minimizes postoperative imaging artifacts and facilitates radiation planning and delivery. Despite these benefits, comparative data on the biomechanical performance of different implant materials in spinal oncology remain limited. Finite element (FE) modeling is a widely recognized engineering simulation method that facilitates the '*in silico*' modeling of complex structures, offering a reliable and validated method to simulate complex spinal biomechanics under both healthy and diseased conditions. This study aimed to compare the biomechanical properties of titanium, continuous carbon fiber-reinforced polyetheretherketone (CFR-PEEK), and chopped CFR-PEEK implants using FE analysis in a lumbar spine model with an L3 vertebral tumor. **Material and Methods:** A validated lumbar spine FE model was employed to simulate an L3 vertebral tumor by reducing cancellous bone properties to 10% of baseline values. Instrumentation constructs spanned L1-L5 with bilateral pedicle screws placed at all levels except L3. Screws measured 50 mm in length and 5.5 mm in diameter, and rods were 6 mm in diameter. Three material types for rods and screws were tested: titanium, continuous CFR-PEEK, and chopped CFR-PEEK. Surgical simulation included L2-L5 laminectomy with removal of the ligamentum flavum and bilateral complete facetectomies at L2/3 and L3/4. Biomechanical parameters analyzed included range of motion (ROM), intervertebral disc pressure, rod stress and strain, and the bone-screw contact force, which is a measure of resistance to screw pull-out. **Results:** Continuous CFR-PEEK constructs showed reduced total ROM in flexion and extension (16.74° and 27.09°, respectively) compared with titanium (17.32° and 27.39°, respectively) and chopped CFR-PEEK implants (22.37° and 35.06°, respectively). Average intervertebral disc pressures were lowest with continuous CFR-PEEK (0.05 MPa flexion, < 0.01 MPa extension) versus titanium (0.06 MPa flexion, < 0.01 MPa extension) and chopped CFR-PEEK (0.14 MPa flexion, < 0.01 MPa extension). Chopped CFR-PEEK rods demonstrated lower stress but higher strain (vonMises stress 12.2 MPa flexion, 17.76 MPa extension; effective plastic strain 0.17% flexion, 0.7% extension) compared with continuous CFR-PEEK (vonMises stress 156.21 MPa flexion, 206.8 MPa extension; effective plastic strain 0.03% flexion, 0.04% extension) and titanium (vonMises stress 157.07 MPa flexion, 203.72 MPa extension; effective plastic strain 0.05% flexion, 0.07% extension). The bone-screw contact force was higher in the continuous CFR-PEEK implants (32.8 N flexion, 59.8 N extension) compared to titanium (23.8 N flexion, 43.3 N extension) and chopped CFR-PEEK (0.5 N flexion, 1.1 N extension). **Conclusion:** Continuous CFR-PEEK implants provided biomechanical stability in flexion and extension and excellent resistance to screw pullout, comparable to titanium and markedly superior to chopped CFR-PEEK implants. The lower strain observed in continuous CFR-PEEK implants suggests a potential advantage in reducing the risk of implant-related complications. Despite these benefits, the higher stress concentrations observed in continuous CFR-PEEK implants warrant further investigation to assess implications for long-term durability.

ID: AGS26/1020
P0052: Measuring mechanical exposure in traumatic spine injuries

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Introduction: Spinal injuries result from a wide spectrum of mechanical exposures, yet current classifications (AIS, AO Spine) focus on morphology rather than quantifying external

force intensity. Mechanisms are often reduced to binary categories ("low- vs. high-energy"), overlooking the continuous nature of exposure and limiting comparability. To address this gap, we developed a multilevel scale providing a standardized, clinically interpretable measure of event severity. The aim was to develop and conduct primary validation of a multilevel (0-10 points) scale for quantitative assessment of external mechanical exposure intensity in spinal trauma. **Materials and Methods:** The study followed COSMIN principles. A literature review (PubMed, Scopus, Web of Science, 1990-2025) defined threshold values and modifying factors (patient mass, impulse transfer coefficient Tland, effective deceleration distance sland). Validation was based on two datasets: 40 standardized clinical vignettes and 52 real cases of thoracolumbar junction trauma (Th11-L2) with mandatory CT/MRI verification. Evaluated parameters included construct and criterion validity, inter-rater reliability (ICC, κ), absolute reliability (SEM, MDC95), diagnostic accuracy (ROC analysis), agreement (Bland-Altman), and threshold stability. **Results:** The analysis confirmed the feasibility of using Equivalent Height (HEQ) as a universal criterion for quantifying mechanical exposure. On this basis, a 0-10 point scale was constructed, along with a derivative metric, the Effective Spinal Height (ESH), aimed at adjusting HEQ for spine-specific biomechanical modifiers. Inter-rater reliability was high: ICC(2,1) reached 0.84 for HEQ and 0.79 for ESH, while pooled ICC(2,k) values were even higher (0.95 and 0.92, respectively), indicating excellent reproducibility across experts. Weighted κ values confirmed substantial agreement. Absolute measurement error was acceptable, with SEM ranging 0.80-0.95 and MDC95 between 2.2-2.6 scale points. Bland-Altman analysis demonstrated narrow limits of agreement and absence of systematic bias, confirming internal consistency of the scale. Threshold stability testing showed that disagreements beyond ± 1 level occurred in fewer than 7% of cases, underscoring robustness of cut-off values. The derivative metric ESH showed significant correlations with clinically relevant morphological features: vertebral body wedge deformity ($r = 0.58$), canal compromise ($r = 0.49$), and ordinal severity according to AO Spine classification ($\rho = 0.62$; $p < 0.001$). These associations support both construct validity (the measure behaves as theoretically expected) and criterion validity (alignment with established classification systems). Logistic regression demonstrated that each 1-m increment in ESH nearly doubled the odds of sustaining injuries of type ≥A3 (OR = 1.85; 95% CI 1.45-2.38), indicating strong predictive capability. Diagnostic accuracy was further supported by ROC analysis: AUC values reached 0.82 for fracture detection, with an optimal cut-off around 1.3 m (sensitivity 0.76, specificity 0.72). This suggests that the scale can effectively discriminate clinically significant injuries and guide risk stratification. **Conclusions:** The proposed scale provides a quantitative, mass-neutral, and clinically interpretable description of event severity. It complements morphological classifications, improves risk stratification, and can be applied for triage, diagnostic planning, and multicenter studies.

ID: AGS26/1086
P0053: Graft bolt outperforms center screw fixation in single-level anterior lumbar interbody fusion: a biomechanical study

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Introduction: Anterior lumbar interbody fusion (ALIF) is a common procedure for lumbar pathology. Failures in standalone ALIFs often result from micromotion and lack of supplemental fixation. Studies highlight the importance of implant material and design in promoting bony ingrowth and fixation. The IdentiTi-ALIF Standalone System introduces a fenestrated, Hollow Graft Bolt designed to enhance screw fixation. While fenestrated screws show biomechanical advantages in other contexts, limited data exist on their use in ALIFs, indicating a need for further biomechanical and clinical evaluation. **Material and Methods:** Six cadavers were dissected into 24 motion segments (L2-L5). ALIF cages were placed on the superior endplate of the caudal lumbar vertebrae of each motion segment with a single distal screw, randomized to either GraftBolt or standard center lock screw. Instrumented segments were potted and mounted on a biaxial testing machine with a custom device to apply an anterior shear load to the cage. 400 N of axial compression was applied using a pulley system while specimens were subjected to 1,000 cycles of shear loading (20-140 N at 1 Hz), followed by shear load-to failure 5 mm/min. Failure was defined as a 30% drop from peak load. Cyclic displacement, ultimate load, displacement at failure, stiffness, and toughness, were compared using students t-test. Failure method of each specimen was visually examined. **Results:** During cyclic shear loading, graft-bolt constructs recorded significantly less anterior displacement than centerscrew constructs at all measured intervals (300-1000 cycles, $p < 0.05$). By the 1000th cycle, displacement was 0.358 ± 0.063 mm for graft bolts versus 0.435 ± 0.122 mm for center screws. When loaded to failure, graft bolts withstood higher maximum force (597.1 ± 186.8 N vs. 471.5 ± 170.7 N, $p < 0.05$). Stiffness, toughness, and displacement at failure were not significantly different ($p > 0.05$). All failures involved shear-induced bone stripping at the screw-bone interface, with no loosening or disengagement of hardware. **Conclusion:** This study compared the immediate post-operative biomechanical performance of a novel graft bolt versus a conventional center screw in single-level ALIF

constructs. The graft bolt significantly reduced implant translation during cyclic loading and demonstrated a higher ultimate load to failure, suggesting enhanced early postoperative stability. These preliminary mechanical findings suggest GraftBolt's hollow design may reduce micromotion and improve fixation in lumbar ALIF constructs.

ID: AGS26/1145
P0054: Bone quality in spinopelvic stabilization: a morphometric analysis of 672 algorithm-optimized S2AI corridors

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Introduction: Sacral alar-iliac (S2AI) screws, placed between S1 and S2, are considered the standard of spinopelvic fixation. However, there is a gap of knowledge on how bone quality within the S2AI corridor changes with age. The objective of this study was to characterize bone volume fraction (BV/TV) and the proportion of the screw corridor located outside the bone in S2AI trajectories (7-10 mm diameter) using a forensic quantitative CT (QCT) dataset. **Material and Methods:** Pelvic bones were automatically segmented from QCT data. An algorithm-optimized iterative approach was developed to optimize screw trajectories within manually defined entry and exit regions. Each screw corridor was subdivided into 16 sections. Statistical analyses included ANOVA, t-tests, Friedman, Mann-Whitney U, Wilcoxon tests, and biphasic nonlinear regression. **Results:** A total of 336 pelves (mean age 52 ± 18 years, range 15-94) and 672 S2AI screw corridors (mean length 137 ± 11 mm) were analyzed. BV/TV followed a characteristic distribution: low values in sections 1-3, an increase in 4-7, a plateau in 7-11, a decline in 12-14, and a second increase in 15-16. The highest mean BV/TV was observed in 10 mm corridors, followed by 9, 8, and 7 mm. In individuals aged ≥ 65 years ($n = 81$), BV/TV was significantly lower across all diameters ($p < 0.0001$), particularly in sections 6-15. The inflection point was identified at 48 years (7 mm) and 47 years (10 mm). Depending on diameter, 6-7% of the total corridor volume extended beyond the bone, mainly in sections 2-9, with a peak in sections 5 and 6. No significant differences were observed between diameters regarding the proportion outside the bone. **Conclusion:** Bone volume fraction within the S2AI corridor decreases significantly with age. In geriatric patients, larger screw diameters should be preferred. Ten-millimeter screws can be safely placed in most cases. To reach regions of highest bone density, S2AI screws should be at least 90 mm in length.

ID: AGS26/1159
P0055: Relationship of posterior superior iliac spine (PSIS) morphology and ideal s1 pedicle screw trajectory: a cross-sectional study of closed vs open PSIS morphology

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Introduction: S1 pedicle screws are commonly used in spine surgery. As these screws are often the most caudal part of the construct, it is essential to have excellent fixation via the ideal pedicle screw placement of a medialized end point in the sacral promontory, yielding tricortical fixation. This trajectory is often precluded by the presence of a closed posterior superior iliac spine (PSIS) morphology, leading to use of alternative, potentially less optimal fixation options. The aim of this study was to define the prevalence of closed PSIS morphology. **Materials and Methods:** Computed tomography (CT) scans of the pelvis from 133 patients at a single institution were reviewed to determine the ideal S1 screw trajectory. PSIS morphology was classified as either open or closed, based on whether a line extending from the ideal S1 pedicle screw trajectory intersected the PSIS. Statistical analyses included descriptive statistics (with 95% confidence intervals), group comparisons (one-sample proportion tests, chi-square tests, t-tests, and Mann-Whitney U tests), correlation analyses, and logistic regression to identify predictors of PSIS morphology. Effect sizes (Cohen's d, Cramer's V) were used to assess clinical significance in addition to statistical significance. **Results:** 81 patients (60.9%) demonstrated closed PSIS morphology. Gender was the only significant predictor of closed PSIS morphology, with males being 79% less likely to have closed PSIS morphology. **Conclusion:** Pre-operative CT imaging should be carefully reviewed and scrutinized to assess for closed PSIS morphology, and if closed PSIS morphology is present, plans for alternative fixation methods should be considered and available at the time of surgery.

ID: AGS26/1301
P0056: Reconceptualizing non-traumatic spine pain: a tensegrity-based review of biomechanical and inflammatory mechanisms

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Introduction: Non-traumatic spine pain remains a prevalent clinical issue, often inadequately explained by disc-centric or segmental degeneration models. A more holistic understanding is needed to explain symptom clustering at spinal transition zones and the chronicity of fascial and muscular dysfunction. This conceptual review aims to structure a more integrative and fascia-aware approach to non-traumatic spine pain, drawing on biomechanics, muscle physiology, and inflammation science. We explore the tensegrity model as a unifying framework to explain regional load accumulation, muscular fatigue, the inflammatory process and fascial adhesions.
Material and Methods: Drawing from human anatomy, myofascial research, and analogies in robotics and bioengineering, the tensegrity paradigm is applied to the spine to explain patterns of muscle deconditioning, fiber-type shifts, and collagen densification. Current literature on fascial biomechanics, neuromuscular adaptation, and pain generation is synthesized.
Results: We identify structural weak points at the regional junctions; cervicothoracic, thoracolumbar, and lumbosacral, as common sites of dysfunction due to load concentration and architectural transitions. Proposed treatment strategies include inflammatory modulation, in addition to isometric and eccentric loading, fascia-targeted manual therapies, and ultrasound-guided trigger point interventions for refractory myofascial nodes.
Conclusion: Reframing spinal pain through the lens of tensegrity enables a systems-level understanding of posture failure, muscle imbalance, and fascial pathology, offering more targeted and durable therapeutic pathways.

ID: AGS26/1379
P0058: Preoperative hip stiffness effect on spinopelvic compensation following lumbar fusion

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Introduction: Spinopelvic sagittal alignment is thought to play a critical role in physical function and clinical outcomes following lumbar fusion surgery. Patients with stiff hips may have a reduced ability to adapt to postural changes following surgery. This study evaluated differences in spinopelvic alignment changes from standing to sitting after lumbar fusion between patients with preoperatively identified stiff hips and controls. **Material and Methods:** Adult patients undergoing 1 or 2 level lumbar fusion by a single surgeon with preoperative and 1-year postoperative lateral radiographs in standing and sitting positions were identified. Exclusion criteria included previous lumbar fusion surgery, revision within 1 year postoperatively, and >2 levels fused. Spinopelvic parameters analyzed included pelvic femoral angle (PFA), pelvic tilt (PT), sacral slope (SS), lumbar lordosis (LL), lumbar tilt (LT), and sagittal angle (SA). LT was defined as the angle between a line drawn from the posterior edge of the superior L1 endplate to the center of the femoral head and a vertical line. SA is the angle between a line drawn from the posterior aspect of the superior L1 endplate to the center of the femoral head and a line parallel to the femoral shaft. Patients were classified as having stiff hips preoperatively if ΔPFA from standing to sitting was less than -55°. Preoperative and 1-year postoperative sitting and standing spinopelvic measurements were compared using independent samples t-tests between groups. **Results:** Fifty-four patients met inclusion criteria. The average age was 64.9 ± 12.3 years, and the group included 32 females (55.2%). The average BMI was 29.3 ± 5.5, with 27 patients identified as having stiff hips preoperatively. Following lumbar fusion, patients with stiff hips showed greater decreases from standing to sitting in SS (-14.89° vs -7.44°) and LL (-18.48° vs -6.73°), greater increases in LT (5.83° vs 8.70°) and PT (16.07° vs 8.30°), and smaller decreases in SA (-64.15° vs -74.15°) and PFA (-58.59° vs -69.15°). Preoperative trends followed similar trends. From preoperative to postoperative, stiff-hip patients had larger decreases in ΔPFA (-17.37° vs -2.26°) and ΔLT (-2.52° vs -0.96°). **Conclusion:** Patients with stiff hips demonstrated increased pelvic retroversion (larger increase in ΔPT, larger decrease in ΔSS) and larger decrease in lumbar lordosis from standing to sitting. These differences in spinopelvic compensation may impact long-term outcomes following lumbar fusion, as there is likely a redistribution of forces into vertebral segments adjacent to the lumbar fusion construct. Patients with preoperative hip stiffness exhibit distinct compensatory spinopelvic adaptations after lumbar fusion surgery, which may alter load distribution across adjacent segments. Increased awareness of how spinopelvic parameters change postoperatively in patients with stiff hips may help guide preoperative planning.

ID: AGS26/1415
P0059: Biomechanics in treatment of spondylolysis with listhesis. Smile technique

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Introduction: Our aim is to describe the biomechanics and the results obtained in 15 patients operated in the last 5 years with spondylolysis with listhesis grade 1 and 2 according to Meyerding classification. The natural history of spondylolisthesis has been extensively studied but the different etiopathogenic theories and the diverse criteria for surgical treatment are still inconclusive. Some studies have evaluated the anatomical and biomechanical capabilities of the lumbosacral spine and its relation with external factors. Under normal conditions and in the upright position the anterior spine supports 80% of the total axial loads, whereas the posterior column bears only the remaining 20%. The biomechanical loads in the lumbosacral disk include those originating from gravity and

muscular action as a vector of combined forces directed forward and downward. Besides the compression of the disc, perpendicular to the vertebral endplates, there is a shearing force directed forward through the intervertebral disc, controlled by the intact fibrous ring and the posterior structures, fundamentally the facets, their capsules and ligaments. Therefore the normal spinal functional unit converts the forces acting in the lumbar region into a load bearing system (discs, vertebral bodies, and posterior arches) and of tensile forces at the level of the posterior ligaments (mainly intralaminar and intraspinous) and finally the spinal extensor muscles which work against gravity. The integrity of the "pars" is fundamental for anteroposterior stability. Our goal is its reconstruction. **Material and Methods:** 15 patients were evaluated, 9 men and 6 women. In all cases the complaint was low back pain or sciatica not relieved through orthopedic and physiotherapy treatment. All patients were studied with Rx, CT scan and MRI. All lysis and listhesis were found at L4-L5 (5 cases) and L5-S1 (10 cases) only grades 1 and 2 were included in this study. **Surgical technique:** Posterior approach at the level of the affected vertebrae. Sharp dissection of the lamina, localization of the lysis and stripping, leaving two bone surfaces facing each other. Placement of two transpedicular screws in the lytic vertebrae and placement of a "U" bar under the spinous process. Reduction of the listhesis with an approximator which grasps the bar under the spinous and the tulip of the transpedicular screw, after the placing of bone graft taken from the spinous of the overlying vertebra. Fixation of the bar in position ("smile technique"). We prefer the use of monoaxial screws, placing them at 70° and fixing them at 90° (between the screw and the bar) exert a significant reduction force over the listhesis. **Results:** In no case was discectomy performed, all patients returned to their usual physical activities, even those who played sports. The patients did not present postoperative complications. Everyone referred complete or partial improvement of their symptoms. **Conclusion:** This method ("smile") is usually used in our department for the treatment of spondylolysis with listhesis grade 1 and 2. For years we operated this pathology in this way achieving very good results. In most cases there was a total remission of symptoms.

ID: AGS26/1419

P0060: Biomechanical impact of splint rods in posterior cervicothoracic fixation: a finite element analysis

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Introduction: Posterior stabilization of the cervicothoracic spine is challenging as constructs must bridge the mobile cervical spine with the rigid thoracic spine. High stresses across this transition zone predispose to hardware complications such as screw loosening or rod fracture. Strategies to increase stiffness include larger rods, cobalt chrome alloys, and larger screws; however, these may transmit higher stresses to the bone-screw interface. Splint rods, or accessory rods, may augment load sharing and reduce primary rod strain, but their biomechanical role in cervicothoracic fixation is unclear. This study used finite element analysis (FEA) to evaluate the impact of splint rods, rod diameter, rod alloy, and lateral mass screw size on construct load bearing capacity. **Material and Methods:** An FEA model simulated a C7 vertebrectomy construct with pedicle screws at T1-T2 and lateral mass screws at C5-C6, replicating ASTM F1717/ISO 12189 conditions. Eight construct variations were analyzed. Variables included primary rod alloy (titanium [Ti] vs cobalt-chrome [CoCr]), presence or absence of splint rods, splint rod diameter (3.5 mm vs 4.5 mm), and lateral mass screw size (3.5 mm vs 4.0 mm). Vertebral bodies were modeled using grade 10 polyurethane foam, and discs were simulated with hyperelastic properties. Each construct underwent ramped cranial-caudal displacement of 2 cm until failure. Outcomes included yield load, displacement, stiffness, and stress distributions. **Results:** The primary failure mode was shear at the lateral mass screw-bone interface, simulating screw loosening. A secondary failure mode was rod notching at T1 from pedicle tulip impingement. The best configuration was 3.5 mm Ti primary and splint rods, yielding 107 N load capacity and 29.8 N/mm stiffness. The worst configuration was a single 3.5 mm Ti rod without splint rods, with 66 N load capacity and 20.3 N/mm stiffness. Increasing splint rod diameter from 3.5 mm to 4.5 mm raised stiffness but reduced load capacity due to earlier screw loosening. Larger 4.0 mm lateral mass screws improved capacity in single-rod constructs but reduced it when combined with splint rods. Switching from Ti to CoCr improved capacity in single-rod constructs but reduced stiffness with splint rods, suggesting altered load sharing. **Conclusion:** Splint rods consistently improved load bearing capacity in cervicothoracic constructs. However, greater stiffness from larger rods, screws, or stiffer alloys did not uniformly increase capacity and sometimes predisposed to earlier screw-bone failure. Construct optimization requires balancing stiffness and load sharing rather than maximizing rigidity. Splint rods appear effective for enhancing construct capacity, but material and dimensional choices are critical. Further studies with dynamic loading are needed to clarify fatigue performance and clinical implications.

ID: AGS26/1430

P0061: Biomechanical comparison of seven occipital-cervical fixation constructs using finite element analysis

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Introduction: The occipitocervical junction (OCJ) is a complex region requiring stabilization when rendered unstable or when neurological compression occurs. Fixation is challenging due to limited occipital bone purchase, proximity to critical neurovascular structures, and the need to resist multi-axis biomechanical forces. Although multiple occipital fixation strategies exist, there is no consensus on the optimal construct design. This study used finite element analysis (FEA) to compare seven commonly used occipitocervical (OC) fixation constructs to determine differences in stiffness, screw pullout forces, and overall biomechanical performance. **Material and Methods:** Seven bilateral OC fixation constructs spanning the occiput to C3 were modeled per ASTM F2706 guidelines. Variations included bilateral rods, keel plates, and one- or two-hole clamp systems, with screws ranging from 4.5 to 5.0 mm in diameter. Vertebral segments were represented by rigid polyurethane blocks, and intervertebral discs were modeled with compression springs to replicate physiological stiffness. Screws were modeled as smooth cylinders bonded to the bone blocks. Each construct was subjected to a ramping flexion torque of 6.12 Nm at the occipital hinge. Outcomes included bending stiffness, screw pullout forces, stress distribution, and a combined performance ranking using the Multi-Attribute Utility Theory (MAUT) score. **Results:** Bending stiffness varied substantially between constructs, ranging from 509 to 820 N·mm/deg. Construct E, composed of medially fixed one-hole and two-hole clamps, achieved the highest stiffness (820 N·mm/deg) and the greatest overall MAUT score (0.79), indicating an optimal balance between stiffness and reduced screw pullout forces. Construct C, a wide keel plate, demonstrated the lowest performance (MAUT 0.19), with high localized pullout forces and reduced stiffness. Constructs employing keel plates concentrated stress centrally, while rod-and-clamp constructs distributed forces more evenly. Increasing screw diameter from 4.5 mm to 5.0 mm provided minimal benefit, with only a 2 N reduction in pullout force. Stress analysis showed all constructs localized peak stresses at implant-rod interfaces, predicting rod notching as a potential failure mode under fatigue loading. Despite these stresses, none of the screw pullout forces exceeded theoretical maximum pullout strength in bone. **Conclusion:** This FEA study demonstrates that construct design significantly influences the biomechanical stability of OC fixation. Medially aligned clamp-based constructs provided superior stiffness and balanced load distribution compared to keel plates, which concentrated forces and risked higher pullout. Larger screw diameter had minimal impact on stability. Stress analysis suggests rod notching at implant interfaces as a possible long-term failure mechanism. Optimal OC fixation requires careful selection of construct type to maximize stability while minimizing screw pullout risk. These findings provide biomechanical insight into construct selection and may guide future clinical decision-making and implant design.

ID: AGS26/1542
P0062: Mapping fusion zones to motion resistance: finite element insights into return-to-activity after interbody fusion

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Introduction: Lumbar interbody fusion is widely used for degenerative lumbar pathologies with TLIF and PLIF common due to technical reliability. While approach influences perioperative outcomes, long-term success hinges on achieving solid interbody fusion that restores stability and alignment as well as reduces undue biomechanical stress. Radiographic assessment treats fusion as global, yet the spatial distribution of bone growth around the cage may differentially affect biomechanics under direction-specific loads. We used finite element analysis to examine how flexion/extension, lateral bending, and axial rotation interact with anterior, posterior, and lateral fusion zones. We aim to inform surgical planning and guide safe and progressive postoperative rehabilitation by linking localized fusion distribution to segmental resistance. **Material and Methods:** We used finite element analysis to examine how flexion/extension, lateral bending, and axial rotation interact with anterior, posterior, and lateral fusion zones in an L4-L5 lumbar interbody fusion model. The disc space was partitioned into four fusion zones (anterior, right, posterior, left) plus a central cage. Two constructs were analyzed: cage-only and cage-screw-rod, with tie constraints at all interfaces to simulate full osseointegration. The L5 inferior surface was fixed while pure moments were applied to L4 to compute angular motion at a superior-center reference point. To reflect construct stiffness, moments were 300/300/400/200 Nm (extension/flexion/lateral bending/torsion) for cage-screw-rod and 100/100/100/50 Nm for cage-only. The vertebrae were modelled as cancellous bone (0.35 GPa), screw and rods as titanium alloy (110 GPa), and cages in both PEEK (2 GPa) and titanium. Fusion-zone stiffness followed power-law scaling according to fusion quality. Scenarios examined zone presence/absence (including asymmetries) and heterogeneous early (50% vs 25%) and mid-term (80% vs 50%) fusion, yielding moduli of 224, 87.5, and 21.9 MPa. **Results:** Construct stiffness increased monotonically with more fusion zones and higher fusion quality. Using a $\leq 5^\circ$ ROM criterion, many 3-zone patterns were close to 4-zone performances, but lateral bending strongly depended on the presence and quality of both lateral zones. A 2-zone lateral pattern could outperform some 3-zone patterns in lateral bending and torsion due to the larger fused contact area. Critical loads were higher with instrumentation at 144.1-334.9 Nm versus 74.1-147.7 Nm for cage-only.

Instrumentation also had the greatest effect when no fusion was present and showed diminishing benefit once lateral zones were included. With instrumentation, removed zones lowered thresholds to 69.0-80.5% of full fusion, while cage-only thresholds were highly quality-dependent and could drop to 7.8%. With screw-rod fixation, three-fusion zones at 80% quality could achieve thresholds within 5% of full fusion, particularly for anterior-posterior loading. However, lateral and torsional responses continue to hinge on the lateral zone quality. Titanium cages provided minimal added stiffness when instrumented (0.5-3.0%) and modest gains in cage-only scenarios (2.1-16.1%). **Conclusion:** Three fusion zones can often achieve 4-zone-equivalent stability for ≤5° ROM, especially in anterior-posterior motions with instrumentation. However, lateral bending uniquely requires both lateral zones and torsional resistance scales with fused contact area. Cage-only constructs are highly sensitive to fusion presence and quality while instrumentation blunts this sensitivity for anterior-posterior motions.

ID: AGS26/1580
P0063: Morphometric measurement of pedicles and feasibility of cortical bone trajectory (CBT) for thoracic spine stabilisation utilising CT-scan

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Introduction: Conventional pedicle screw (CPS) fixation for spinal stabilisation is often compromised by screw loosening, especially in poor bone quality, with loosening rates reported as high as 54.6% in certain cases. The Cortical Bone Trajectory (CBT) technique has emerged as an alternative to traditional pedicle screw techniques where it maximises engagement with cortical bone, demonstrating superior pullout strength and insertional torque. While extensively studied for the lumbar spine, there is limited data on its application in the thoracic region, which presents unique anatomical challenges like smaller pedicles and proximity to vital structures. This research will address the current gap in the literature regarding thoracic CBT morphometry in the region and the data gathered will provide an essential reference for surgeons, aiding in preoperative planning and potentially improving the safety and efficacy of thoracic spinal fixation in the Malaysian population. **Material and Methods:** A retrospective study was conducted using Computed Tomography (CT) images of thoracic vertebrae from Malaysian adults aged 18-60 without spinal deformities. Morphometric parameters relevant to the CBT technique - including pedicle width, pedicle height, cephalad angle, lateral angle, screw width, and screw length. The data was collected from the Picture Archiving & Communication System (PACS) radiological data at the University Sains Malaysia Specialist Hospital in Kelantan, Malaysia between August 2019 to July 2024. **Results:** This study analysed 756 thoracic vertebrae from 63 Malaysian adults (42 males, 21 females). The results showed that pedicle height and feasible screw length increased progressively from T1-T12, while pedicle width & the corresponding screw diameter were narrowest in the critical mid-thoracic region (T4-T5). In terms of trajectory, the cephalad angle remained relatively consistent (15°-20°) across all levels, but the lateral angle was unmeasurable in the upper thoracic spine (T1-T4) due to medial pedicle orientation, increasing steadily from T5 downwards. Significant sex-based differences were noted, with males consistently demonstrating larger pedicle dimensions, lateral angles, and feasible screw sizes compared to females at nearly all levels; however, no significant difference was observed for the cephalad angle. These findings align with other international studies however underscores a critical safety concern as the risk of lateral wall fracture is higher in females. **Conclusion:** This study highlights the potential benefits & the feasibility of thoracic spine CBT technique in the Malaysian population. Based on these anatomical constraints, the study concludes that CBT is most feasible at T6 and below for males & T9 and below for females. Although CBT offers a key safety advantage by directing screws away from the spinal canal (reducing neurological risk), complication rates like screw misplacement & pedicle fracture are comparable to traditional techniques. However, meticulous preoperative CT imaging is essential, for better outcomes.

ID: AGS26/1760
P0064: Assessment of the angular measurements of the spine. Are we doing our best?

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Introduction: The Cobb angle method, although widely adopted in clinical and research contexts for spinal assessment, presents intrinsic limitations. By restricting the measurement to the angular relationship between segmental

endpoints, it fails to provide an accurate representation of the curvature distribution along the entire spine. Consequently, important morphological variations and localized alterations may remain undetected. To address these limitations, alternative strategies have been proposed to refine the quantification of sagittal alignment and improve the reliability of curvature analysis. **Material and Methods:** We developed a methodology based on mathematical modeling of the spine, designed to enable continuous and segmental analysis of spinal curvature. Three independent observers annotated the vertebral body vertices from C3 to S1, as well as the femoral heads, in 26 standing lateral spine radiographs. Each examination was repeated twice, with a minimum interval of one week between sessions. From these landmarks, vertebral centroids were calculated as the intersection of diagonals connecting opposite vertices. The centroids were then interpolated to generate a mathematical model of the spine. Segmental intervertebral angles were subsequently computed by measuring the difference of the inclination of each vertebral body relative to the normal of the model. Inter and intraobserver reliability were assessed using intraclass correlation coefficients (ICCs). **Results:** The proposed method demonstrated superior reproducibility and accuracy compared with the traditional endplate-based approach. Intraobserver reliability was consistently high across vertebral levels, and interobserver agreement was equally robust. Specifically, mean ICC values for the endplate method were 0.49 (interobserver) and 0.55 (intraobserver), whereas the centroid method reached 0.92 (interobserver) and 0.94 (intraobserver). These results confirm the method's capacity to provide a reliable, segment-by-segment characterization of spinal curvature. By enabling individualized and reproducible assessment, the approach captures subtle morphological features frequently overlooked by conventional techniques. **Conclusion:** The intervertebral angle profile proved to be a precise and reliable method for comprehensive evaluation of curvature pattern. Unlike the Cobb method, which offers only a global estimate, this methodology allows continuous and individualized analysis of curvature distribution at each vertebral level. The findings support its potential as an advanced alternative for the investigation and monitoring of structural spinal alterations, overcoming the limitations inherent to conventional approaches.

ID: AGS26/1872
P0065: Prospective analysis of functional outcomes using 3D-printed trabeculated titanium interbody cages in minimally invasive TLIF

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) has emerged as an effective technique for managing degenerative lumbar pathologies. Interbody cage design significantly influences osseointegration, stability, and long-term outcomes. Three-dimensional (3D) printed titanium cages, with their porous architecture mimicking cancellous bone, promise improved biomechanical integration compared to conventional cages. However, clinical evidence on their functional efficacy remains limited. **Material and Methods:** This prospective study included 35 patients undergoing single-level MIS-TLIF using 3D-printed titanium interbody cages between February 2025 and May 2025. Demographic data, perioperative parameters, and radiological findings were recorded. Functional outcomes were assessed preoperatively and at follow-up (3, 6, and 12 months) using the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) for back and leg pain. Fusion status was evaluated using plain radiographs and CT scans where indicated. **Results:** The mean age of the cohort was 46.2 years, with a slight female predominance. Operative time averaged 152 minutes, and mean blood loss was 112 ml. All patients demonstrated significant improvement in ODI and VAS scores at the 6- and 12-month follow-up ($p < 0.05$). Radiological assessment suggested early signs of osseointegration and bridging trabeculae, with 93% achieving Grade I or II fusion by 12 months. No cage subsidence, migration, or major complications were observed. **Conclusion:** This preliminary prospective analysis indicates that 3D-printed titanium cages in MIS-TLIF provide favorable short-term functional and radiological outcomes, supporting their potential role in enhancing spinal fusion. Larger, long-term comparative studies are warranted.

ID: AGS26/1955
P0066: Quantitative CT is superior to MRI-based bone quality for predicting vertebral compression strength

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Introduction: Determining vertebral strength is critical in planning lumbar spine surgery, since poor bone quality increases the risk of screw loosening, cage subsidence, and perioperative fractures. Several imaging-derived markers of bone health have been suggested. Volumetric bone mineral density (vBMD) derived from quantitative CT (qCT) and MRI-based vertebral bone quality (VBQ) have been proposed as surrogate markers of bone integrity. Abdominal aortic calcification (AAC) assessed on radiographs reflects systemic vascular disease and has been linked to skeletal fragility. Yet, their relative importance in predicting mechanical strength remains uncertain. Finite element

analysis (FEA) yields individualized estimates of vertebral compression strength (CS) but is not widely available in clinical settings. We sought to determine which imaging parameters best predict FEA-derived vertebral CS, hypothesizing that CT-based vBMD would be the strongest predictor. **Material and Methods:** We retrospectively reviewed patients with degenerative spinal disorders who underwent lumbar fusion at a single specialized orthopedic center (2014-2020). IRB approval was obtained. Inclusion criteria required preoperative lumbar CT and MRI within 12 months; patients with prior fusion, fracture, tumor, infection, or poor imaging quality were excluded. Seventy-six patients met criteria. CT-derived vBMD at L1-L2 was calculated using scanner-specific calibration of Hounsfield units. $VBQ_{L1/2}$ was determined on T1-weighted MRI as vertebral body signal intensity normalized to cerebrospinal fluid. AAC was scored on lateral lumbar radiographs using the Kauppila method. Vertebral CS was calculated by FEA from CT-based three-dimensional models with incrementally applied compressive displacement until failure. Spearman correlations assessed associations between CS and imaging parameters. Multivariable linear regression adjusted for age, sex, and BMI, with collinearity checks (VIF > 2.5). **Results:** Of the 76 patients (54% female; mean age 61.1 ± 10.6 years; BMI 29.6 ± 6.2 kg/m^2), vBMD strongly correlated with CS ($\rho = 0.75$, $p < 0.001$). VBQ ($\rho = -0.20$, $p = 0.086$) and AAC ($\rho = -0.22$, $p = 0.062$) were not significant. In regression models, vBMD was the only independent imaging predictor ($\beta = 64.9$, $p < 0.001$), with male sex also contributing ($\beta = 2252$, $p < 0.001$). VBQ did not predict CS ($p = 0.606$; adjusted $R^2 = 0.09$). Adding VBQ or AAC to vBMD did not improve explanatory power (adjusted $R^2 = 0.77$ vs. 0.76-0.78). **Conclusion:** qCT-derived vBMD was the only imaging biomarker that reliably predicted vertebral CS, underscoring trabecular density as the key determinant of load capacity. In contrast, MRI-based VBQ and AAC did not improve prediction, likely reflecting marrow composition or systemic processes rather than intrinsic vertebral strength. CT-based bone quality assessment therefore remains the most robust and practical approach for preoperative risk stratification in patients undergoing lumbar fusion. Future studies should validate these findings in larger, diverse populations and investigate complementary roles of MRI- and vascular-based biomarkers in comprehensive skeletal health assessment.

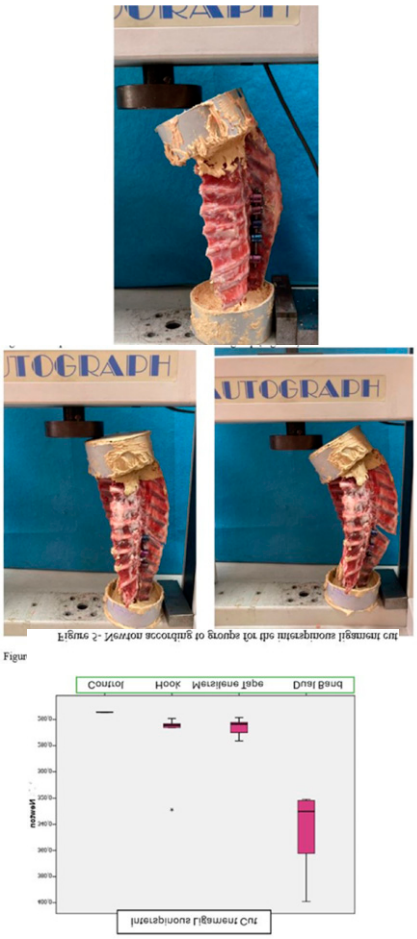
ID: AGS26/1959
P0067: The effect of four different surgical methods on preventing junctional kyphosis in a sheep spine model: a biomechanical study

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Introduction: Proximal junctional kyphosis (PJK) is a problem with rigid systems made with pedicle screws owing to improved instrument systems and understanding of spinal deformities. Proximal junctional kyphosis is defined as the development of a kyphotic deformity of more than 10 °between the instrumented vertebra and the proximal level. PJK is an important problem because it requires revision surgery and there is no consensus in the literature on its prevention. The aim of our study was to determine which of the different materials placed proximal to the instrument is more durable with loading and to help reduce the incidence of PJK. In our study, we aimed to evaluate the effect of a transverse hook, mersilene tape, and a dual-band system with and without cutting the interspinous ligament in preventing proximal junction kyphosis. **Material and Methods:** In our study, 23 sheep spines of 3-4 years old Karaman sheep breed, in which paraspinal soft tissues were preserved between C7-T10 levels, were included. The facet joints and interspinous and supraspinous ligaments of the spines included in the study were preserved. The first group was divided into four different groups by placing 5 level bilateral pedicle screws between T2-7. The first group was the control group(A0) with five sheep spines, the second group was the mersilene tape (A1) with six sheep, the third group was the transverse hook (A2) with six sheep, and the fourth group was the dual band (A3) system with six sheep. In the second stage, the interspinous ligament was cut at the level proximal to the pedicle screw level in the spine of 17 sheep, and mersilene tape(B1), transverse hook(B2), and dual band(B3) system were placed in two sheep in the control group (B0) and five sheep each proximally. **Results:** In the first phase of the study, where the interspinous ligament was intact, the control group(A0) had an average of 335.88 ± 53.46 Newton, A1 group had 473.97 ± 89.13 Newton, A2 group had 486.57 ± 122.6 Newton, and A3 group had 436.00 ± 86.16 Newton. No significant difference was observed between the Newton values obtained ($p > 0.05$). In the second phase, where the interspinous ligament was cut, the control group(B0) had 254.35 ± 0.35 Newton, B1 group had 266.14 ± 7.10 Newton, B2 group had 276.38 ± 29.42 Newton, and B3 group had 346.82 ± 33.75 Newton. Newton values showed a statistically significant difference between the groups ($p = 0.010$; $p < 0.05$). Pairwise comparisons revealed that Newton values in the control group were significantly lower than those in the dual-band group ($p = 0.012$; $p < 0.05$). Comparing the experiments with and without cutting the interspinous ligament, the Newton values of the A2 group, where the interspinous ligament was intact, were significantly higher than those of the group with the cut interspinous ligament(B2) ($p = 0.004$; $p < 0.01$). Similarly, the Newton values of the A1 and A3 groups with intact interspinous ligaments were significantly higher than those of the groups with cut interspinous ligaments (B1-B3) ($p = 0.004$, $p < 0.01$, and $p = 0.030$; $p < 0.05$, respectively). **Conclusion:** PJK is one of the most important problems in spinal surgery. In addition to ensuring sagittal alignment, the use of surgical techniques and materials has also made important contributions. In our study, the importance of preserving the interspinous ligaments re-emerged,

and the use of dual bands increased the durability of the junction area.



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P0068: Sagittal imbalance after posterior fossa tumor surgery in children: an underestimated problem

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Introduction / Objectives: Posterior fossa tumors are among the most common pediatric brain neoplasms. With improved survival, long-term complications gain importance. Postoperative sagittal spinal imbalance remains underrecognized. This study evaluates its incidence, mechanisms, and clinical impact in children treated for posterior fossa tumors. **Materials and Methods:** We retrospectively reviewed pediatric patients operated on for posterior fossa tumors between 2015 and 2020. Clinical data, imaging, and follow-up were analyzed. Sagittal balance was assessed using standing spine radiographs (sagittal vertical axis, pelvic parameters, thoracic kyphosis, lumbar lordosis). Functional outcomes were evaluated using pediatric quality-of-life scales. **Results:** Of 42 children, 7 (16.6%) developed progressive sagittal imbalance within 2-4 years post-surgery. Contributing factors included postoperative truncal hypotonia, cerebellar mutism syndrome, and radiation-induced myopathy. Radiographs showed global sagittal malalignment with compensatory pelvic retroversion. Clinically, affected children had postural difficulties, gait disturbances, and reduced participation in daily activities. Early rehabilitation was insufficient to halt deformity progression; 2 patients required spinal fusion. **Conclusion:** Sagittal imbalance is a significant but underreported long-term complication after posterior fossa tumor surgery in children. Systematic spinal follow-up allows early detection and timely intervention with physiotherapy, orthoses, or preventive surgical strategies. Incorporating spinal assessment into multidisciplinary survivorship programs is essential to optimize long-term outcomes.

ID: AGS26/2411
P0069: Biomechanical and clinical evaluation of PSO, modified PSO and VCR treating OVCF kyphosis: a finite element analysis

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Introduction: In the context of an aging population, osteoporotic vertebral compression fracture (OVCF) has become one of the major complications of osteoporosis. For OVCF patients with severe kyphosis, osteotomies may be necessary to restore sagittal balance. Several osteotomy techniques are currently used in clinical practice. As OVCF patients are often elderly and severely osteoporotic, perioperative risks are high and postoperative mechanical complications are common, making it difficult to select the optimal osteotomy strategy. In recent years, some scholars have proposed a modified pedicle subtraction osteotomy (mPSO) to correct kyphosis. Although this technique has demonstrated favorable clinical outcomes and prognosis in some patients, its biomechanical rationale remains unclear. **Material and Methods:** Clinical Study: A retrospective study was conducted involving 33 consecutive patients with no significant differences in risk factors for mechanical complications. Sagittal parameters were measured on preoperative, postoperative, and follow-up lateral spinal radiographs. Biomechanical Study: A finite element (FE) model was developed using CT scan data from a female OVCF volunteer with kyphosis only. The model was used to simulate pedicle subtraction osteotomy (PSO), vertebral column resection (VCR), and modified pedicle

subtraction osteotomy (mPSO). Each postoperative model was tested under six loading conditions (flexion, extension, left/right lateral bending, left/right rotation). Stress distribution and deformation of the finite element models were measured. **Results:** Clinical Study: No significant differences were observed in preoperative sagittal parameters. mPSO showed superior outcomes in multiple postoperative and follow-up sagittal parameters compared to PSO and VCR, with shorter operative time and less intraoperative blood loss. There were no significant differences in postoperative mechanical complications. Biomechanical Study: Under most loading conditions, the displacement in mPSO was similar to that in PSO and greater than in VCR. The maximum equivalent stress in all vertebral bodies remained within a safe range, with stress mainly distributed at the T10 vertebra and the fixed L2 vertebra. The stress in VCR was higher than in mPSO and PSO. Under all loading conditions, VCR exhibited the highest intervertebral disc pressure, followed by PSO, and then mPSO. The maximum pressure was located at the T10-T11 disc. **Conclusion:** Finite element analysis indicates that mPSO provides spinal stability comparable to PSO and may offer a better environment for bone fusion while preventing adjacent segment degeneration. Combined with its lower surgical risk, we believe that modified pedicle subtraction osteotomy can be a suitable surgical option for indicated OVCF patients.

ID: AGS26/2422
P0070: Spinopelvic compensation in sitting and standing postures following lumbar fusion

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Introduction: Spinopelvic sagittal alignment is thought to play a critical role in physical function and clinical outcomes following lumbar fusion surgery. While sagittal alignment is typically assessed in the standing position, sitting is the most common posture in daily life. Lumbar fusion may induce changes in spinopelvic adaptation, potentially impairing the body's ability to achieve optimal alignment during postural transitions from standing to sitting. This study aimed to describe the normative changes in spinopelvic sagittal alignment after lumbar fusion in both the standing and sitting positions, and to evaluate the magnitude of the changes in spinopelvic compensatory mechanisms when transitioning from standing to sitting after surgery. **Material and Methods:** Adult patients undergoing 1 or 2 level lumbar fusion by a single surgeon with preoperative and 1-year postoperative lateral radiographs in standing and sitting positions were identified. Exclusion criteria included previous lumbar fusion surgery, revision within 1 year postoperatively, and > 2 levels fused. Spinopelvic parameters analyzed included pelvic femoral angle (PFA), pelvic tilt (PT), sacral slope (SS), lumbar lordosis (LL), lumbar tilt (LT), modified lumbar tilt (mLT), and sagittal angle (SA). LT was defined as the angle between a line drawn from the posterior edge of the superior L1 endplate to the center of the femoral head and a vertical line; mLT was similar, but with the line drawn from the posterior edge of the superior L3 endplate. SA is the angle between a line drawn from the posterior aspect of the superior L1 endplate to the center of the femoral head and a line parallel to the femoral shaft. Preoperative and 1-year postoperative sitting and standing spinopelvic measurements were compared using paired samples t-tests. The magnitude of change in spinopelvic parameters from standing to sitting posture between preoperative and postoperative radiographs was compared using paired samples t-test. **Results:** Fifty-four patients met inclusion criteria. The average age was 64.9 ± 12.3 years, and the group included 32 females (55.2%). The average BMI was 29.3 ± 5.5, and 43 patients (79.6%) underwent one-level fusions. In standing, postoperative increases were observed in SS (33.7° to 35.7°) and PFA (192.8° to 196.2°). In sitting, SS increased (19.3° to 24.5°), PFA decreased (138.8° to 132.3°), PT decreased (37.0° to 33.7°), and LL increased postoperatively (32.4° to 37.3°) (all $p < 0.05$). Comparing standing-to-sitting transitions, postoperative changes included a larger ΔPFA (-54.1° to -63.9°) and ΔSA (-65.0° to -69.1°), and a smaller ΔSS (-14.3° to -9.8°), ΔLL (-16.8° to -12.7°), ΔPT (15.6° to 12.2°) (all $p < 0.05$). **Conclusion:** Postoperative changes were more pronounced in the sitting position, highlighting the importance of evaluating both postures during surgical planning and postoperative follow-up. Lumbar fusion reduced spinopelvic compensatory capacity during transitions, as reflected by limited pelvic retroversion (decreased ΔSS and ΔPT) partially offset by increased hip flexion (greater ΔPFA). Understanding how lumbar fusion alters spinopelvic alignment in both standing and sitting positions provides insight into compensatory limitations during postural transitions. These findings may help guide surgical planning and postoperative care to optimize functional outcomes and reduce mechanical complications.

ID: AGS26/2489
P0071: Real-time cage-endplate pressure mapping in circumferential (360°) lumbar fusion: effects of staged decompression and controlled screw compression

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Introduction: Circumferential ("360°") lumbar fusion achieves high fusion rates, yet time- and space-resolved pressures at the

cage-endplate interface across a complete surgical sequence remain insufficiently characterized. Prior in-vitro and in-silico studies often report single-point forces or static load steps and rarely use standard implants, limiting transferability. We establish a reproducible, implant-agnostic protocol for continuous endplate pressure mapping during a standardized 360° fusion workflow and report feasibility signals from an initial specimen; full accrual and analysis will be completed before presentation. **Material and Methods:** Fresh-frozen thoracolumbar spines undergo pre-test CT with a hydroxyapatite phantom to derive specimen-specific trabecular vBMD (covariate). CT-based segmentation informs pedicle-trajectory planning and fabrication of vertebra-conforming guides to standardize screw placement. At the index level, bilateral pedicle screws/rods are placed; after standardized discectomy, ultrathin (0.1 mm) pressure films are positioned cranially and caudally so that each film lies between cage and endplate, followed by central cage insertion. A calibrated compression clamp applies quasi-static plateaus of 0/50/100 N while pressure maps are sampled at 100 Hz during sequential configurations: unilateral facetectomy→ bilateral facetectomy → extended laminectomy. Primary outcomes: peak/mean interface pressure, active contact area, apparent axial stiffness. A prespecified linear mixed-effects model includes configuration and load as fixed effects, vBMD as covariate, and specimen-level random intercepts. Sensitivity analyses address variance structures and influential observations. **Results:** Feasibility (pilot n = 1 FSU, L3-4): Continuous acquisition was stable and artifact-free across all three configurations and load plateaus in a single test sequence. No device malfunctions occurred, and no macroscopic endplate or posterior-element damage was observed on post-test inspection. Time-resolved maps qualitatively captured early pressure relaxation within each plateau. These pilot signals confirm the practicality of repeated, configuration-wise testing with controlled screw compression and complete cage-footprint coverage in one specimen. **Conclusion:** This standardized, design-agnostic workflow yields continuous, spatially resolved pressure maps throughout a full 360° fusion sequence using standard implants and controlled preload. Integrating CT-derived vBMD and guide-assisted instrumentation enhances reproducibility and enables quantification of configuration- and bone-quality-dependent changes in peak pressure, contact area, and stiffness. Final results are intended to define practical bounds for intraoperative compression and provide high-fidelity inputs for finite-element calibration; completed data will be presented at the Global Spine Congress.

ID: AGS26/2515

P0072: Comparison of pull-out strength of different screwing techniques in cases with pedicle fracture or requiring pediculectomy: study on a porcine cadaver spine model

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Introduction: In modern spine surgery, the primary goals include achieving stabilization, correcting deformities, and preserving neurological structures. However, intraoperative pedicle injury, pedicle fractures associated with trauma, or pedicle involvement in oncological cases may compromise pedicle integrity. In such situations, stabilization systems are often extended to one or more adjacent segments to reduce the risk of transpedicular screw loosening. Spinal fusion, however, may increase the range of motion (ROM) and intradiscal pressure at adjacent motion segments, thereby accelerating degenerative changes. Consequently, current literature emphasizes that the shortest possible fusion should be preferred in order to minimize the risk of adjacent segment degeneration and preserve spinal mobility. The aim of this study was to investigate the biomechanical effects of different screw placement techniques on pull-out strength. **Material and Methods:** In this study, seven cadaveric porcine spines from six-month-old pigs weighing 100-110 kg were used. Each level was selected through blinded randomization, and 35 vertebral segments were divided into seven different groups. Thus, all vertebral levels from L1 to L5 were equally represented. The groups were arranged as follows:

1. Group: Monocortical transpedicular screw placement into an intact vertebra
2. Group: Bicortical transpedicular screw placement into an intact vertebra
3. Group: Bicortical cement-augmented transpedicular screw placement into an intact vertebra
4. Group: Monocortical transpedicular screw placement into a pedicle-trimmed vertebra
5. Group: Monocortical cement-augmented transpedicular screw placement into a pedicle-trimmed vertebra
6. Group: Bicortical transpedicular screw placement into a pedicle-trimmed vertebra
7. Group: Bicortical cement-augmented transpedicular screw placement into a pedicle-trimmed vertebra

All screws used were 4.5 mm in diameter and varied in length (35, 40 and 50 mm). Biomechanical pull-out tests were conducted at a rate of 5 mm/min. **Results:** The highest mean pullout strength was observed in G7, followed by G6, G4, G3, G5, G1, and G2 respectively. One-way ANOVA with post hoc (LSD) pairwise comparisons was performed. It showed that G7 had significantly higher pullout strength than all other groups ($p < 0.05$), except G6, where the difference was not statistically significant ($p = 0.085$). Comparisons among the remaining groups revealed that G4 was significantly higher than G1 ($p < 0.05$), which indicated that bicortical fixation was superior to

monocortical fixation. Cement augmentation (G3, G6) consistently increased pullout strength compared to their respective non-cement counterparts (G1, G4). Pedicle shaving alone (G2, G5) did not provide a statistically significant benefit compared to the G1 group (monocortical). **Conclusion:** The literature emphasizes that the shortest possible fusion should be preferred in order to prevent adjacent segment degeneration and preserve spinal mobility. The findings of this study demonstrate that, in cases requiring pediculectomy or with pedicle compromise, stabilization can be achieved with an effective and safe technique that reduces the need to extend fusion to adjacent segments. This approach provides significant advantages such as shorter operative time, reduced complication risk, and preservation of motion segments, thereby maintaining spinal mobility. Moreover, in the group with resected pedicles, bicortical and cement-augmented screws yielded superior outcomes compared to monocortical screws placed in intact vertebrae, offering an advantage in managing intraoperative complications.

ID: AGS26/2606
P0073: Bone density of traditional pedicle screw, cortical bone pedicle screw, and modified cortical bone pedicle screw trajectories - a CT-based morphometric analysis of 1750 vertebrae

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Introduction: Pedicle screw fixation is a cornerstone of spinal stabilization, yet screw loosening remains a significant complication, particularly in osteoporotic bone. Alternative trajectories such as the cortical bone trajectory (CBT) and modified cortical bone trajectory (MCBT) have been proposed to enhance fixation strength by engaging denser cortical bone. However, comparative morphometric and bone density data across these trajectories remain limited. We aim to evaluate and compare bone density along the traditional pedicle trajectory (TPT), CBT, and MCBT using computed tomography (CT)-derived Hounsfield unit (HU) measurements. **Methods:** CT scans of the lumbar spine (L1-L5) of adult patients who presented for non-spinal ailments were retrospectively analyzed. Three pedicle screw trajectories were virtually simulated: TPT, CBT, and MCBT. For each trajectory, CTHU values were measured in sagittal section at four anatomical points along the screw path: posterior cortex, mid-pedicle, mid-vertebral body, and anterior vertebral body cortex. Mean CTHU values, maximum screw lengths were compared across trajectories, and subgroup analyses were performed. Statistical comparisons were conducted using one-way ANOVA with post hoc testing, linear regression, and independent-sample t-tests, with significance set at $p < 0.05$. **Results:** A total of 350 patients (1,750 vertebrae) were analyzed. Mean CTHU values differed significantly among trajectories: CBT (538.2 ± 73.1 HU) > MCBT (472.6 ± 87.9 HU) > traditional PS (362.8 ± 68.4 HU) ($p<0.001$). At the posterior cortex, density was highest for CBT (1,128.9 ± 147.6 HU), followed by MCBT (962.4 ± 192.7 HU) and TPT (582.1 ± 162.3 HU). Across mid-pedicle, mid-body, and anterior cortex, CBT and MCBT showed comparable values, both significantly greater than TPT. Age negatively correlated with CTHU across all trajectories, most pronounced in TPT ($r = -0.36$, $R^2 = 0.13$). Patients ≥ 60 years exhibited a 17.8% reduction in TPT density versus 6.9% and 4.2% for MCBT and CBT, respectively. Gender differences were significant only for TPT ($p<0.05$). MCBT showed significantly increased length of screw compared to CBT and TPT ($p < 0.001$). **Conclusion:** Cortical bone-based trajectories traverse denser bone than the traditional pedicle path, with CBT showing the highest density and MCBT offering the advantage of longer screw length. Both cortical-based approaches were less affected by age-related bone loss, supporting their clinical utility in optimizing pedicle screw fixation, particularly in elderly or osteoporotic patients.

ID: AGS26/2644
P0074: Fulcrum-induced extension bending of fusion rods during flexion relaxation enables smart implant detection

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Introduction: Sensor-equipped implants provide an opportunity to monitor mechanical loading in spinal fusion constructs. While axial compression is the dominant load on the spine and generally produces only small, non-critical rod forces, anterior bending moments are far more harmful. These may occur at end range anterior flexion with inadequate muscular contraction due to fatigue, sudden movements, or postoperative muscle degeneration. The objective of this study was to reproduce such conditions, referred to as flexion relaxation, in cadaveric lumbar segments with intact discs, PLIF and TLIF cages, and to assess whether strain-gauged rods can detect the resulting critical loading patterns. **Material and Methods:** Twelve fresh-frozen

human lumbar motion segments were dissected while preserving intervertebral discs and bony elements. A test setup simulated flexion relaxation by applying a 100 N axial force transformed into an 18.6 N·m sagittal bending moment via the spinous process. Each specimen was equipped with four pedicle screws and two strain-gauged rods. Four specimens received a PLIF cage, four a TLIF cage, both with embedded force sensors, and four had no cage. In the no-cage group, sequential decompression (laminotomy, nucleotomy, facetectomy) was performed. In cage groups, rod and cage loads were recorded before and after simulated cage subsidence and cage removal. **Results:** Under flexion relaxation, fixation rods in all specimens consistently exhibited extension bending, as confirmed by strain-gauge outputs. This occurred because the disc or cage acted as a central fulcrum, generating distraction forces on the rods. The resulting tensile loading produced a counter-moment that placed them in extension despite the externally applied flexion load. This counter-moment, detected by the rod sensors when the segments were in flexion, could be considered an indicator of harmful loading on the construct. At 18.6 N·m bending moment in flexion relaxation, median normalized rod strain decreased by 35.6% after endplate disruption and by 41.9% after cage removal ($p = .009$ and .003), while cage load declined by 50% following endplate disruption ($p = .001$). Progressive decompression increased rod strain by 6.6-10.2% ($p = .090$ to $< .001$), whereas complete nucleotomy reduced it by 45.7% ($p = .004$). The reductions observed after cage subsidence and complete nucleotomy further confirmed the fulcrum effect, indicating loss of the mechanism that previously amplified loading on the fixation rods. Notably, cage configuration also influenced rod loading, with rod strain 18.9% lower in the PLIF group and 38.5% higher in the TLIF group compared to no-cage controls. **Conclusion:** Our results demonstrate that critical loading can be detected across different fusion constructs using sensor-equipped fixation rods. Recognition of the fulcrum effect and the resulting extension bending on the rods is central to this detection. These findings support the potential of future smart implants to identify harmful loading conditions occuring specifically during flexion-relaxation in spinal fusion.

ID: AGS26/2683

P0074.1: Biomechanics of Lumbar Lateral Interbody Fixation Augmented with Pedicle Screws, Facet Screws, or Spinous Process Plate

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Introduction: Posterior stabilization is commonly used to augment lateral interbody fusion by limiting motion and protecting against implant migration and subsidence. Among available options are bilateral pedicle screws, bilateral transfacet screws, and spinous process plates. The relative contribution of these constructs when paired with a standalone lateral interbody device has not been fully quantified under physiologic loading. This cadaveric study compared the stabilizing effects of these constructs across primary motion planes. **Materials and Methods:** Fourteen human lumbar spine specimens ($n = 14$) from L3 to S1 were tested at the L4 to L5 motion segment using a non-constraining pure moment protocol to 7.5 newton meters in flexion extension, lateral bending, and axial rotation. Specimens were evaluated sequentially in the intact state, lateral interbody alone, lateral interbody with spinous process plate, and lateral interbody with unilateral or bilateral fixation using pedicle screws or transfacet screws. Motion was tracked with an optoelectronic system. Range of motion was the primary outcome. Repeated measures analyses with post hoc testing compared constructs, with significance at $p < 0.05$. Pullout strength and displacement variance were also assessed. **Results:** All posterior constructs significantly reduced range of motion compared with lateral interbody alone in all planes. Bilateral pedicle screw and bilateral transfacet screw constructs provided the largest reductions and approached intact-spine stability, especially in axial rotation. In flexion extension, there were no significant differences among constructs. In lateral bending, the lateral interbody plus spinous process plate exhibited greater motion than other constructs except lateral interbody with spinous process plate and unilateral pedicle screw fixation ($p = 0.073$). Pullout strength variance was not significant across constructs, while displacement variance demonstrated significance for pullout strength but not for displacement. **Conclusion:** Augmentation of lateral interbody fusion with posterior fixation improves mechanical stability. Bilateral constructs provide the greatest benefit, and transfacet screw constructs perform comparably to pedicle screws in key planes. These data can inform selection of posterior augmentation tailored to desired stability while considering invasiveness.

ID: AGS26/2821

P0076: Biomechanical changes in kyphotic cervical spine after anterior cervical discectomy and fusion with different degrees of correction

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Introduction: A finite element simulation study exploring the appropriate correction angle of cervical kyphosis based on patient imaging data from a mechanical perspective. **Material and Methods:** We utilized CT data from three patients with severe cervical kyphosis of different etiologies (idiopathic, iatrogenic, degenerative) and employed finite element simulation to compare the mechanical environment differences of the cervical spine under varying correction angles following multilevel anterior cervical discectomy and fusion. **Results:** All patient-specific models demonstrated consistent biomechanical behavior across varying orthopedic angles. Adjacent C2-C3 segments exhibited greater flexion mobility under low correction angles and increased extension under high angles, while axial rotation showed irregular patterns. Stress distribution maps revealed that extreme correction angles caused localized and asymmetric stress concentrations, whereas intermediate angles (10°-20°) promoted more uniform stress across intervertebral discs, facet joints, and implants. Quantitative analysis of Von-Mises stress showed a clear U-shaped trend across key structures. In Patient A, cage stress decreased from 5.06 MPa at 40° to 1.50 MPa at 20°, then increased to 7.51 MPa at −10°; interface stress followed a similar pattern, dropping to 1.00 MPa at 20° and rising to 5.62 MPa at −10°. Titanium plate and screw stresses also minimized at moderate angles before increasing again at extreme corrections. These results indicate that moderate Cobb angles reduce mechanical burden and may lower the risk of postoperative complications. **Conclusion:** As the correction degree increases, the adjacent segment ROM demonstrates varied trends, remaining relatively balanced at moderate correction levels. The stress on adjacent intervertebral discs, cages, facet joints, vertebral surfaces, plates and screws initially decreases and then rises with increasing correction degree. The correlation between these biomechanical data and the occurrence of complications following cervical kyphosis correction underscores the presence of an appropriate range of correction angles.

ID: AGS26/3003
P0077: Biomechanical effects of facet joint, tension band, and spinous process violation in TLIF surgery

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Introduction: Transforaminal lumbar interbody fusion (TLIF) is a well-established procedure for treating degenerative pathologies of the lumbar spine. This study aims to investigate the impact of breaches during TLIF surgery on ROM of the instrumented and adjacent segment. **Material and Methods:** Seven human cadaveric spines (L1-L5) underwent quasi-static non-destructive biomechanical testing in flexion-extension (Flex-Ext), lateral bending (LB), and axial rotation (AR). Motion was evaluated native, after TLIF L3-4, and a three-step sequential damage protocol was applied: superior-segment facet joint capsule incision at L2/3 (step 1), posterior tension band disruption at L2-3 (step 2), and spinous process fracture L3 (step 3). Primary outcome was Range of motion (ROM) and neutral zone (NZ) at the cranial adjacent level. To analyze relative changes, ROM and NZ were normalized to the native state. **Results:** At the cranial adjacent level L2-3, step 1 increased relative ROM significantly in AR (172%, $p = 0.041$). Step 2 significantly increased relative ROM in Flex (131%, $p = 0.019$). Step 3 did not significantly change relative ROM ($p \geq 0.058$). At L2-3, mean NZ increased for all loading directions without statistical significance. At L3/4 TLIF instrumentation decreased L3-4 ROM significantly in Flex (-2.05 ± 1.05°, p=0.007), Ext (1.44 ± 0.81°, $p = 0.003$), right LB (-2.0 ± 1.59°, $p = 0.032$), and left LB (1.35 ± 0.57°, $p = 0.027$), with a trend in left AR (-0.69 ± 0.74°, $p = 0.071$) and right AR (0.95 ± 0.91°, p=0.079). Steps 1-3 did not cause significant change of the absolute and relative ROM at L3-4 ($p \geq 0.079$). **Conclusion:** In vitro testing of human lumbar specimens showed that minor instabilities become more pronounced when they occur adjacent to a fused segment. The investigated surgical breaches should be avoided wherever possible.

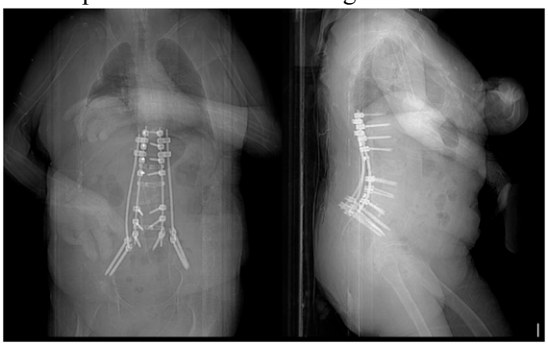
ID: AGS26/3030
P0078: The impact of technical factors on pelvic parameters and pseudarthrosis in long-segment spinal instrumentation

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Objective: Long-segment spinal instrumentation is a complex surgical procedure performed in patients with advanced spinal deformities or degenerative pathology. Restoration and preservation of sagittal balance are essential for favorable outcomes. Technical details such as dual-rod constructs, domino connectors, and iliac fixation are believed to influence both radiographic alignment and the risk of pseudarthrosis. This study aimed to evaluate the relationship between these surgical techniques, spinopelvic parameters, and pseudarthrosis, with specific consideration of pelvic incidence score (PIS) stratification. **Materials and Methods:** We retrospectively analyzed patients who underwent long-segment spinal stabilization between 2022 and 2024. Only patients in whom the construct extended inferiorly to the pelvis and superiorly to at least L1 were included. Demographic characteristics, surgical details (single vs. dual rods, presence of domino

connectors, iliac domino fixation), and spinopelvic parameters were collected. Radiographic parameters (PI, PT, SS, LL, SVA, GT) were evaluated both pre- and postoperatively. Patients were classified according to PIS: grade 1 (< 45°), grade 2 (45-60°), and grade 3 (> 60°). Pseudarthrosis was assessed at the 6th postoperative month based on radiographic and clinical criteria. Statistical analysis was performed to determine significant associations.



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Results: The cohort consisted of patients with a mean age of 60 ± 12 years, with a predominance of female cases. Dual-rod constructs were associated with more stable sagittal balance and reduced loss of lumbar lordosis compared with single-rod constructs ($p < 0.05$). Domino connectors contributed significantly to lordosis preservation in high PIS patients ($p = 0.041$). Iliac domino fixation was associated with a markedly reduced rate of pseudarthrosis ($p = 0.032$). Stratification by PIS demonstrated that grade 3 patients (> 60°) had the greatest challenge in restoring sagittal alignment and exhibited the highest rate of pseudarthrosis, despite technical reinforcement ($p < 0.05$). In contrast, grade 1-2 patients showed significantly lower pseudarthrosis rates and more favorable radiological outcomes. **Conclusion:** Technical factors play a crucial role in the success of long-segment spinal instrumentation. Dual-rod constructs, domino connectors, and iliac fixation provide biomechanical advantages that support sagittal balance and lower the risk of pseudarthrosis, particularly in high PIS patients. Pelvic incidence stratification should be considered during preoperative planning, as higher PIS values are predictive of greater biomechanical demand and increased risk of nonunion. Tailoring the construct according to pelvic morphology may optimize long-term stability and improve patient outcomes. **Limitations:** The main limitations of this study include the relatively small number of patients and the follow-up limited to six months, which may restrict the generalizability of the findings. Larger prospective series with longer follow-up are required to validate these results.

ID: AGS26/3255
P0079: Anatomical and biomechanical considerations of posterior fixation at the cervicothoracic junction: literature review

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Introduction: The cervicothoracic junction (CTJ) represents a biomechanically complex region due to the transition from the flexible cervical to the rigid thoracic spine. Variations in vertebral morphology and pedicle size increase the risk of screw misplacement and implant failure during posterior fixation. Understanding these anatomical and biomechanical features is essential for safe and effective stabilization. **Material and Methods:** A systematic review of PubMed and Google Scholar was performed using the keywords: "cervicothoracic junction," "posterior fixation," "pedicle screw," "biomechanics," and "anatomy." Studies reporting vertebral measurements, pedicle dimensions, screw placement techniques, and biomechanical outcomes were included. Data on clinical outcomes, complication rates, and construct stability were also analyzed. **Results:**

- Pedicle dimensions vary significantly from C7 to T2, influencing screw trajectory and diameter selection.
- Biomechanical analyses show that short-segment constructs across the CTJ may experience higher stress at the junction, whereas long constructs improve stability but may increase adjacent segment motion.
- Intraoperative navigation and imaging significantly enhance screw placement accuracy and reduce neurovascular injury.
- Clinical series highlight the importance of preoperative planning based on CTJ anatomy and biomechanics to optimize construct stability and minimize complications.

Conclusion: Posterior fixation at the CTJ requires meticulous preoperative planning informed by anatomical and biomechanical data. The use of intraoperative navigation and imaging improves safety, and construct length should be tailored to balance stability with preservation of adjacent segments. Further in vivo biomechanical studies are warranted to refine surgical strategies and improve patient outcomes in this challenging anatomical region.

ID: AGS26/3262
P0080: Contribution of biomechanical modeling of the trunk in lower back pain

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Introduction: The spine is supported by the core muscles, which ensure balance and stability during movement. Disorders of the core muscles are a common cause of spinal pain. Analysis of spinal loads and surrounding muscle forces provides insight into and may even predict the progression of painful lumbar disorders. The aim of this project was to determine the muscle activities that maintain spinal balance during daily physical activities, as well as the potential compensatory mechanisms in the presence of chronic low back pain. Musculoskeletal modeling is used to estimate trunk

muscle loads, reactions, and joint moments during various postures and loads. **Material and Methods:** Two healthy subjects and two patients suffering from chronic non-specific low back pain, aged between 32 and 69, participated in this study. Videos of load-bearing movements were recorded. A biomechanical analysis involving mathematical estimates of trunk muscle strength, trunk segment kinematics, and moment calculations was performed. In this project, the spine model, developed using OPENSIM musculoskeletal modeling software, consisted of the entire thoracolumbar spine and rib cage. The subjects performed flexion movements with and without a 12 kg load. Comparisons between the groups were made on the average model of the complete cycle of all biomechanical variables for the different postures studied. **Results:** Biomechanical modeling revealed significant differences between the groups for certain muscles (lumbar and thoracic erector spinae). In the trunk extension posture, we clearly observe that the L5-S1 intervertebral joint bears the most load, with an articular moment intensity five times higher than the other intervertebral joints. In healthy subjects, we found that in the L5-S1 joint, the flexion moment increased from 19.06 Nm in the standing position with load to 222.84 Nm in the 90° flexed position with load, which represents an increase of 203.78 Nm. Despite a wide variability in the responses reported in the literature, in this project, a smaller range of motion in flexion was observed in patients with chronic low back pain. Thus, the stiffening of the trunk due to increased muscle activity, which is often reported as a protective mechanism in people with chronic low back pain, leads to limited movement. **Conclusion:** Biomechanical analysis of healthy and pathological trunks during standardized physical activity has revealed the impact of movements and external forces on the forces applied by the trunk muscles and joint reactions. Musculoskeletal modeling was used to analyze the effects of spinal flexion and extension on its various bone and muscle components. This work is a preliminary study to test the contributions of this biomechanical analysis to the study of low back pain, opening up interesting and more in-depth perspectives on this topic.

ID: AGS26/3274
P0081: GAP score as a functional parameter in outpatient low back pain assessment

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Introduction: The Global Alignment and Proportion (GAP) score was designed to predict mechanical complications after surgery for adult spinal deformity. While its role in surgical planning has been well studied, little is known about its clinical relevance in patients who have not undergone surgery. Understanding whether sagittal imbalance measured by GAP is related to pain and disability in routine outpatient settings may provide new insight into its broader utility. This study aimed to investigate the association between GAP score and patient-reported outcomes, including the Oswestry Disability Index (ODI), back pain Visual Analog Scale (VAS), and Roland-Morris Disability Questionnaire (RMDQ), in a cohort of nonoperatively managed patients with low back pain. **Material and Methods:** This cross-sectional study included 107 consecutive patients who visited our outpatient clinic with low back pain. None of the patients had previous spinal surgery. Standard standing radiographs were used to measure sagittal parameters, and the Global Alignment and Proportion (GAP) score was calculated for each patient. Patient-reported outcomes were collected on the same day, including the Oswestry Disability Index (ODI), back pain Visual Analog Scale (VAS), and Roland-Morris Disability Questionnaire (RMDQ). Patients were grouped as proportioned, moderately disproportioned, or severely disproportioned according to GAP. Statistical analysis included Spearman correlation between GAP and each outcome, and group comparisons using Kruskal-Wallis tests. A p-value < 0.05 was considered statistically significant. **Results:** A total of 107 patients were evaluated. The Kruskal-Wallis test showed a significant difference in Oswestry Disability Index (ODI) scores among GAP categories ($\chi^2 = 7.59$, $p = 0.023$). Post-hoc analysis revealed that patients in the moderate and severe disproportion groups had higher disability scores compared with the aligned group. In contrast, no significant differences were observed for back pain Visual Analog Scale (VAS) scores ($\chi^2 = 1.52$, $p = 0.467$) or Roland-Morris Disability Questionnaire (RMDQ) scores ($\chi^2 = 3.10$, $p = 0.212$). Although ODI increased with worsening GAP category, pain intensity and RMDQ scores did not follow the same pattern. These findings suggest that GAP is more closely associated with functional disability than with pain severity. **Conclusion:** This study showed that the Global Alignment and Proportion (GAP) score is associated with disability, but not directly with pain, in patients with low back pain who have not undergone surgery. These findings suggest that GAP may provide useful information about functional limitation beyond traditional pain scores. In this way, GAP has the potential to serve as a simple and practical parameter in the routine outpatient evaluation of patients with low back pain. Given the cross-sectional design and sample size, these results should be interpreted cautiously, and further prospective studies are needed to confirm whether GAP can be integrated as a standard clinical measure.

ID: AGS26/3485
P0082: Systematic review of lordotic cage angles in posterior/lateral lumbar fusion: higher angles yield greater segmental correction but inconsistent total improvement

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Introduction: Interchange lordosis is important to restoring lumbar sagittal alignment in spinal fusion. Cage angles can range from neutral to hyperlordotic in order to optimize radiographic and clinical outcomes. This systematic review evaluates radiologic outcomes across different lordotic cage angles in posterior/lateral lumbar fusion. **Methods:** This systematic review was performed adhering to PRISMA Guidelines to compare the different angles of the lordotic cage. PubMed and Google Scholar were queried for studies comparing varying cage angles (0°, 4-5°, 6-8°, 10-12°, and 15-20°) in PLIF or LLIF. Studies that were non-English and pediatric were excluded. Lumbar lordosis and segmental lordosis were recorded. Mean differences, ranges, and p-values were extrapolated to analyze by grouped angles (0°, 4°-8°, 10°-12°, 15°-20°). **Results:** Our final review included nine studies with 940 patients in which 197 had non-lordotic cages (0°), 255 received low-angle cages (4°-5°), 239 had medium-angle cages (6°-8°), 174 had high-angle cages (10°-12°), and 75 received extreme-angle cages (15°-20°) when undergoing posterior/lateral lumbar interbody fusion. When comparing to non-lordotic cages, the mean difference between low-angle cages was 8° total and the segmental was 3° ($p < 0.05$); the mean differences for medium-angle cages were -1.99° total and 3° segmental ($p > 0.05$); for high-angle cages were -0.8° total and -2.6° segmental ($p > 0.05$). For medium angles, compared to low-angle cages mena differences ranged from -1.4° to +2.4° total and +0.6° to +1.5° segmental indicated mixed statistical significance; compared to high-angle cages had a +2.3° total and -0.2° segmental difference, ($p > 0.05$); extreme-angle cages had -1.4° total and -2.9° segmental differences, ($p < 0.05$). When comparing high angles and medium angles, mean differences ranged from -2.3° to -5.6° total ($p > 0.05$) and the segmental differences ranged from +0.61° to +10.2° segmental ($p < 0.05$); extreme angles showed -1.4° total and -2.9° segmental differences, ($p < 0.05$). **Conclusion:** Lordotic cage angle is positively correlated with segmental lordosis restoration. Higher angles (≥ 10°) show superior segmental correction but do not consistently improve global lumbar alignment or pelvic parameters. These findings suggest segmental alignment may benefit from higher angles. Only nine studies have been performed so far and further research is necessary to establish their impact on global alignment and patient-reported outcomes.

ID: AGS26/1281

P0082.1: Mechanical Properties of 3D-Printed Porous Spinal Implants: Structural Optimization and Effects of Surface Ceramization

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Introduction: To reduce the elastic modulus of TC4, a porous design was applied to the implant without compromising its strength. By removing "redundant portions," mechanical matching at the implant-bone interface was achieved. **Material and Methods:** The CAD method was selected for the optimized design of the porous structure. Using UG NX 12.0 software, a rhombic dodecahedron was chosen as the unit cell, with the porosity fixed at 65%. Four types of porous spinal implant components with pore sizes of 650 μm, 650 μm, 850 μm, and 1100 μm were designed. The Gibson-Ashby model was used to predict the mechanical properties before and after surface ceramization. These predictions were then validated through quasi-static compression experiments. Considering the manufacturing precision of the selective laser melting (SLM) process, porous samples highly compatible with the bone tissue repair and mechanical properties of different spinal motion segment regions were selected, achieving structural optimization of the porous spinal implant. **Results:** (1) SEM Surface Quality Observation: The SLM-formed porous samples exhibited a regular structure with neatly arranged struts and relatively uniform dimensions. No severe defects such as pores or cracks were observed on the surface. Pores were clearly visible without fused pores or irregular pores caused by strut overlapping. Samples of the same type showed good consistency in forming. No significant difference in surface quality was observed between carburized and non-carburized samples, indicating that surface ceramization did not alter the surface morphology. However, partially unmelted spherical powder particles and "step-like" structures were observed on the strut surfaces, resulting in a relatively rough microscopic morphology and slightly larger formed dimensions compared to the design model. (2) Compared to the design model, the structural dimensions of the formed parts showed slight deviations. A one-way ANOVA comparing the model design parameters with the formed parameters measured by Micro-CT revealed that all P-values were greater than 0.05, indicating no statistically significant differences between the designed and measured values of pore size, strut diameter, and porosity for the different porous structures. This phenomenon is related to the "rapid melting and solidification" characteristics of the SLM process. Unmelted metal powder adhering to the strut surfaces and the layer-by-layer powder stacking during inclined surface formation increased strut diameter, reduced pore size, and consequently decreased porosity. Statistical analysis demonstrated that the selected SLM process parameters ensured good consistency and high forming quality for the porous structures designed in this experiment. (3) Mechanical Properties: The stress-strain curves of the four types of porous structures before and after carburization showed that, in the initial stage of the compression test, the stress-strain curve exhibited nonlinear behavior due to slight mismatching between the compression plates and the porous samples, resulting in incomplete parallelism of the assembly end faces with the horizontal plane. Subsequently, the samples quickly entered the elastic deformation stage and remained in a linear elastic deformation state under the given load conditions without undergoing plastic failure. The stress-strain curves of the four types of porous

structures before and after carburization were plotted. The elastic modulus of the samples, represented by the slope of the curve, was uniformly determined at a compressive strain of 0.015% to represent the mechanical properties of the samples. The results demonstrated that the porous design significantly reduced the elastic modulus of TC4, avoiding the "stress shielding" effect. (4) Bone Ingrowth Experiment: The porous structure with a pore size of 850 μm showed the highest amount of bone tissue ingrowth. **Conclusion:** The porous spinal implant with a rhombic dodecahedron unit cell, 65% porosity, and 850 μm pore size exhibited an elastic modulus and mechanical strength close to those of spinal vertebral bone tissue, along with excellent osseointegration capability. It can serve as a foundational design unit for porous spinal implants.

Deformity-cervical

ID: AGS26/59
P0083: Third occipital condyle: as rare as it is

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Introduction: Third occipital condyle or condylus tertius or the median occipital condyle is congenital anatomical variation due to an embryological remnant of the proatlas sclerotome. On imaging or anatomical studies, it appears attached to the skull base and often articulates with the anterior arch of the atlas and the odontoid apex. In some cases, it could be assessed as occipital condyle fracture. The incidence of the third condyle is extremely rare, but it could lead to significant instability and neurovascular compression. In the literature until now are presented 14 cases with third condyle with variable symptomatology. In the present study, we aim to report a case of third occipital condyle. **Case Description:** A 36-years old male was presented to the emergency department due to reported bar fight in the last 48 hours. The patient was fully responsive with 15/15 Glasgow Coma Scale, without any neurological deficits. The only reported symptoms were neck pain and vertigo. There were no additional injuries or symptoms. The patient obtained an x-ray of the cervical spine and skull. The report was insufficient for the presence of any pathology in the craniovertebral junction, or the skull, therefore the patient obtained a brain and cervical computer tomograph scan (CAT). The results showed the presence of third condyle without any additional injuries. Additionally, the patient was evaluated by ENT specialist for the vertigo and conservative therapy was prescribed for several days. **Conclusions:** Third occipital condyle is very rare entity that could be easily confused with occipital condyle fracture. The importance of such cases is to raise awareness of the presence of such anomalies that could change completely the therapeutic approaches.

ID: AGS26/251
P0084: Pott's disease of the cervical spine: a case report of a rare tubercular localization

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Introduction: Tuberculosis remains a healthcare problem in many underdeveloped countries. Tuberculosis of the central nervous system accounts for approximately 1% of all cases of tuberculosis, among which 50% involve the spine. Tuberculosis (TB) of the spine, also known as Pott's disease, is the most common form of skeletal TB. Lumbar and thoracic spines are the most frequent localizations of this infection. **Material and Methods:** We report the case of a 19 years-old female patient with no medical background. She presented for the onset of cervical pain evolving since 2 months with no improvement after medical treatment. Neurological examination didn't show any motor or sensitive deficit, or any abnormalities in reflexes. Standard Radiography and cervical CT scan showed a lytic lesion of C2 with an evident compression on the spinal cord. The MRI confirmed the diagnosis showing a complete destruction associated to an epiduritis at the level of C1 and C2. A surgical biopsy was realized, and pathological examination concluded to a tubercular localization of the cervical spine. The patient was reoperated. An osteosynthesis of the cervical Spine performed, followed by 12 months of anti tuberculosis treatment with a good outcome. After 3 years of clinical and radiological follow up, the patient had neither recurrence of the pain, nor neurological signs. Imaging showed a total removal of the lytic lesions. **Results:** Spinal Tuberculosis represents approximately half of all cases of skeletal TB. The most common involved site is the mid thoracic vertebrae along with lumbar spine. The involvement of the cervical spine remains less common. Diagnosis of spinal TB is made essentially made by a combination of imaging and culture of Mycobacterium tuberculosis from biopsy samples. In addition to that, spinal lesions are often accompanied by the presence of a large para-spinal abscess. Currently, medical treatment with four-drug therapy is considered to be a first-line treatment for spinal tuberculosis. Surgery for these kind of lesions is risky, it has limited indications including neurological sequelae, spinal instability, significant kyphosis, refractory pain, or failure of medical treatment. It is important in these patients to provide close neurological follow-up with appropriate TB medications and aggressive pain control for successful medical management. **Conclusion:** Prognosis for cervical Pott's disease has been improved by early diagnosis and rapid intervention. A high degree of clinical suspicion is required if patients present with chronic pain, even in the absence of neurologic symptoms and signs. Medical treatment

is generally effective. Surgical intervention is necessary in cases with marked bony involvement, abscess formation, or neurological deficit.

ID: AGS26/347
P0085: Imaging-based evaluation and surgical decision-making in retro-odontoid pseudotumor: proposal of a novel scoring system

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Introduction: Retro-odontoid pseudotumor (ROP) can cause cervical myelopathy due to spinal cord compression, requiring precise clinical judgment and imaging-based assessment. While ROP is frequently associated with rheumatoid arthritis, non-rheumatoid cases are increasingly recognized, and optimal criteria for surgical decision-making remain unclear. **Material and Methods:** We retrospectively reviewed 38 consecutive patients (mean age, 75.8 ± 8.0 years; 65.8% male) with non-rheumatoid ROP who underwent cervical spine surgery at our institution between 2017 and April 2025. Eighteen patients underwent surgery for ROP (surgical group, S group), and 20 were managed conservatively (conservative group, C group). Radiographic parameters included atlantoaxial instability, atlantodental interval (ADI), C1/2 osteoarthritis, C2-7 sagittal vertical axis (SVA), T1 slope, O-C1 angle, C1-2 angle, C2-7 angle, and ranges of motion (ROM) at O-C1, C1-2, and C2-7. MRI variables included disc degeneration (C2/3-C7/T1), retro-odontoid soft tissue thickness (t-ROP), spinal canal anteroposterior diameter (APD), and the t-ROP/APD ratio. **Results:** Age, sex, and C1/2 osteoarthritis did not differ between groups. A tendency toward atlantoaxial instability was observed in the S group ($p = 0.08$). Compared with the C group, the S group demonstrated greater C2-7 SVA (50.0 vs. 33.9 mm, $p < 0.05$), smaller O-C1 angle (0.78° vs. -11.4°, $p < 0.001$), smaller C2-7 angle (5.8° vs. 15.3°, $p = 0.05$), decreased ROM at O-C1 (7.1° vs. 11.8°, $p < 0.05$) and C2-7 (20.5° vs. 36.5°, $p < 0.001$), increased t-ROP thickness (11.4 vs. 7.8 mm, $p < 0.001$), reduced APD (8.1 vs. 12.7 mm, $p < 0.001$), and higher t-ROP/APD ratio (1.65 vs. 0.63, $p < 0.001$). Significant disc degeneration at C4/5 was also noted. Based on ROC-derived cutoffs, we constructed a scoring system incorporating four variables: O-C1 angle ≤ -4° (1 point), ROM(O-C1) ≤ 8° (1 point), ROM(C2-7) ≤ 30° (2 points), and t-ROP/APD ratio ≥ 1.0 (2 points), with a maximum score of 6. A score ≥ 4 identified 94.1% of surgical cases, while no conservative cases exceeded this threshold. The score correlated strongly with surgical indication ($p < 0.001$), with an AUC of 0.98, indicating excellent discriminative ability. **Conclusion:** Decreased mobility of the occipito-atlantal and subaxial cervical segments appears to promote compensatory atlantoaxial instability and ROP formation. We propose a novel exploratory scoring system integrating dynamic radiographic and MRI indices, which demonstrated strong discriminatory performance in identifying surgical candidates. Although limited by small sample size and single-center design, this system may serve as a practical guide for surgical decision-making in non-rheumatoid ROP. External validation in larger multicenter cohorts is warranted.

ID: AGS26/381
P0086: Single-stage circumferential correction of rigid post-traumatic cervical kyphosis in a patient with DISH and OPLL: a rare case report

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Introduction: Rigid post-traumatic cervical kyphosis in patients with Diffuse Idiopathic Skeletal Hyperostosis (DISH) and Ossification of the Posterior Longitudinal Ligament (OPLL) is uncommon. These deformities cause severe mechanical pain and functional limitation, and their surgical correction carries respiratory and neurological risks, requiring mandatory neurophysiological monitoring. Few reports describe single-stage circumferential correction in this setting. **Material and Methods:** A 67-year-old woman with aspirin allergy and prior gynecological and bariatric surgery sustained a fall with occipital trauma, resulting in a C5-C6 fracture. After 5 months she developed rigid kyphotic deformity, mechanical pain, and severe functional limitation (vertical chin-brow angle [vCBA] of 40°) without neurological deficits. MRI and CT showed chronic C5-C6 wedge fractures with bone fragility, DISH and cOPLL, C3-7 canal stenosis (most severe at C3-C4), and kyphosis with C2-C7 angle 27° and C4-C7 angle 31°. **Results:** A single-stage surgery was performed under multimodal neurophysiological monitoring. First, posterior release and C4-C7 facets osteotomy were done, followed by anterior approach with C5-C6 corpectomy and C4-C7 anterior fusion with an expandable titanium spacer and plate. At 10 months follow-up, bone fusion was achieved, correction of C2-C7 kyphosis to 8° and C4-C7 kyphosis to 5°, and reduction of vCBA to 10°, with marked functional improvement and no neurological deficits. **Conclusion:** This case represents a rare example of rigid posttraumatic cervical kyphosis with combined DISH and OPLL, without neurological impairment. The single-stage circumferential posterior- anterior approach restored cervical alignment, improved function, and minimized neurological risk through neurophysiological monitoring. The radiological angle correction aligns with favorable outcomes reported in limited

literature, although this combination is rare. Careful planning, posterior release, and stable anterior reconstruction are essential for satisfactory clinical and radiological results.

ID: AGS26/528
P0087: Cervical muscle morphology and cervical alignment changes following lumbar pedicle subtraction osteotomy

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Introduction: Sagittal alignment correction in adult spinal deformity is achieved through various osteotomy techniques, including pedicle subtraction osteotomy (PSO). Prior research has traditionally focused on sagittal alignment, degree of lumbar correction, and curve rigidity to optimize surgical outcomes. However, the paraspinal soft tissue envelope is increasingly recognized as an important factor. This study evaluates the impact of preoperative cervical muscle morphology on cervical alignment changes following PSO. **Material and Methods:** A retrospective analysis was conducted on patients who underwent lumbar PSO with available preoperative and postoperative standing whole-spine lateral radiographs. Cervical alignment changes were assessed preoperatively and at two postoperative time points (PO1: 1-30 days and PO2: 1-2 years). Alignment parameters included cervical lordosis, C2-7 sagittal vertical axis (cSVA), C0-2 angle, T1 slope, C7 slope, cervical tilt, cranial tilt, neck tilt, and thoracic inlet angle (TIA). Cervical muscles from C3 to C7 were segmented as five groups: sternocleidomastoid (SCM), trapezius (TP), anterior group (AG), posteromedial (PM), and posterolateral (PL). Functional cross-sectional area (fCSA) and fat infiltration (FI) were measured. Spearman correlation assessed relationships between preoperative muscle parameters and both immediate (Preoperative to PO1) and long-term (PO1 to PO2) cervical alignment changes. **Results:** Twenty-two patients (54% female, median age 61, BMI 26.6 kg/m^2) were included. Spearman analysis revealed several significant correlations (all $p < 0.05$). In the immediate analysis, higher AG fCSA at C3 correlated with smaller decreases in cSVA, while higher PL fCSA at C3 and C7 correlated with smaller decreases in C7 slope and cranial tilt. In contrast, higher PM fCSA at C6-C7 correlated with larger decreases in cranial tilt. TP fCSA showed mixed effects: at C3 it correlated with larger decreases in cSVA, whereas at C4 it correlated with smaller decreases in cervical tilt and C7 slope. Regarding FI, higher trapezius FI correlated with smaller decreases in cSVA (C3) and larger decreases in cranial tilt (C5), while higher PM FI correlated with smaller decreases in C7 slope (C4) and cranial tilt (C4-C6). In the long-term analysis, higher PM fCSA at C3-C4 correlated with greater increases in cSVA and T1 slope, while higher AG fCSA at C5 correlated with greater increases in the C0-2 angle. PL fCSA correlated with greater increases in TIA and C0-2 angle. In contrast, TP fCSA at C5 correlated with smaller increases in C0-2 angle. Higher FI across multiple levels correlated with smaller increases in TIA, T1 slope, C7 slope, cranial tilt, C0-2 angle, and cSVA. By contrast, higher TP FI at C3 and C5 correlated with greater increases in T1 slope and C7 slope. **Conclusion:** Preoperative cervical muscle morphology had an impact on both immediate and long-term cervical alignment changes after PSO. Higher fCSA was generally linked to smaller early changes, suggesting short-term stabilization, and to larger long-term increases, consistent with compensatory adaptation. In contrast, higher FI was associated with smaller changes both immediately and over time, pointing to short-term mechanical stiffness and long-term reduced adaptability. These findings highlight the role of cervical muscles in modulating reciprocal cervical alignment after lumbar correction and support its consideration in surgical planning.

ID: AGS26/623
P0088: Vertebral anomalies in MURCS association: case-based evidence and systematic review of reported cases

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Introduction: Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome is a rare congenital disorder in 46, XX females, typically presenting with uterine and vaginal agenesis. The MURCS association, a subtype of MRKH, additionally involves renal malformations and cervicothoracic somite anomalies. Spinal malformations, although common and clinically significant, remain underreported. This study presents a rare case of MURCS with complex vertebral anomalies and provides a systematic review of reported spinal abnormalities in the literature. **Material and Methods:** Following PRISMA guidelines, a systematic search was performed across PubMed, Scopus, Web of Science, and Cochrane Library (1979-2025). Studies reporting spinal anomalies in MURCS were included, while reviews without primary data and duplicates were excluded. Descriptive statistics were used to

summarize clinical features, radiological findings, and management strategies. Additionally, a 35-year-old female patient presenting with cervical scoliosis, block vertebrae, and an omovertebral bone was evaluated with multimodal imaging, clinical assessment, and genetic confirmation. **Results:** Forty studies involving 41 patients were included. Publications spanned 1979-2025, with India, the USA, and Turkey being the most frequent contributors. The mean age was 20.5 ± 11.2 years; females accounted for 87.8%. Common presenting complaints were amenorrhea (41.5%), infertility (17.1%), neck pain (12.2%), and abdominal pain (9.8%). Short stature and short neck were noted in 53.7% each, while scoliosis (36.6%), Sprengel's deformity (19.5%), and torticollis (14.6%) were frequent clinical findings. Cervical vertebral fusion was the predominant anomaly (53.7%), followed by Klippel-Feil syndrome (26.8%), hemivertebrae (12.2%), and cervical ribs (14.6%). Non-cervical anomalies included rib malformations (12.2%), spina bifida (7.3%), and spondylolisthesis (4.9%). Renal anomalies were nearly universal (92.7%), while hearing loss (24.4%) and cardiac defects (17.1%) represented key systemic associations. Despite the high prevalence of structural deformities, only 7.3% underwent surgical correction, with most managed conservatively. **Conclusion:** MURCS syndrome represents a multisystemic disorder with high prevalence of spinal anomalies, particularly cervical fusion and scoliosis, often accompanied by renal malformations. Early recognition through comprehensive imaging is essential to guide management and prevent long-term complications. Multidisciplinary care, including gynecology, urology, orthopedics, and genetics, is critical for optimizing outcomes in affected individuals.

ID: AGS26/713
P0089: Beyond the incision: does release extent matter in congenital muscular torticollis? A systematic review and meta-analysis

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Study Design: Systematic review and meta-analysis. **Objectives:** To compare outcomes after unipolar versus bipolar sternocleidomastoid (SCM) release for congenital muscular torticollis. (CMT). **Methods:** Following PRISMA, 17 observational studies were included (total 382 procedures: unipolar 228, bipolar 154). The primary endpoint was a good-excellent global result (Lee or modified Cheng-Tang). Secondary endpoints were recurrence and any complication. For comparative synthesis, random-effects meta-analysis (log-odds ratio, Haldane-Anscombe correction) was restricted to the 5 studies reporting both techniques (n = 133; unipolar 92, bipolar 41). Technique-specific context used random-effects single-arm pooling of proportions (logit transform). Heterogeneity was summarized with. I^2. **Results:** Comparative meta-analysis showed no difference in good-excellent outcomes between unipolar and bipolar (OR 1.08, 95% CI 0.22-5.27, p = 0.920; k = 4, I^2 = 21.6%). Recurrence favored bipolar but was not significant (OR 2.07, 95% CI 0.37-11.50, p = 0.406; k = 3, I^2 = 18.1%). Across all studies, pooled success was high for both techniques-unipolar 0.85 (95% CI 0.75-0.92; k = 4) and bipolar 0.76 (95% CI 0.61-0.87; k = 4). Pooled recurrence was 8.1% (95% CI 1.8-30.1%; k = 6, I^2 = 73.7%) after unipolar (sensitivity excluding an early small outlier: 4.1%, 0.7-21.6%) and 9.5% (95% CI 5.0-17.5%; k = 10, I^2 = 0%) after bipolar; pooled complications were 5.0% (95% CI 1.6-14.7%; k = 4, I^2 = 21.1%) vs 9.1% (95% CI 4.8-16.6%; k = 9, I^2 = 0%), respectively. Angle/ROM data (where available) improved markedly after both procedures; in the adult neglected cohort, CMA correction was similar between techniques while minor complications occurred only in bipolar. **Conclusion:** Unipolar and bipolar SCM release yield comparable global outcomes with low recurrence and complication rates. Differences are more likely driven by age at surgery and postoperative rehabilitation intensity than release extent. Comparative certainty is limited by small head-to-head samples and incomplete arm-level reporting.

ID: AGS26/960
P0090: Distal junctional kyphosis at the cervicothoracic junction following surgery for adult cervical deformity: a systematic review

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Introduction: Distal junctional kyphosis (DJK) is a significant postoperative complication in adult cervical spine deformity surgery. DJK at the cervicothoracic junction presents challenging complications that can significantly impact patients' quality of life. This systematic review aims to summarize the current literature on DJK at the cervicothoracic junction, identify knowledge gaps, and suggest directions for future research. **Material and Methods:** We conducted a systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to include studies that

discussed DJK at the cervicothoracic junction. Our systematic review focused on risk factors, management, and prevention strategies for DJK at the cervicothoracic junction. **Results:** Sixty-five articles were included in this systematic review. The identified risk factors for DJK at the cervicothoracic junction included: (1) Patient-related factors, such as preoperative neurological symptoms (e.g., presence of myelopathy), patient comorbidities (e.g., frailty), and compromised bone quality; (2) Radiographic factors, including increased preoperative C2-7 sagittal vertical axis, elevated T1 slope, reduced cervical lordosis, and thoracic hypokyphosis; And (3) surgical factors, as performing combined anterior/posterior approaches, performing Smith-Peterson or pedicle subtraction osteotomies, and choosing lower instrumented vertebra (LIV) at thoracic apex. The clinical presentation of DJK can range from asymptomatic radiographic changes to severe symptomatic conditions, significantly impacting patients' quality of life. Symptoms include neck pain, weakness, sensory impairment, symptoms of myelopathy, and radiculopathy. Radiographic evaluation should be the initial step in assessing patients with concerns about DJK. Scoliosis films (36-inch standing films) are essential for assessing global spinal alignment. Computed tomography (CT) and single-photon emission computed tomography (SPECT) scans can serve as valuable adjunctive tools for evaluating patients with suspected pseudarthrosis, adjacent segment degeneration, and hardware failure. Furthermore, an MRI should be obtained for patients presenting with any new neurological deficits, and it can also be beneficial in preoperative planning. To prevent DJK, it is essential to achieve optimal correction and proper cervical alignment, judiciously select the LIV with sufficient bone health, and preserve the posterior ligament complex in the distal segment. The management of DJK represents a wide range of options, with variations arising from the diversity of surgical approaches and underlying pathologies. Asymptomatic cases are typically treated non-surgically, whereas symptomatic cases often require surgical intervention. In cases where scoliosis is present in the thoracic spine, consideration should be given to extending the fusion to a sagittally stable vertebra. **Conclusion:** A comprehensive preoperative risk assessment and strategic surgical planning are critical for achieving optimal correction and preventing DJK at the cervicothoracic junction. Future research should prioritize high-level clinical studies that explore patient-specific, age-adjusted deformity parameters and leverage artificial intelligence to improve the prediction of DJK at the cervicothoracic junction, thereby enhancing surgical outcomes.

ID: AGS26/1089
P0091: Occipitalization of atlas with basilar invagination treated by occipitocervical fixation: a rare case report

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Introduction: Occipitalization of atlas is an osseous anomaly of the craniovertebral junction which occurs at the base of the skull in the region of the foramen magnum. The incidence rate of occipitalization has been reported 1.42.5/1000 children. Most of the patients are asymptomatic initially. Clinical features usually appear after 3rd decade depending on the level and degree of spinal cord compression with surrounding vital structures such as vertebral artery involvement. Hence, early definitive diagnosis and subsequent successful treatment are necessary in such cases to prevent life-threatening complications. **Methods:** a 46 year old female come with progressive tetraparesis since a year ago with limited neck movement. Cervical spine CT scan shown the absence of atlas. MRI revealed the odontoid process above the Chamberlains line suggestive basilar invagination. Occipital cervical fixation was planned also with foramen magnum decompression. **Results:** Patient had motoric improvement after post operative and able to walk without assisted. **Conclusions:** The knowledge of atlanto-occipital assimilation and its clinical significance can help in sensitizing the patient about potential existing/future neurological implications to seek medical advice and intervention. Treatment modality completely depends on neurological symptoms and instability. Although, different surgical options are available but decompression of the spinal cord with occipitocervical fusion is the most superior surgical option for occipitalization of atlas with instability.

ID: AGS26/1127
P0092: Surgical strategy for dropped head deformity based on the surgicaloutcomes of 51 cases

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Introduction: Dropped head syndrome (DHS) is characterized by chin-on-chest deformity with horizontal gaze difficulty and neck pain. Surgical strategy for DHS remains unestablished. Since 2019, we have been applying thoracolumbar corrective surgery to the DHS patients with significant thoracolumbar deformity factors (TL group) such as SVA > 50 mm, PI- LL > 10°, local kyphosis due to OVF > 30°. The purpose of this study is to evaluate the impact of thoracolumbar spinal alignment on surgical outcomes of the DHS patients. **Material and Methods:** We included DHS patients who underwent corrective surgery in our facility since 2014. Patients were divided in two groups, TL group and cervical (C) group (others). The surgical outcome of each group was compared. We investigated the spinal sagittal alignment parameters (C2-7A, CSVA, T1slope, SVA, TK, LL, PI, PT), surgical procedures,

improvement of horizontal gaze difficulty and complications such as junctional failure and revision surgery. **Results:** This study included 51 cases (13 males, 38 females, mean age 74.9 years, F/U period 22.4 months). 22 cases in the TL group showed significantly higher preoperative SVA, T1S, PI-LL, and PT compared to 29 cases in the C group. All cases in the C group underwent cervical corrective surgery. In comparisons of pre- and post-operative spinal parameters, significant improvement was seen in C2-7A, CSVA, SVA, PT, and PI-LL. 28 cases (96.5%) showed symptom improvement whereas only one case had poor outcomes (DJF, required extension of fixation). In the TL group, 4 cases out of 7 with cervical surgeries (57.1%) had poor outcomes (2 DJF, 2 symptom recurrence due to lumbar kyphosis), with 3 cases requiring reoperation (additional surgery). In contrast, among 15 cases of TL group with thoracolumbar corrective surgeries, 12 cases (80%) showed significant improvement of the symptoms, whereas 3 cases (residual symptoms, recurrence, PJF) required reoperation (additional surgery). Significant improvements were seen in C2-7A, CSVA, SVA, T1S, PT, and PI-LL in comparisons of pre- and post-thoracolumbar corrective surgery. Finally, symptom improvement was achieved in 43 cases (84.3%), with reoperation in 7 (13.7%) cases. The ratio of poor outcomes was higher in the TL group (7/22 cases, 31.8%) than in the C group (1/28 cases, 3.6%). **Conclusion:** Surgical outcomes of DHS were generally favorable. Although the TL group patients with cervical corrective surgery showed poor results, improvement were achieved in 80% of cases with thoracolumbar corrective surgery. These findings suggest that DHS may occur secondarily due to anterior displacement of the weight-bearing axis associated with thoracolumbar kyphosis and inadequate compensation. Therefore, to solve this pathology, it is considered crucial to improve the underlying thoracolumbar deformity factors. It is considered that treatment selection based on assessment of whole spinal alignment is important for improving surgical outcomes in DHS.

ID: AGS26/1186
P0093: Treatment of muscular torticollis in adults. Clinical observational study

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Introduction: Congenital torticollis results from contracture or fibrosis of the sternocleidomastoid muscle, leading to homolateral tilt and contralateral rotation of the face and chin. The etiology of congenital torticollis remains unknown. The main method of treatment is conservative in children under 1-4 years of age, in case of unsatisfactory results of treatment, surgical treatment is used. However, in some cases, patients do not receive treatment until adulthood. Surgical treatment of adult patients is controversial. The aim of our study was to evaluate the results of surgical treatment of patients with congenital muscular torticollis older than 18 years. **Material and Methods:** Prospective observational study was conducted from 2010 to 2023 years and involved 14 patients with congenital muscular torticollis, who were not operated in childhood, 5 male and 9 female. One patient was excluded from the study due to previous surgical treatment for congenital muscular torticollis. The average age was 23.7 years (18-37 years). All patients treated conservatively in childhood without significant effect. For various reasons, surgical treatment was not performed. In terms of preoperative preparation, all patients underwent examination to confirm the muscular etiology of torticollis - X-ray, CT, ultrasound. Surgical treatment was carried out according to the clinical protocol. Under general anesthesia, a halo ring was applied, followed by dissection of the altered strand of the sternocleidomastoid muscle, followed by the removal of the head into the hypercorrection position in the Halo apparatus for 6-8 weeks. **Results:** The average wearing time of the Halo device was 6.9 weeks. The mean angle of lateral bending restriction was improved by 17.9° (20.3° PreOp vs 2.4° PostOp), and the mean angle of rotation restriction was improved by 6.1° (8.7° PreoOp vs. 2.6° PostOp). The CMA was 18.5° (9.1°-33°) PreOp and 2.1° (0°-7.6°) PostOp. There were no complications that required revision interventions. In 1 patient at week 5, inflammation of the skin of the head around the pin was detected, which resolved conservatively. Cosmetic and functional satisfaction was in 11 patients, good results in 2 patients. **Conclusion:** The use of Halo device with hypercorrection in the postoperative period can significantly improve cosmetic and functional results in adult patients with congenital muscular torticollis.

ID: AGS26/1311
P0094: Combined surgical management of basilar invagination with platybasia and atlanto-occipital assimilation: endoscopic transnasal odontoidectomy and occipitoaxial fixation

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Introduction: Basilar invagination (BI) is a complex malformation of the craniovertebral junction, characterized by the upward migration of the odontoid into the foramen magnum, leading to compression of the brainstem and upper spinal cord. This anomaly may be congenital or acquired, and is frequently associated with other osseous abnormalities such as platybasia (a decrease in the basal angle of the skull) and atlas assimilation (fusion of the posterior arch of C1 with the occipital bone), which together constitute a clinical and radiological scenario of remarkable diagnostic and therapeutic complexity. Historically considered a radiological curiosity, basilar invagination has been redefined following the recognition of its origin in atlantoaxial instability rather than in a fixed, irreducible bony fusion. This understanding has led to a paradigm shift from classic decompression techniques (transoral or posterior approaches) toward

surgical strategies centered on reduction, realignment, and stabilization of the atlantoaxial joint. The clinical presentation of these patients may include occipital headache, cervical pain, motor and sensory deficits, ataxia, dysphagia, and bulbar dysfunction. In advanced cases, brainstem compression can be life-threatening. Radiological diagnosis relies on reference lines such as Chamberlain, McGregor, and McRae, as well as morphometric measurements of the clivus and cranio-cervical axis, which help quantify the degree of invagination and guide the surgical approach. The combination of basilar invagination, platybasia, and atlas assimilation represents a particularly severe variant of craniovertebral malformations. Far from being incidental findings, these alterations reflect a chronic adaptive response to structural instability at the C0-C2 segment. Consequently, surgical management must address not only neural decompression but also biomechanically stable reconstruction of the craniovertebral complex. In recent years, combined approaches (such as endoscopic endonasal decompression followed by occipitocervical fusion) have been successfully described, allowing effective and minimally invasive treatment in selected cases. This clinical case is presented within this context to illustrate the diagnostic, anatomical, and surgical challenges involved in treating a patient with basilar invagination associated with platybasia and atlas assimilation, emphasizing the importance of a multimodal approach to evaluation and surgical planning. **Material and Methods:** We present the case of a 39-year-old male patient from Mexico City with a clinical and radiological diagnosis of basilar invagination associated with platybasia and atlas assimilation. He was initially evaluated in April 2025 due to a three-month history of progressive symptoms, including cervical and lumbar pain, paresthesias in all four limbs, gait disturbance, and foot numbness during prolonged walking, without improvement under conventional medical treatment. Physical examination revealed reduced cervical mobility, pain on palpation and lumbar movement, generalized hyperreflexia (++++) in all extremities, bilateral clonus, preserved strength and sensation, and no sphincter dysfunction. Imaging studies included CT and MRI of the cervical spine, which confirmed basilar invagination with odontoid migration above Chamberlain's line, platybasia, and congenital atlas assimilation to the occiput. Ventral brainstem compression and cervical myelopathy were noted on T2-weighted sequences. Surgical treatment was performed on June 24, 2025, using a single-stage combined approach. The first stage consisted of an endoscopic transnasal odontoidectomy assisted by endoscopy and navigation, achieving direct resection of the odontoid and brainstem decompression. During the same session, a posterior approach was carried out with occipito-axial cranio-cervical fixation using an occipital plate with two screws (3.5 × 8 mm), bilateral C2 translaminar screws (20 and 24 mm × 3.5 mm), two longitudinal rods, and a cross-link. **Results:** The surgery was completed in a single stage with sequential anterior and posterior approaches, without intraoperative complications. Complete resection of the odontoid process was achieved by endoscopic transnasal odontoidectomy, followed by cranio-cervical stabilization with occipito-axial instrumentation. The system included bilateral C2 translaminar screws (20 and 24 mm × 3.5 mm), an occipital plate with two screws (3.5 × 8 mm), bilateral rods, and a central cross-link. In the immediate postoperative period, the patient evolved favorably, with resolution of cervical pain, recovery of gait, spontaneous voiding, and tolerance of oral intake, without evidence of new neurological deficits. The surgical wound remained clean, and postoperative imaging confirmed correct hardware placement and adequate decompression of the cranio-medullary junction. The patient was discharged 48 hours later with a favorable prognosis for neurological function and quality of life. **Conclusion:** Basilar invagination associated with platybasia and atlas assimilation is a complex craniovertebral anomaly requiring individualized surgical planning based on precise clinical, radiological, and anatomical criteria. The combination of endoscopic transnasal odontoidectomy with posterior occipito-axial cranio-cervical fixation is a safe and effective strategy to achieve ventral brainstem decompression and biomechanical stabilization of the C0-C2 complex. This case demonstrates that, even in patients with congenital osseous malformations and significant brainstem compression, functional neurological recovery and stable structural outcomes can be obtained through a well-planned minimally invasive combined approach. Proper technical execution and careful clinical and imaging follow-up are essential to ensure long-term durability and minimize complications. The described surgical approach should be considered a first-line option in selected cases, particularly when anatomical conditions are favorable and the necessary infrastructure for endoscopic, image-guided surgery is available.

ID: AGS26/1771
P0095: Platysma muscle splitting incision enhances early cosmetic outcomes following anterior cervical discectomy and fusion: a prospective randomized trial

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Introduction: Anterior cervical discectomy and fusion (ACDF) typically employs a transverse skin incision to optimize cosmesis by aligning with natural skin creases. However, whether the underlying platysma is split vertically (in line with its fibers orientation) or cut transversely (in line with the skin incision) influences incisional cosmetic healing is not known. **Material and Methods:** This is a prospective, randomized, single-center trial, and aims for evaluating if platysma incision orientation influences scar cosmesis. Among 127 enrolled patients undergoing elective ACDF, 103 subjects who had standardized follow-up data were included.

All patients received a standardized transverse skin incision. Platysma incision was randomized to either vertical (muscle splitting, in line with muscle fibers orientation) or transverse (muscle cutting, in line with skin incision) orientation using block randomization stratified by surgeons. Demographic, comorbidity, and operative variables were collected. Standardized clinical photographs were obtained at 2 weeks, 3 months, 6 months, and 12 months and each was graded independently by two blinded reviewers using the validated, modified Hollander Wound Evaluation Scale (0 - 6, higher = better). The mean score at each time point was analyzed. Potential predictors were first assessed individually with univariate analysis, followed by a multivariate logistic regression to identify predictors of achieving a perfect Hollander grade (6/6) at each timepoint. Inter-rater reliability between graders was measured with intraclass correlation coefficients (ICC). **Results:** Baseline characteristics were comparable between groups. At 2 weeks, vertical platysma splitting was a predictor of better cosmetic healing (OR 120.3, 95% CI 15.0-964.6; $p < 0.001$). The association between vertical platysma splitting as a predictor of cosmetic healing persisted at 3 months (OR 73.8, 95% CI 8.1-668.4; $p < 0.001$). Hyperlipidemia reduced the odds of healing at 3 months only (OR 0.192, 95% CI 0.045-0.828; $p = 0.027$). At 6 and 12 months follow up, there were no significant predictors of achieving a Hollander grade of 6/6. By 6 months, 86% of all patients achieved a Hollander grade of 6/6 and 87.2 % by 12 months. At 12 months, 100% of the vertical group and 75% of the transverse group had perfect scores. Inter-rater reliability was excellent across all timepoints (ICC 0.973 at 2 weeks, 0.956 at 3 months, 0.976 at 6 months), with perfect agreement at 12 months (ICC = 1.000). **Conclusion:** Following a transverse skin incision for ACDF access, a vertical platysma splitting rather than a transverse muscle cutting incision, yields superior cosmetic surgical wound healing, especially in the first three months and sustained cosmetic advantage at 12 months follow-up. Overlapping transverse skin and transverse platysma incisions may potentiate surgical site inflammation and scarring in the early stages of wound healing. These findings help with patient counseling and can be employed to improve patient satisfaction with wound cosmesis.

ID: AGS26/2249

P0096: Retrospective study on conventional and extended transoral approach for the treatment of craniocervical junction pathologies. surgeries performed between 2000 and 2018 at a specialized spine center in Brazil

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Introduction: Diseases affecting the craniovertebral junction present a challenge to surgeons planning to approach them. The intricate cervical anatomy, with so many vital and delicate structures, makes access to the upper cervical spine and skull base difficult. In recent decades, with the development of revolutionary posterior techniques such as C1-C2 facet distraction and arthrodesis, conditions that previously required an anterior approach as an absolute indication could be treated from the back. However, transoral approaches still remain highly useful in certain situations and hold their due importance both in the present and the future of cervical spine surgery. Therefore, our objective is to review surgical cases of patients with high cervical spine diseases treated via transoral (TO), extended access (glossotomy-labio-mandibular - GLM), and percutaneous approaches, comparing with relevant literature. **Material and Methods:** Review of surgical cases approached via the transoral route between 2000 and 2018 at the same specialized Brazilian spine surgery center. Patients were followed clinically and radiologically for a minimum period of one year. The evaluated parameters included: patient age at the time of surgery, underlying pathology, type of surgical procedure performed (classic, extended, or percutaneous transoral approach), whether or not a velotomy was performed, type of pharyngeal access, preoperative Frankel classification, year of surgery, length of follow-up, whether posterior fusion was performed as a complementary procedure, and the complications encountered. Complications were classified as either major or minor. **Results:** Among 23 patients with transoral approaches, two were reoperated, totaling 26 procedures. Fourteen were TO, four GLM, and six percutaneous. Approach was suitable for all. Extended exposure required GLMM. For proximal approaches including skull base, velotomy was effective. Complications included four velopharyngeal insufficiencies (mainly nasal voice), two incidental duratomies repaired intraoperatively, and one polymethylmethacrylate extravasation needing transoral removal. One GLM patient had superficial wound infection, delayed pharyngeal dehiscence, and pseudoarthrosis. **Conclusion:** Transoral approaches efficiently treated each disease, providing good exposure, acceptable neurovascular safety, and favorable outcomes with few, mostly manageable, complications.

ID: AGS26/2348

P0097: The impact of workers' compensation claims on outcomes of cervical spine surgery: a meta-analysis

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Introduction: Work-related musculoskeletal disorders can lead to significant disability, impaired productivity, and quality of life. WC status in patients has been linked to worse outcomes following orthopedic surgeries, including cervical spine procedures. Studies analyzing the influence of WC claims on different cervical spine surgeries report contradicting results. This meta-analysis aims to clarify the impact of Workers' compensation (WC) status on cervical spine surgery outcomes. **Material and Methods:** Following the PRISMA guidelines, PubMed, Cochrane, and Google Scholar (pages 1-20) were accessed and explored until May 2025. The extracted data consisted of overall complications, number of reoperations, surgery-related outcomes (estimated blood loss (EBL), operative time, and length of stay (LOS)), the improvement in patient reported outcome measures (PROMS) at 1 year post-operatively, number of patients returning to work, and mean time to return to work. **Results:** Eight retrospective studies met the inclusion criteria, including 801 patients in the WC group and 1102 in the NWC group. The patients in the WC group had a shorter operative time (Mean difference = -2.83 minutes; 95% CI: -5.03 - -0.64, p = 0.01), and LOS (Mean difference = -2.62 hours; 95% CI: -4.61- -0.63, p = 0.01). On the other hand, they had a worse improvement in neck pain (Standardized mean difference = -0.32; 95% CI: -0.45 - -0.19, p < .001), and arm pain (Standardized mean difference = -0.26; 95% CI: -0.39 - -0.13, p < .001), as well as a longer time to return to work (Mean difference = 4.53 weeks; 95% CI: 2.70 - 6.36, p < .001). **Conclusion:** Patients with WC claims had worse improvement in arm and neck pain and needed more time to return to work. These results highlight the impact of WC claims have on cervical spine surgery outcomes, making compensation status an essential factor to consider in clinical evaluation and patient counseling.

ID: AGS26/2363
P0098: Decision making and use of outcome analysis of staged surgery in pathologies of cervical spine

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Introduction: Due to anatomical peculiarities and specific nature of pathology, many a times cervical spine requires staged surgeries. Sometimes it poses a challenge for treating surgeon in decision making. We present long term outcome in patients of cervical spine affected by different pathologies requiring staged procedure (Anterior, Posterior or combined) under same anesthesia or after interval of few days to few weeks. The algorithm used in decision making proved extremely beneficial in terms of neural safety, neurological recovery and biomechanically aligned sound column. **Material and Methods:** In a tertiary referral institute we treated 84 patients suffering from different pathologies of cervical spine where staged surgery was done. Age ranged from 3yrs to 70 years. There were 51 males and 33 females .74 patients had neurological deficit. We had a minimal follow up of 5 years. Outcome analysis was done in terms of neural recovery, bio-mechanical column alignment and complications. Pathologies were grouped according to its etiologies. These were as follows - Congenital (20), Post operative kyphosis (10) Degenerative cervical myelopathy (35), Infection - 5, Trauma- 14. We grouped these patients in 4 different categories according to procedure and stages used. A. Only anterior soft tissue release and then turning the patient prone to perform fixation, column alignment and fusion. B. Anterior bony excision (anomalous bony mass / vertebral body) then turn the patient prone under same anesthesia or after a gap of few days to weeks. The interval being utilized for post-operative traction for deformity correction or observing the neural recovery and further optimizing the general condition of patients. Anterior bony excision / Posterior (± decompression) fixation and column alignment / Revisit anterior and do sound reconstruction {so Anterior - Posterior - Anterior} C. First stage Posterior decompression / alignment and fixation then turn the patient (either same anesthesia or after a gap of few days to weeks time then do anterior decompression and reconstruction.
All these patients were followed up for 5 years and were assessed for neural recovery, correction of deformity, maintenance of achieved column alignment and any complications. **Results:** Except traumatic etiology patients, all other patients of different etiologies improved neurologically. Three patients deteriorated neurologically in follow up due to implant failure and re-appearance of deformity. Fixation was revised and re-fusion was done. These 3 patients regained their motor power. Two patients had CSF leak and were managed conservatively. In the beginning 3 patients had superficial occipital sore and were managed conservatively. Later on we started keeping the head on soft foam during lying down / sleeping. 4 patients had superficial surgical site infection which could be managed with dressing. **Conclusion:** Understanding the pathology and changed biomechanics of cervical spine in different etiologies is extremely important. Even with unique neurovascular orientation and adjacent vital structures, cervical pathologies can be tackled meticulously and successfully by following an algorithm of staged procedure. It helps in decision making in terms of neural safety, neural recovery and providing normally aligned sound cervical column.

ID: AGS26/2594
P0099: Efficacy of minimally invasive surgery for adult congenital muscular torticollis: a real-world retrospective study

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Introduction: Congenital muscular torticollis (CMT) is a common musculoskeletal anomaly caused by unilateral sternocleidomastoid (SCM) contracture. Minimally invasive surgery (MIS) has gained popularity for its smaller incisions and lower complication rates. This study was performed to evaluate the efficacy and radiographic outcomes of MIS in adults with CMT and to introduce a novel SCM tension-based classification (Type S: sternal head-dominant; Type C: clavicular head-dominant) for optimizing surgical management. **Material and Methods: Design** This was a retrospective real-world study conducted at a tertiary hospital in China. **Patient Sample** The study included 90 adults with CMT who underwent MIS between March 2022 and April 2025, with a follow-up of 3 months. **Outcome Measures** Radiographic outcomes included parameters of the head, neck, and overall postural balance. Clinical outcomes included cosmetic appearance, functional scores, operative details, and complications. **Results:** The mean age of the cohort was 29.33 ± 8.70 years. At baseline, Type S patients had greater head tilt (7.44° ± 4.20° vs. 5.66° ± 2.83°, $p = 0.022$) and torticollis angle (9.21° ± 4.48° vs. 7.17° ± 4.07°, $p = 0.027$) than Type C patients. Postoperatively, all patients showed significant improvements in head shift, head tilt, torticollis angle, Cobb angle, thoracic kyphosis, cervical sagittal vertical axis, and coronal balance deviation (all $p < 0.05$). Type S patients demonstrated a significant increase in cervical lordosis (14.82° ± 10.93° to 19.53° ± 9.54°, $p = 0.006$), while Type C patients showed marked improvement in shoulder tilt (3.25° ± 2.07° to 1.89° ± 1.55°, $p < 0.001$). The overall prevalence of scoliosis decreased from 34.44% at baseline to 20.00% at 3 months. EQ-VAS scores improved from 83.15 ± 8.96 to 95.10 ± 5.98 ($p < 0.001$). The most common complications were effusion (10%) and hematoma (3.33%), and none required reoperation. **Conclusion:** MIS is effective for treating CMT in adults, leading to improvements in head and neck alignment as well as overall spinal balance. The proposed SCM tension-based classification offers a practical framework for surgical planning and may enhance the precision and outcomes of treatment.



Figure 1. Illustration of surgery and postoperative treatment.
(A) The positioning and surgical mark of the patients; (B) Intraoperative arthroscopy and radiofrequency ablation used; (C) Fibrotic sternal head of the sternocleidomastoid muscle (SCM) (arrow); (D) Fibrotic clavicular head of the sternocleidomastoid muscle (arrow); (E) Released sternal head (single arrow) and clavicular head (double arrows) of the SCM, shown in relation to the clavicle (triple arrows); (F) The two small incisions after surgery; (G-H) Schematic illustration of the proposed mechanism by which SCM release improves craniocervical posture.

ID: AGS26/2596
P0100: A novel bone screw implantation strategy in isolated C1-2 instability: a framework for evolving high cervical spine surgery

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Introduction: We evaluated the safety and accuracy of C1-2 pedicle screw insertion using our-developed planning software and 3D-printed guiding templates, comparing outcomes with freehand techniques to identify an optimal strategy for atlantoaxial fixation. **Material and Methods:** A 3D planning method associated with guiding template techniques was present to pedicle screws in high cervical vertebra fixation. Thirteen patients (Group 1) received freehand screw placement, while 17 (Group 2) were treated using the planning and guiding system. We analyzed demographics, complications, and screw placement precision. **Results:** Demographics, operative time, and blood loss were compared. Complications occurred in Group 1 patients; none were reported in Group 2. Most Group 2 patients underwent the C1PD + C2PD approach, which showed significantly higher screw placement safety. **Conclusion:** C1PD + C2PD is preferable to occipitocervical fusion when feasible. The planning strategy and its associated guiding system improves the implanted screws precision and safety of pedicle screw placement, particularly in cases with high-riding vertebral arteries. When the C2 pedicle diameter exceeds 3 mm, C2PD can be safely performed. This method supports more precise preoperative planning for atlantoaxial instability.

ID: AGS26/2655
P0101: Tomographic evaluation of the upper cervical spine in patients with cleft lip and palate and Class III malocclusion

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Objective: To perform a morphometric analysis of the upper cervical spine (UCS) by means of cone-beam computed tomography (CBCT) for the diagnosis of malformations or craniocervical instabilities in patients with cleft lip and palate (CLP) and class III malocclusion. **Materials and Methods:** A total of 72 CBCTs from adult patients (48 male and 24 female) with Angle Class III malocclusion were divided into three groups: 1) Unilateral cleft lip and palate (UCLP) (n = 29; male = 65.5%; age = 24, 2 ± 4.2 years); 2) Bilateral cleft lip and palate (BCLP) (n = 18; male = 83.3%; age = 26.4 ± 6.0 years); 3) Control group (CON) (n = 25; male = 56.0%; age = 27.8 ± 9.3 years). The version 11.7 of the Dolphin® software (Chatsworth, California, USA) was used to evaluate the morphometric measurements and anomalies of the UCS. Data were analyzed by descriptive and inferential statistics ($p \leq 0.05$). **Results:** For the UCLP, BCLP and CON groups, respectively, the measures were: atlantodental interval (2.1 ± 0.5; 2.1 ± 0.4; 2.0 ±

0.3 mm), basion-opisthion (35.9 ± 3.2; 36.4 ± 3.0; 34.7 ± 1.9 mm), hyoid-C3 (34.5 ± 3.7; 34.5 ± 5.2; 35.3 ± 4.5 mm), and hyoid-sella (108.1 ± 9.8; 111.3 ± 9.2; 109.7 ± 10 mm); clivus-canal angle (152.3 ± 13; 150.3 ± 10; 150.7 ± 10°) and Torg-Pavlov index (1.0 ± 0.2; 1.0 ± 0.1; 1.1 ± 0.2). Potentially unstable anomalies and malformations were more prevalent in the UCLP group (34.4%). **Conclusion:** Subjects with UCLP presented compressive or unstable anomalies on upper cervical spine, more frequently than controls and BCLP, despite the lack of statistically significant differences among groups. Future studies could increase the safety of patients and healthcare professionals specialized in craniofacial anomalies.

Keywords: cleft lip and palate, computerized tomography, craniofacial morphology, imaging, orthopedic treatment, skeletal morphology

ID: AGS26/2875
P0102: Instability at the craniovertebral junction in children

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Introduction: The craniovertebral junction (CVJ), also known as the occipitoatlantoaxial complex, is a stable, interconnected unit that forms the transition between the skull and the spine. The presence of multiple synovial joints and the complex mobility of this region make it susceptible to trauma and various pathologies. Instability at the CVJ is a significant clinical concern, particularly in pediatric patients, due to the elevated risk of neurological complications, even after minimal trauma. **Materials and Methods:** Between 2024 and 2025, we treated four pediatric patients (aged 5-13 years) diagnosed with craniovertebral junction instability. Two of the patients had Down syndrome. The etiology of instability was as follows: trauma in one patient (who also had Down syndrome), infection (Grisel syndrome) in two patients, and congenital abnormalities in one patient due to Down syndrome. Surgical interventions were tailored to the type of instability, using either anterior or posterior instrumentation. **Results:** All patients showed significant improvement in neurological function, overall status, and quality of life following treatment. Of the two patients with Grisel syndrome, one required surgical intervention due to persistent instability despite initial conservative management. The surgical procedures of choice in all three cases was C1-C2 fusion or occipital cervical fusion. The patients with Down syndrome required a staged surgical approach. **Conclusion:** The cases presented illustrate a variety of etiological factors and therapeutic strategies, highlighting the importance of early diagnosis, meticulous preoperative preparation, and a multidisciplinary approach in managing CVJ instability. Close postoperative monitoring and vigilance following conservative treatment are essential due to the potential for disease progression, which may necessitate further intervention.

ID: AGS26/2944
P0103: Bilateral Sprengel's shoulder in an 11yr old girl

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Introduction: Symptomatic Sprengel's shoulder patients rarely present for treatment in our society. Many just accept the deformity and carry on in spite of any limitations in upper limb movement. Those that seek treatment usually present late when they become symptomatic. Bilateral cases are even more rare with a typical bilateral shoulder elevation and difficulty abducting both upper limbs. **Material and Methods:** We present an 11yr old girl who presented with difficulty moving her neck sideways and inability to raise both upper limbs above her head of 9years duration. Her parents noticed these at 2years of age. Examination revealed a reduced range of motion (ROM) of the neck, shoulder and hypoplastic scapula. CT-Scan revealed a bilateral omovertebral body connecting superomedial scapula to the cervical spine with hypoplastic scapula. She had modified Woodward procedure and soft tissue release with a satisfactory outcome. **Results:** She had an excellent outcome with full ROM over the affected parts. She has commenced physiotherapy and both the patient and her parents are very happy with the outcome. **Conclusion:** Early and appropriate surgical intervention for Sprengel's deformity gives a satisfactory outcome with prognosis higher in early patient presentation and intervention.

ID: AGS26/3332
P0104: Cervical neurofibroma with progressive neurological deficit: case report and surgical management

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Introduction: Spinal neurofibromas are rare benign tumors arising from peripheral nerve sheaths, most frequently in the cervical region. Despite their benign nature, they may cause significant neurological deficits through local mass effect. We report a case of cervical neurofibroma managed surgically and discuss the therapeutic strategy. **Material and Methods:** A 61-year-old woman, with a history of hypertension and diabetes, presented with chronic cervical pain, dysphagia, and left upper limb paresthesias. Clinical examination revealed cervical tenderness without initial neurological deficit. Imaging (CT and MRI) demonstrated a cervical mass extending from

C3 to C5, suggestive of a nerve sheath tumor. An initial posterior decompression with arthrodesis C3-C7 was performed, followed by adjuvant radiotherapy (40 Gy in 20 fractions). Two months later, the patient presented with progressive spastic tetraparesis. **Results:** MRI confirmed residual tumor compression. A second-stage anterior approach with C3-C5 corporectomy, subtotal tumor resection (R2), and anterior arthrodesis with fibular graft was performed. Postoperative course was uneventful, with stable neurological status. Histopathological analysis confirmed a neurofibroma. **Conclusion:** This case highlights the therapeutic challenges of cervical neurofibromas, especially when neurological deterioration occurs after initial management. Multidisciplinary treatment combining staged surgery and radiotherapy may provide tumor control and prevent further deterioration. Early diagnosis and complete resection remain crucial for optimal neurological outcome.

Deformity-thoracolumbar (Adolescent)

ID: AGS26/61
P0105: Thoracoplasty does not improve patient-reported outcome measures in adolescent idiopathic scoliosis patients undergoing posterior spinal fusion: a systematic review and meta-analysis

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Purpose: Adolescent idiopathic scoliosis (AIS) is commonly associated with rib hump (RH) deformity, which poses a significant cosmetic concern for patients. Traditionally, thoracoplasty (TH) has been the preferred treatment to address this issue. This systematic review and meta-analysis evaluates the impact of combining TH with posterior spinal fusion (PSF) compared to PSF alone in AIS surgery. It focuses on patient-reported outcome measures (PROMs), particularly self-image, to assess the true cosmetic benefit of incorporating TH into PSF procedures. **Methods:** Following PRISMA guidelines, a systematic review was conducted from inception to March 2025 using Medline, Scopus, Embase, and Cochrane Library. Search terms included "thoracoplasty", "scoliosis", "rib hump", "Scoliosis Research Society Score" and "self-image scores". Outcomes assessed included surgical and radiological metrics, functional outcomes and complications. A meta-analysis was conducted to compare PROMs between patients treated with TH+PSF and those treated with PSF alone. The risk of bias was assessed using the MINORS score. **Results:** The 5 included studies had a level of evidence of either 2 or 3, with a total of 599 patients analyzed. Patients who underwent TH+PSF (n = 270) did not exhibit statistically significant differences in functional outcomes, including SRS questionnaire scores for pain, function, mental health, satisfaction, self-image, and overall score, compared to those who underwent PSF alone (n = 329) ($p > 0.05$). Additionally, the TH+PSF group experienced an higher rate of postoperative complications than the PSF alone group. **Conclusion:** The current meta-analysis indicates that TH did not result in significant improvements across any PROMs domains when added to PSF in AIS patients. Further well-conducted randomized controlled trials are needed to refine clinical decision-making by identifying the degree of deformity that may benefit from the addition of TH.

ID: AGS26/96
P0105.1: Evaluation of a Novel Osteoinductive Synthetic Bone Substitute in Spinal Deformity Surgery: A Retrospective Case Review

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Introduction: Synthetic calcium phosphates with submicron surface features have been demonstrated to have osteoinductive capacity. This retrospective case review was performed to evaluate the performance of a novel synthetic bone graft, a biphasic calcium phosphate with submicron surface topography, in patients undergoing spinal deformity surgery with fusion within the period from November 1, 2021, to May 24, 2023 at the Orthopedics department of the Royal Victoria Infirmary, Newcastle. **Material and Methods:** A retrospective analysis was conducted of a cohort comprising 44 spinal deformity patients who received corrective surgery with the synthetic bone graft, of which 31 patients have reached 6 months follow-up, and 21 patients have reached 12 months follow-up. For all patients, routine Cobb angle measurement was performed pre- and post-operative, and fusion was assessed using CT at 6 months and 12 months follow-up. **Results:** The cohort exhibited various cases of kyphosis (n=9) and scoliosis (n=36), including but not limited to adolescent idiopathic scoliosis (n=23). Mean patient age was 31 ± 20.69 years, with a median of 18 years, and a of range 5-73 years. Mean Cobb angle pre-surgery was 60.00° ± 21.03 and 17.22° ± 10.49 after surgery, corresponding to a mean correction of 39.36° ± 18.79 and a correction rate of 71.94% ± 14.26. The fusion rate as determined by CT at 6 months post-surgery was

96.77% (30/31), and 100% (21/21) at 12 months follow-up. One pseudoarthrosis with a broken rod was identified at 6 months follow-up in a 52-year old patient after a revision surgery of a complex deformity correction. **Conclusion:** This retrospective case review demonstrates the favorable performance of a novel synthetic calcium phosphate in spinal deformity surgery among a diverse group of patients with spinal pathology. The data highlights the high fusion rates and correction rates achieved, substantiating the suitability of this bone substitute for spinal deformity correction.

ID: AGS26/114
P0106: Selective fusion in adolescent idiopathic scoliosis lenke type 1B and 1C: a study of 102 cases

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Introduction: Adolescent idiopathic scoliosis (AIS) is a complex three-dimensional deformity of the spine. The primary objectives of surgical treatment are to stop the progression of the spinal curve, achieve and maintain deformity correction, preserve both coronal and sagittal alignment, minimize the incidence of perioperative and long-term complications, and, whenever possible, retain spinal mobility. Selective thoracic fusion, a surgical strategy in which only the vertebrae strictly necessary for deformity correction are fused, has become increasingly accepted, particularly in patients with Lenke type 1B and 1C curves. By limiting the distal extension of the fusion, this technique aims to maintain lumbar motion segments, thereby improving long-term function and quality of life. This study builds upon an earlier investigation of 25 cases and extends the sample to 102 patients treated between 2007 and 2017. The larger cohort and longer follow-up provide stronger evidence regarding the effectiveness and safety of selective thoracic fusion in AIS. **Material and Methods:** A retrospective cohort study was conducted including 102 consecutive patients with AIS Lenke 1B and 1C who underwent selective thoracic fusion at Hospital Provincial del Centenario between 2007 and 2017. The minimum follow-up was 5 years. Clinical and radiographic variables were collected: age at surgery, sex, Risser grade, lumbar modifier, Cobb angles (thoracic and lumbar), thoracic kyphosis, lumbar lordosis, apical vertebral translation (AVT), coronal and sagittal balance, and perioperative or long-term complications. **Results:** Clinical characteristics: The mean age at surgery was 14.6 years; the female:male ratio was 11.5:1, and the mean Risser grade was 3.7. Radiographic outcomes: - Thoracic curve: reduced from a mean preoperative Cobb angle of 62° to 30.1° at final follow-up, reflecting a 59.5% correction. - Lumbar curve: decreased from 42° preoperatively to 12.4° at follow-up, representing a 72.4% correction. - AVT: thoracic AVT improved from 57 mm to 24 mm; lumbar AVT from 45 mm to 20 mm. - Coronal balance: improved from 14 mm preoperatively to 10.3 mm at follow-up. - Sagittal balance: remained stable, with no significant alterations. **Complications:** The overall complication rate was 16%. Superficial infection occurred in 12%, deep infection in 4%, and transient radicular deficit in 4%. One patient presented mild lumbar decompensation, successfully managed with revision surgery. These results confirm that selective thoracic fusion provides substantial correction of both the structural thoracic curve and the compensatory lumbar curve while preserving lumbar mobility and sagittal alignment. **Conclusion:** Selective thoracic fusion in AIS Lenke 1B and 1C patients demonstrates long-term effectiveness and safety. In this cohort of 102 patients with a minimum follow-up of 5 years, the technique achieved: - Durable correction of both thoracic and lumbar curves, as well as AVT. - Preservation of lumbar motion segments, ensuring better flexibility and long-term function. - Improvement of coronal balance without negatively affecting sagittal alignment. - A complication profile comparable to that reported in international literature. Taken together, these findings support selective thoracic fusion as a reliable treatment option in carefully selected AIS patients, offering lasting structural correction, maintenance of spinal mobility, and improved quality of life.

ID: AGS26/151
P0107: Magnetically controlled growing rod in early onset scoliosis. A case series with early experience

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Introduction: The aim of this study is to report our early experience of magnetically controlled growing rod system (MAGEC) in early onset scoliosis. **Material and Methods:** A total of six patients with early onset scoliosis treated with MAGEC in a tertiary hospital in Malaysia. The medical records were reviewed to obtained pre-operative, post-operative and follow-up Cobb angles. The T1 to S1 length was measured on whole spine X-ray in standing, antero-posterior view. All patients were followed-up for at least one-year duration (12- 36 months). The serial lengthening was done in clinic every six month. **Results:** All six patients were female with three congenital, two neuromuscular and one idiopathic cause of early onset scoliosis. A total of three patients had dual rod constructs implanted and three patients received single MAGEC rod constructs. All six patients had MAGEC rods as primary procedure. The patients mean age at the surgery of growing rod insertion was 10.2 years (range: 6.9 - 11.9). The mean pre-operative Cobb angle was 82.2 degree (range: 50- 110), with immediate post-operative Cobb angle of 62.2 degree (range: 40-83.7). The mean correction immediate post- operation was 24.3 %. The mean Cobb angle during final follow-up was 60.2 degree (range: 42- 80.3). The mean pre-

operative T1 to S1 length measured was 350.8mm (range: 230-355). The mean T1 to S1 length during final follow-up was 376.0mm (245-365). The mean percentage of lengthening achieved in this series was 7.2% (range: 2.8-10.2) One of the case experienced proximal thoracic screw pulled out underwent revision surgery 6 months post surgery. We do not experience loss of magnetic distraction in current series. **Conclusion:** MAGEC growing rod system is effective in control early onset scoliosis. The complications of this rod systems include rod breakage, screw pulled out and loss of magnetic distraction are not uncommon. However, MAGEC growing rod system stands a point in avoidance of multiple lengthening surgeries. This is especially important in the group of patients with multiple comorbidities.

ID: AGS26/584
P0108: An Obstetrical and Gynaecological Insight to Measure the Gender Specific Issues Including Menstrual Disorders in Patients with Scoliosis – A Genuine Step Towards Empowering Women's Inclusive Health

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Introduction: Scoliosis, a three-dimensional spinal deformity, has systemic implications beyond musculoskeletal changes. Its potential impact on hormonal, menstrual, reproductive, and obstetrical health in females remains underexplored. The objective of this study is to evaluate and compare the menstrual, reproductive, and obstetrical health of females with different subtypes of scoliosis and to identify associated gynaecological abnormalities. **Material and Methods:** An ambispective observational study was conducted at a tertiary care centre between January 2021 and November 2022. A total of 292 female scoliosis patients (192 retrospective, 100 prospective) and 50 age-matched controls were enrolled. Participants were assessed through clinical evaluation, questionnaires, and ultrasonographic examination. Parameters studied included age at menarche, cycle regularity, bleeding characteristics, physical/psychological symptoms, and ultrasonographic findings (endometrial thickness, ovarian morphology). Obstetric outcomes were recorded where applicable. Statistical tests included Fisher's exact test and Bartlett's test for variance. **Results:** Mean age at menarche was delayed in scoliosis patients, especially in congenital scoliosis (12.5 ± 0.77 years) compared to controls (12.04 ± 0.75 years, $p < 0.01$). Menstrual irregularities, menorrhagia, and dysmenorrhea were significantly higher in congenital and syndromic scoliosis groups. Physical complaints were significantly more common in scoliosis groups than controls ($p = 0.003$), but psychological symptoms showed no statistical difference. Endometrial thickness and incidence of follicular cysts/bulky ovaries were significantly elevated in congenital and syndromic scoliosis groups. Of 15 patients who conceived, 13 had unplanned caesarean sections; no cases of spontaneous abortion or infertility were recorded. **Conclusion:** Scoliosis, particularly of congenital and syndromic origin, is associated with delayed menarche, menstrual irregularities, and gynaecological abnormalities. Although obstetrical data were limited, trends suggest potential complications that merit further investigation.

ID: AGS26/330
P0109: Bridging the gaps in scoliosis care: experiences of patients, families and providers during transition

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Introduction: The transition from pediatric to adult healthcare poses significant challenges for patients with chronic conditions, including scoliosis. This period is often marked by gaps in continuity of care, differing treatment approaches, and varying levels of readiness among patients, families and providers. Despite the recognized importance of structured transition processes, little is known about the lived experiences and perspectives of those directly involved in scoliosis care. Understanding these viewpoints is critical to informing patient-centered strategies that improve long-term outcomes and satisfaction. **Material and Methods:** A prospective qualitative study was conducted, involving semi-structured interviews with scoliosis patients ages 18 to 25 who had recently transferred from pediatric to adult care, as well as their family members and healthcare providers. Interviews were audio-recorded, transcribed verbatim, and analyzed using thematic analysis to identify common experiences, challenges and facilitators in the transition process. **Results:** Preliminary findings indicate that patients and families often experience uncertainty regarding expectations in adult care, with information gaps emerging as a major barrier to smooth transition. Differences in care models between pediatric and adult systems were highlighted, particularly regarding family involvement and psychosocial support. Patients and families often report increased anxiety and worry during the transition period. Key facilitators included prompt adult follow-up and sufficient information about scoliosis management and long-term health expectations. All patients and families interviewed supported the implementation of a dedicated transition coordinator, noting that such a role would facilitate timely follow-up updates, promote continuity of care, reduce stress and provide a reliable point of contact to address emerging questions of concerns. Participants also consistently highlighted the importance of online resources that can give accurate information on disease condition, self-management and appropriate care. **Conclusion:** Transitioning from pediatric to adult scoliosis care is a complex process shaped by the perspectives of patients, families, and providers. Our findings underscore the need for

structured, multidisciplinary transition programs that foster communication, autonomy, and sustained support. Incorporating these stakeholder insights may help bridge current gaps and optimize long-term outcomes for individuals living with scoliosis.

ID: AGS26/357
P0110: Patient-specific pre-bent rods in spinal deformity surgery. Clinical impact and predictive value

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Introduction: Pre-bent, patient-specific rods (PSRs) have been developed to optimize surgical outcomes for sagittal deformity. This prospective study aimed to evaluate the accuracy of PSR alignment parameters achieved during surgery, analyze the learning curve, investigate the correlation between alignment correction and complication rates, and explore the predictive ability of preoperative parameters for surgical outcomes. **Material and Methods:** We enrolled 22 consecutive patients undergoing spinal deformity correction using the UNiD™ rod system. Standardized full-spine radiographs were obtained pre- and postoperatively and at the one-year follow-up. The following parameters were measured: pelvic incidence (PI), lumbar lordosis (LL), T1 pelvic angle (TPA), pelvic tilt (PT), sacral slope (SS) and sagittal vertical axis (SVA). Two novel metrics were developed to evaluate surgical accuracy: The Correction Achievement Ratio (CAR), where 100% represents perfect achievement, and the Correction Maintenance Index (CMI), where 0% represents perfect maintenance. A learning curve analysis was conducted using chronological case analysis, cumulative summation analysis and case complexity stratification. Logistic regression analysis was used to examine the association between postoperative complications and correction accuracy. **Results:** Twenty patients could be evaluated (15 females with an average age of 66.5 ± 6.3 years). Significant improvements in sagittal alignment parameters were achieved from preoperative to immediate postoperative measurements. Closest to the planned targets were PI-LL mismatch (CAR = 102.8%) and TPA (CAR = 91.9%). PT (CAR = 149.2%) and SS (CAR = 123.5%) tended to overcorrect. Most parameters exhibited low stability over time (CMI > 20%), except lumbar lordosis, which exhibited moderate stability (CMI = 12.5%). Learning curve analysis revealed a significant turning point around case 8. After this point, the variance of correction decreased significantly. Overcorrection of PT (CAR > 120%, OR = 3.41, p = 0.025) and PI-LL mismatch (CAR > 120%, OR = 4.25, p = 0.007) were significantly associated with an increased risk of complications, particularly proximal junctional kyphosis. **Conclusion:** Initial sagittal alignment parameters can significantly be improved by PSR technology, but maintenance of correction is difficult. Surgical accuracy improves significantly after the initial learning curve. Overcorrection significantly increases the risk of complications, so accurate preoperative planning is crucial. This technology shows potential in reducing mechanical complications.

ID: AGS26/438
P0111: Scoliosis in chest wall deformities: coincidence or a unique pattern?

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Introduction: Pectus excavatum (PE) and pectus carinatum (PC) are the most common congenital chest wall deformities. Although these deformities primarily affect the anterior thoracic structure, their relationship with spinal deformities and especially with scoliosis is attracting more and more attention. The aim of this study was to determine the prevalence and predictors of scoliosis in patients with PE and PC. **Material and Methods:** A retrospective analysis was performed on a total of 1,352 patients diagnosed with PE or PC in our centre. Demographic data (age, gender) of the patients were recorded. The presence and pattern of scoliosis were divided into four subgroups based on radiographic findings: proximal thoracic (PT), main thoracic (MT), thoracolumbar (TL) and lumbar (L). The direction of curvature was also evaluated as right or left. **Results:** Of a total of 1,352 patients, 803 (59.4%) were diagnosed as pectus excavatum (PE) and 549 (40.6%) as pectus carinatum (PC). The mean age was 15.69 ± 4.92 years in PE patients and 15.42 ± 7.21 years in PC patients. Male gender was predominant in both groups; 78.5% in the PE group and 78.9% in the PC group. The overall prevalence of scoliosis was 22.9% in the PE group and 8.4% in the PC group. When scoliosis subtypes were evaluated, proximal thoracic (PT) scoliosis was found in 16.2%, main thoracic (MT) in 7.6%, thoracolumbar (TL) in 5.1% and lumbar (L) in 0.5% in the PE group. In the PC group, PT scoliosis was observed in 6.4%, MT scoliosis in 3.3%, TL scoliosis in 2.2%, and L scoliosis was not detected. **Conclusion:** This study shows that the prevalence of scoliosis is significantly increased in patients with chest wall deformity, especially in individuals with PE. The findings suggest that the scoliosis pattern in chest wall deformities tends to increase especially in the proximal thoracic region.

ID: AGS26/502
P0112: Features of spinal deformities after treatment of open neural tube defects

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Introduction: Open neural tube defects (ONTD), including myelomeningocele and myeloschisis, are frequently associated with the development of severe spinal deformities. These deformities range from rigid angular kyphosis with trophic disorders to paralytic scoliosis with pelvic obliquity. The aim of this study was to analyze the specific features of spinal deformities developing after surgical closure of ONTD. **Material and Methods:** A total of 65 patients who underwent closure of ONTD followed by surgical correction of spinal deformity between 2010 and 2023 were included. Patients were divided into two groups: group K (n = 38) with kyphosis/kyphoscoliosis, and group S (n = 27) with paralytic scoliosis and pelvic obliquity. Radiographic parameters, neurological status, and functional presentation were analyzed. **Results:** Group K patients demonstrated rigid angular kyphosis located mainly at the thoracolumbar junction, often accompanied by skin trophic ulcers over the apex. Group S patients presented with long, progressive paralytic scoliosis, frequently associated with pelvic obliquity and hip dislocation. In both groups, progressive deformity significantly impaired sitting balance and ambulation. **Conclusion:** Spinal deformities after myelomeningocele repair present with distinct features depending on the predominant pathology. Kyphosis is usually rigid and ulcerated, while scoliosis is progressive and combined with pelvic imbalance. Recognition of these patterns is essential for planning surgical correction.

ID: AGS26/613

P0113: Intraoperative fluoroscopic assessment of coronal balance in adolescent idiopathic scoliosis using rod aligned along the plumb line

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Introduction: Achieving and maintaining coronal balance (CB) is a crucial goal in correction of AIS. The target alignment should be within a range between -2 cm to +2 cm from the CSVL. Long-cassette AP radiograph is a known method for assessment of intraoperative CB but requires the availability of a radiolucent table and is associated with increased radiation exposure. This paper introduces a fluoroscopic method in intraoperative assessment of CB. **Material and Methods:** A prospective study was conducted on 50 patients with AIS who were corrected using transpedicular screw rod system in the period between March 2021 and March 2023 in our institute. After correction of the deformity a rod was applied externally on the skin at the cervicothoracic junction along the plumb line (PL) starting at the spinous processes of C7 and T1 under fluoroscopic control. AP view was done at the lower part of the lumbar spine. Deviation of the PL from the CVL was then measured in mm using the PACS system. **Results:** CB was achieved without the need for additional correction in 37 patients (74%). In the remaining 13 patients (26%) further correction was added to achieve an accepted CB. The deviation of the PL from CSVL at the end of the operation ranged from -20 mm to +21 mm (mean 13 mm, SD: 5.5 mm). The mean PL-CSVL deviation at the immediate postoperative period was 18 mm. Five patients (10%) developed coronal imbalance and three of them (6%) retained this imbalance after one year from the operation. **Conclusions:** The rod-aligned plumb line method is a simple but adequate measurement of intraoperative CB of the spine. It can be implemented in any operative room. The real-time feedback allows timely adjustments to the spinal instrumentation before closing the wound. The introduced method is inexpensive and is associated with low exposure to radiation compared to using long-cassette films. However, an achieved intraoperative CB is not always a guarantee against the development of coronal imbalance at the postoperative period.

ID: AGS26/616

P0114: Preoperative paraspinal muscle size and fat infiltration as predictors of postoperative recovery in adolescent idiopathic scoliosis patients: a pilot study

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Introduction: The iliopsoas and other paraspinal muscles play a crucial role in spinal stability and postoperative mobility. In adults undergoing lumbar spinal surgery, preoperative cross-sectional area (CSA) of paraspinal muscles has been shown to influence recovery. To date, no studies have specifically evaluated these parameters in pediatric populations, including patients with adolescent idiopathic scoliosis (AIS). This study aimed to evaluate preoperative CSA and muscle quality of the iliopsoas, erector spinae, and multifidus in AIS patients, and their relationship with key perioperative parameters, including blood loss, operative time, time to first ambulation, and length of hospital stay (LOS). **Material and Methods:** This retrospective study included 81 consecutively

treated AIS patients undergoing posterior spinal fusion from September 2021 to August 2023 at a single institution. Preoperative MRI was used to measure paraspinal muscle CSA and Goutallier grade at the L3 level. Measurements were independently performed in a blinded fashion by two trained radiologists, and the mean values were used for analysis. Inter-observer reliability was assessed to ensure consistency between the observers. Postoperative outcomes recorded included intraoperative blood loss, surgical duration, time to first ambulation, and LOS. Correlation analyses and Kruskal-Wallis tests were performed to assess associations between muscle parameters and outcomes ($p < 0.05$). **Results:** Patients (mean age 14.8 ± 1.7 years) were divided by Lenke type: 1-2 (Group 1, N = 26), 5 (Group 2, N = 18, lumbar curves), and 3-4-6 (Group 3, N = 37). Mean CSA and Goutallier scores of paraspinal muscles were similar across groups ($p > 0.05$). No significant correlations were observed between CSA or muscle quality and intraoperative blood loss or surgical duration in any group. In Group 2 (lumbar curves), an higher fat infiltration of erector spinae muscles and total paraspinal muscles correlated with longer LOS ($p = 0.042$ and $p = 0.026$, respectively). In Group 3 (double or triple curves), lower total paraspinal CSA also correlated with longer LOS ($p = 0.039$). Group 1 (thoracic curves) showed no significant associations. **Conclusion:** Preoperative paraspinal muscle size and quality appear to have minimal influence on intraoperative parameters in AIS surgery. Nonetheless, increased fat infiltration and reduced CSA-particularly in the erector spinae and overall paraspinal muscles-were associated with longer LOS in patients with lumbar-dominant curves (Lenke 5) and related subtypes (Lenke 3-4-6). These findings highlight the potential value of preoperative muscle assessment in anticipating early postoperative recovery. Further prospective studies are needed to confirm these results and to investigate targeted prehabilitation strategies.

ID: AGS26/619
P0115: Enhanced recovery after surgery for adolescent idiopathic scoliosis: a revised systematic review and meta-analysis

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Introduction: Adolescent idiopathic scoliosis surgery (AIS) is often associated with high costs and significant recovery challenges. Enhanced recovery after surgery (ERAS) protocols aim to improve outcomes, reducing hospital stays and complications compared to traditional (TD) pathways. This study evaluates the impact of ERAS protocols on AIS treatment. **Material and Methods:** Following PRISMA guidelines, a systematic review identified 30 studies (n = 15,954 patients). Search terms included "ERAS," "adolescent idiopathic scoliosis," and "posterior spinal fusion." Outcomes assessed included surgical metrics, recovery milestones, complications, and pain. A meta-analysis was performed, and the risk of bias was evaluated using the MINORS score. **Results:** ERAS patients (n = 5582) had shorter surgical durations (- 23 min, $p = 0.08$) and reduced blood loss (- 126 mL, $p = 0.033$) compared to TD patients (n = 7916). Recovery milestones improved, including earlier ambulation (- 37.4 h, $p < 0.0001$), patient-controlled analgesia discontinuation (- 1.1 days, $p < 0.0001$), catheter removal (- 0.75 days, $p < 0.001$), and shorter hospital stays (- 1.7 days, $p < 0.0001$). Complications were lower in the ERAS group (4% vs. 8%, $p = 0.0074$), while wound-related complications and 30-day readmission rates were comparable. Pain scores were significantly reduced from surgery day to postoperative day 2 ($p < 0.0181$). **Conclusion:** ERAS protocols improve recovery and reduce complications in AIS surgery, with shorter hospital stays and enhanced patient outcomes. These findings support broader implementation and further randomized trials to evaluate long-term benefits and patient satisfaction.

ID: AGS26/620
P0116: All-pedicle screw posterior spinal fusion after magnetically controlled growing rods in walking early-onset scoliosis patients: radiographic and surgical outcomes

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Introduction: Early-onset scoliosis (EOS) significantly affects lung development and life expectancy. Magnetically Controlled Growing Rods (MCGR) effectively promote thoracic growth while managing curvature progression. This study aims to assess the impact of definitive spinal fusion on residual deformity and complications in EOS patients treated with MCGRs. **Material and Methods:** The study included 27 EOS patients who underwent final fusion surgery between January 2017 and September 2022. The primary outcome was the evaluation of coronal and sagittal radiographic parameters postoperatively and at a minimum of 2 years of follow-up (FUP). Secondary outcomes

included major complications (≥ IIIB, according to Clavien-Dindo Classification), surgery duration, blood loss and length of hospital stay (LOS). **Results:** Major curve (45.5° and 33.5°, p = 0.003, Brunner-Munzel Test Statistic = - 3.869254) and Thoracic Kyphosis (TK) (19.8° and 13.5°, p = 0.002, Brunner-Munzel Test Statistic = - 2.258845) were statistically impacted by arthrodesis, and maintained at the final follow-up. The surgeries had an average duration of 254.2 ± 39.5 min (range: 195-336 min) and an average blood loss of 574.1 ± 255.1 mL (range: 200-1300 mL). The mean LOS was 8.5 ± 1.8 days (range: 6-13 days). Following the final fusion, 5 patients (18.5%) developed a complication, of which one was classified as major. **Conclusion:** This study demonstrated substantial improvements in coronal and sagittal alignment following graduation surgery, with results maintained at the two-year FUP. Further research with larger sample sizes is needed to provide a more comprehensive assessment of radiographic and surgical outcomes and to establish guidelines for implant density in MCGR graduation surgery.

ID: AGS26/621
P0117: Final fusion strategies in early-onset scoliosis: does implant density make a difference after magnetically controlled growing rod treatment?

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Background / Objectives: Early-onset scoliosis (EOS) frequently requires growth-friendly interventions, such as magnetically controlled growing rods (MCGRs), followed by definitive spinal fusion upon skeletal maturity. The optimal implant density (ID) for final posterior spinal fusion in these patients remains controversial. This study aimed to compare the radiographic, surgical, and economic outcomes associated with high-density (HD) versus low-density (LD) screw constructs in EOS patients previously treated with MCGRs undergoing definitive fusion. **Material and Methods:** This retrospective study included 27 EOS patients who underwent definitive posterior spinal fusion between January 2017 and September 2022. Participants were categorized into two groups: HD (n = 13) and LD (n = 14). Primary outcomes included coronal and sagittal radiographic parameters assessed at early postoperative and final follow-up visits (minimum of 2 years). The secondary outcomes analyzed were major postoperative complications (grade ≥ IIIB according to Clavien-Dindo-Sink Classification [CDSC]), operative time, blood loss, hospital stay length, and total implant costs. **Results:** Baseline characteristics between the HD and LD groups were comparable. Early postoperative radiographic assessment demonstrated significantly greater thoracic kyphosis (16.3 ± 7.6° vs. 10.9 ± 14.4°, p = 0.021) and T1-S1 spinal height (43.3 ± 6.7 mm vs. 39.1 ± 4.3 mm, p = 0.039) in the HD group. At final follow-up, only T1-S1 spinal height remained significantly higher in the HD group (45.4 ± 7 mm vs. 39.7 ± 5.1 mm, p = 0.021). Implant costs were significantly higher in the HD group (EUR 6046.5 ± 1146.9 vs. EUR 4376.4 ± 999.4, p < 0.001), while operative time, blood loss, and hospital stay length showed no significant differences. HD constructs had three major complications requiring surgical revision, whereas LD constructs reported no perioperative complications but experienced three late-onset complications also necessitating revision surgery. **Conclusion:** LD constructs provided comparable long-term radiographic and clinical outcomes to HD constructs, with significantly lower implant-related costs. Despite initial superior kyphosis correction in HD constructs, this benefit diminished by the final follow-up. These findings support a selective, lower-density screw placement strategy to minimize costs and surgical complexity without compromising patient outcomes in EOS undergoing definitive spinal fusion.

ID: AGS26/678
P0118: Clinical applicability of AI-based photo analysis in scoliosis follow-up and comparison with radiographic measurements (artificial intelligence assisted scoliosis examination-prospective randomized controlled trial)

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Introduction: The aim of this study was to evaluate the effectiveness and accuracy of a photo-based artificial intelligence (AI) measurement method that can reduce radiation exposure in the diagnosis and follow-up processes of scoliosis patients. **Material and Methods:** The prospectively designed study included 17 patients with adolescent idiopathic scoliosis and 15 healthy controls. Markers were placed at specific vertebral points on the back of the participants and clinical photographs were taken under standardized conditions. The YOLOv8 model was trained on the obtained photographs and spine curvature angles were calculated automatically. The results obtained with AI were compared with the gold standard radiographic Cobb angles. **Results:** High correlation (r = 0.93, p < 0.0001) was found between radiographic and AI-based measurements. The mean measurement difference was 3.71° (± 5.85°) and

statistically significant (p = 0.019). **Conclusion:** Artificial intelligence-based photo analysis method provides radiation-free, reliable and reproducible results in scoliosis follow-up. This method has the potential to reduce the need for radiography, especially in routine follow-up. It can be integrated into clinical practice and improve the quality of orthopedic care with larger-scale studies in the future.

ID: AGS26/693
P0119: Active apex correction in early onset scoliosis patients with neurofibromatosis

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Introduction: Active apex correction (APC) is a posterior tethering technique for correction of children with Early Onset Scoliosis (EOS). APC has been increasingly used for treatment of EOS in patients with neurofibromatosis. The aim of the study was to assess the outcomes of APC on EOS with neurofibromatosis patients in terms of curve correction, spine length, complications, and unplanned surgeries. **Material and Methods:** This is a retrospective multicenter study including 11 neurofibromatosis patients with EOS treated by APC which involves posterior tethering in adjunct with guided growth allowing modulation of the apex according to the Hueter-Volkmann law. Excluded patients with other etiologies, follow-up < 1 year and in whom APC was not the primary surgical intervention. **Results:** Mean age 8.8 ± 1.9 years, mean follow-up post-surgery 39.4 ± 22 months. At final follow up, there was a statistically significant improvement in major Cobb angle (Δ = 25.7%, p = 0.0009), minor Cobb angle (Δ = 21.7%, 0.0014), spinal length T1-L5 (Δ = 18.9%, p = 0.0012) but not apical vertebral translation (AVT) albeit clinical improvement (Δ = 6.8%, p = 0.15). 3 Complications (27%) including 1 proximal screws pull-out, 1 broken rod and 1 distal hook pull-out and 1 unplanned surgery (9%) for broken rod change. **Conclusion:** APC is a corrective modality for scoliotic deformities in neurofibromatosis patients with promising results in terms of clinical improvement, complication rates and need for unplanned reoperation.

ID: AGS26/703
P0120: Determining the optimal screw density in adolescent idiopathic scoliosis surgery: a breakpoint analysis reveals a clinical threshold at 1.94 screws/level

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Introduction: High screw density is commonly assumed to improve curve correction in adolescent idiopathic scoliosis (AIS) surgery, but the optimal threshold remains unclear. Our aim in this study is to determine a clinically relevant cut-off for screw density (screws per fused level) and its relationship with curve correction and complications. **Material and Methods:** This retrospective single-center study included 49 AIS patients with complete screw count and fusion length data. Screw density was calculated as total screws / fused vertebral levels. Primary outcome was major curve correction percentage: (Preop Cobb - Postop Cobb) / Preop Cobb × 100. A segmented (piecewise) regression model identified the breakpoint. Groups were compared below and above the cut-off using Welch t-test and Fisher's exact test. **Results:** The optimal threshold was identified as 1.94 screws/level. Patients below the threshold had higher mean correction (73.6% ± 12.7) compared to those above (67.8% ± 12.6, p = 0.022), despite having higher preoperative Cobb angles (60.9° vs 51.9°) and longer fusions (12.84 vs 10.71 levels). Complication rates were lower above the cut-off (7.7% vs 12.0%, p = 0.35). **Conclusion:** Screw density above ~2.0 screws/level does not yield additional curve correction and may represent a point of diminishing returns. This finding supports a more cost-effective approach without compromising outcomes. Prospective multicenter validation is warranted.

ID: AGS26/718
P0121: Curved narratives: cultural representation of spinal deformity in children's animated films and its psychosocial implications

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Background: Spinal deformities, particularly adolescent idiopathic scoliosis (AIS), are associated with impaired self-image. While psychosocial consequences are well-documented in clinical literature, little is known about how such conditions are represented in children's media or how these portrayals may contribute to stigma and self-perception. **Objective or Hypothesis:** This study aimed to systematically evaluate how spinal deformities are portrayed in Disney and Pixar animated films and to assess whether recurring visual and narrative stereotypes reflect psychosocial challenges reported by adolescents with AIS. **Methods:** A systematic content analysis was conducted of all full-length Disney and Pixar films released from 1989 to 2025. Characters were included if they exhibited consistent anatomical features suggestive of kyphosis, scoliosis, or lordosis. Each character was assessed for physical, social, and moral traits using a standardized checklist. Clinical plausibility was confirmed by

an FRCS-trained spine surgeon. Descriptive statistics were used to analyze prevalence and trait distribution. **Results:** Forty-eight characters met inclusion criteria, most showing kyphosis (79%). The majority were secondary (42%) or peripheral (35%) figures. Common portrayals included clumsiness (60%), frailty (42%), and frightening demeanor (33%). Only 27% were heroes and 19% were leaders. Female characters were underrepresented (27%). **Conclusions:** Spinal deformity is frequently depicted in children's animation through lenses of physical and social inferiority. These portrayals may contribute to internalized stigma and identity challenges in adolescents with AIS. Clinicians should consider these cultural narratives when discussing appearance-related treatment options.

ID: AGS26/719
P0122: Beyond the curve: sexual and psychological health after adolescent idiopathic scoliosis treatment

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Background: While the primary goal of treating Adolescent Idiopathic Scoliosis (AIS) is curve correction, long-term psychological and sexual outcomes are rarely examined. This systematic review evaluates whether bracing or surgical treatment affects sexual health, body image, and psychological well-being compared to healthy controls. **Methods:** A systematic review was conducted in accordance with PRISMA guidelines. PubMed, Embase, and CENTRAL were searched up to November 2024 for studies assessing sexual and psychological outcomes in AIS patients treated with bracing or surgery. Inclusion criteria encompassed observational and interventional studies with validated outcome tools. Risk of bias was assessed using the ROBINS-I tool. **Results:** Nine studies involving 3,231 participants were included. Among 1,085 AIS patients (average age 15.6 years; 18F:1M), 498 underwent bracing and 587 surgery. Compared to healthy controls, AIS patients reported higher rates of sexual distress, body image dissatisfaction, and reduced self-esteem. Surgically treated patients showed marginally better sexual satisfaction scores than braced patients, though differences in psychological or intimacy measures were inconsistent. Physical limitations and pain-related sexual dysfunction were noted across both treatment groups. **Conclusion:** AIS treatment may influence long-term sexual and psychological health, particularly among brace-treated patients. While surgical intervention may offer modest benefits, evidence remains limited. These outcomes should be incorporated into AIS follow-up and future research, emphasizing patient-centred care.

ID: AGS26/726
P0123: The Lenke paradox: substantial agreement or methodological mirage?

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Study Design: Systematic review and meta-analysis. **Introduction:** The Lenke system is widely used in AIS surgical planning. While initial reports showed excellent reproducibility, subsequent studies have yielded inconsistent results, particularly for lumbar and sagittal modifiers. We aimed to evaluate inter- and intra-observer reliability of the Lenke classification for adolescent idiopathic scoliosis (AIS) and identify methodological factors influencing agreement. **Methods:** Following PRISMA guidelines, five databases (PubMed, Embase, Cochrane CENTRAL, Scopus, and Web of Science) were searched to August 2025. Data on observer characteristics, imaging protocols, measurement methods, and statistical indices (κ, ICC) were extracted. Study quality was assessed with QAREL. Descriptive synthesis and random-effects meta-analysis were performed. **Results:** Eleven studies (528 radiographs) met inclusion. Inter-observer reliability averaged $\kappa = 0.76$ (range 0.50-0.96); lumbar $\kappa = 0.75$ (0.53-0.92); sagittal $\kappa = 0.79$ (0.41-1.0). Pooled analysis of two studies with confidence intervals yielded $\kappa = 0.69$ (95% CI 0.56-0.82; $I^2 = 21\%$). Intra-observer reliability was higher ($\kappa \approx 0.82$). Reliability improved with pre-measured radiographs, experienced observers, computer assistance, and short repeat intervals; it was lower with non-premeasured films, mixed cohorts, and longer intervals. Lumbar modifiers were relatively robust, whereas sagittal reproducibility was most vulnerable to methodological bias. One study illustrated the κ paradox, with high agreement but $\kappa = 0.41$ due to skewed distribution. **Conclusions:** The Lenke classification is reliable under controlled conditions but less consistent in everyday practice. Reported κ values should be interpreted within their methodological context. Standardised protocols, transparent reporting, and digital tools may improve reproducibility.

Keywords: adolescent idiopathic scoliosis, Lenke classification, reliability, reproducibility, systematic review, meta-analysis

ID: AGS26/789
P0124: Efficacy of intraoperative taping technique in the reduction of deformity in adolescent idiopathic scoliosis surgery and its impact on surgical outcomes

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Introduction: Surgery for idiopathic scoliosis, especially with severe abnormalities, is still very problematic. Pedicle screw

fixation has been the traditional practice in surgery though this may pose some challenge under severe conditions. Intraoperative traction has proven to be an effective method in reducing the deformity and facilitate instrumentation. This study outlines a new less invasive skin taping method aimed at reducing the severity of scoliosis before insertion of pedicle screws. The objective of this study is to evaluate the effectiveness and safety of a novel skin taping technique used during patient positioning in scoliosis surgery. **Material and Methods:** This retrospective cohort study analyzed the outcomes for AIS patients who underwent derotation surgery from 2017 to 2023. Patients were grouped among those who received skin taping and those who did not. The study excluded patients with syndromic scoliosis, severe scoliosis curve exceeding 100 degrees, congenital scoliosis, revision surgery, or no available data of more than 1 year's follow-up time. **Results:** The study analyzed 52 patients, with no significant difference in gender distribution and average age between the taping and non-taping groups. However, the major curve size for taping was higher than that of non-taping patients. After surgery, there was significant improvement for both major and secondary curvature among the two groups after surgery, with the taping group showing a higher percentage of correction. The taping group also had a higher incidence of skin redness, while the non-taping group had a slightly higher incidence of screw complications. **Conclusion:** The study concludes that the use of a skin taping method can contribute to a reduction in the major curve during patient positioning in scoliosis surgery. This technique may allow for safer insertion of pedicle screws and less manipulation during reduction maneuvers. Despite some limitations due to the retrospective nature of the study, the results suggest that the taping technique may enhance the correction of deformity. However, further studies are needed to fully demonstrate the effect of this technique in scoliotic curve reduction.

ID: AGS26/826
P0125: Surgical treatment in late diagnosed kyphoscoliotic Ehlers-Danlos syndrome - Case report

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Introduction: Kyphoscoliotic Ehlers Danlos syndrome (kEDS) is a severe and rare genetic condition affecting collagen production causing hyperlaxity, tissue fragility and hypermobility. One of the orthopaedic issues is represented by kyphoscoliosis. The exact incidence is unknown with estimates of about 1: 100.000 births. The literature mentions a series of severe perioperative complications which is why the surgical treatment of kyphoscoliosis should be cautious and individualized. The aim of this paper is to present the diagnostic and therapeutic challenges in a severe case of kEDS to add data to the already presented cases in the literature. **Material and Methods:** Our patient is a premenarchal 12-years-old female with severe thoracolumbar kyphoscoliosis. The deformity was first noticed 1 year after birth. Initial treatment consisted of a brace and kinesiotherapy. The curve progressed despite adequate conservative treatment reaching a severe U-shaped lumbar kyphoscoliosis. Clinical examination revealed the thoracic hypokyphosis and a prominent left lumbar gibbus resulting in a severe sagittal imbalance. No neurologic issues were noticed. Other specific features of this patient include arachnodactyly, generalized ligamentous hyperlaxity and hyperpigmentation overlying the patellae. The patient was severely underweight with a body mass index of 11.3 (23kg and 143cm) raising concerns of spinal implant coverage. Preoperative X-rays highlighted the severity of the deformity with a L1-L5 kyphosis of 100° and thoracic hypokyphosis. No associated spinal cord anomaly was observed on MRI. The surgical treatment consisted of a single stage posterior approach with T4-pelvic fixation associated with multilevel Ponte osteotomies. Intraoperative correction was achieved progressively using multiple rods, applied consecutively. **Results:** No major intra and postoperative complications occurred. A brace was used postoperatively, and assisted walking was possible 6 days after surgery. The patient gained 7 cm in height immediately after surgery. Postoperative X-rays and clinical exam reasonable spatial correction of the deformity. The 1-year clinical and X-rays follow-up showed minimal correction loss without any other complications. The latest BMI is 13.4 (31kg and 152 cm). **Conclusion:** Kyphoscoliotic Ehlers-Danlos syndrome is a diagnostic and therapeutic challenge due to comorbidities and spinal curve pattern. Posterior-only approach is suitable to reasonably correct the spatial balance of the spine.

ID: AGS26/831
P0126: Free hand vs navigation guided pedicle screw insertion in scoliosis - An analysis of 5000 screws using intra operative low dose CT scan

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Introduction: Pedicle screw placement accuracy is critical in scoliosis correction surgery. Previous studies have shown up to 3.6 % rate of malposition despite the use of navigation. Malposition can lead to a return to theatre up to 2 % in free hand technique. Our Aim is to evaluate whether there is a significant difference in revision rates between pedicle screws inserted, using

the freehand technique versus navigation-guided placement, assessed utilizing intraoperative low-dose CT for assessment. **Material and Methods:** A retrospective analysis of all consecutive operative cases of scoliosis between 2019 to 2022 at Alder Hey was undertaken. 275 patients and a total of 5,006 implanted pedicle screws were included. Of these, 4,449 were inserted freehand and 557 using navigation. Screw positioning was assessed intraoperatively with low-dose CT, and intra operative revisions were recorded. Statistical analyses included the Wilcoxon test, Kruskal-Wallis test, and chi-square test as appropriate. **Results:** Of the 5,006 screws, 4,803 (95.9%) were deemed to have been in acceptable position, while 203 (4.1%) were unsatisfactory and required intra operative revision. Counter intuitively the revision rates were similar between the freehand and navigation groups, with no statistically significant difference. No association was found between revision rates and gender, vertebral level, instrumentation length, Cobb angle, or operation time. The median Cobb angle was 75° (IQR: 63-90), median operation time was 300 minutes (IQR: 240-360), and median instrumentation length was 12 levels (IQR: 10-13). Two patients returned to theatre, one for PJK and the second for rod breakage. No patient returned to theatre for screw malposition. **Conclusion:** The revision rates for pedicle screws inserted freehand and navigation guided in scoliosis surgery in a high-volume specialist unit are comparable. Intraoperative low-dose CT is an effective tool for real-time assessment after screw placement. It allows for intra-operative revision and eliminates the risk of return to theatre.

ID: AGS26/878
P0127: Results of surgical treatment of high-grade spondylolisthesis

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Introduction: Spondylolisthesis of Grade III-IV according to the Meyerding classification, referred in the literature as "high-grade spondylolisthesis," involves a significant degree of vertebral displacement and leads to substantial impairment of spinal function, gait disturbances, and early disability in patients. Despite the fact that clinical symptoms, classifications, and diagnostic methods have been known and established for quite some time, the issue of surgical treatment remains a subject of debate to this day. **Material and Methods:** A retrospective analysis was conducted on the surgical outcomes of 24 patients with significant vertebral displacement who underwent intraoperative traction and transpedicular fixation using a "spine-pelvis" system. Pre- and postoperative radiographic measurements included the slip angle (SA), pelvic incidence (PI), lumbar lordosis (LL), sacral slope (SS), pelvic tilt (PT), as well as evaluation of sagittal vertical axis (SVA) alignment and pelvic tilt angle (PT). **Results:** All patients demonstrated a reduction in slip angle (SA) and restoration of sagittal vertical axis (SVA) alignment to within normal limits. Other parameters of spinopelvic balance were also moderately improved, thereby bringing sagittal spinal alignment closer to normal values and enhancing the biomechanical conditions for spinal function. Eight patient had gait disturbance postoperatively that resolved 3-6 month after the surgery. Rod breakage observed in 3 patients after 1, 2 and 5 years correspondingly. **Conclusion:** The use of intraoperative traction via ligamentotaxis allowed for repositioning of the displaced vertebra and facilitated the placement of transpedicular screws. The combination of intraoperative spinal traction and pulling on transpedicular screws using reduction devices enabled correction of the displaced vertebra to Grade.

ID: AGS26/963
P0128: Preoperative pain distribution and mental health in Lenke type 1-2 AIS: a prospective cross-sectional study

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Introduction: Pain is common in adolescents with idiopathic scoliosis (AIS), yet its distribution is heterogeneous and mechanisms remain incompletely understood. Beyond structural factors, emerging evidence suggests a psychosocial component with links to mental health. This study investigated associations between preoperative pain distribution and mental health in Lenke type 1-2 AIS undergoing posterior spinal fusion. **Material and Methods:** In this prospective single-center cohort (July 2023-July 2025), patients completed SRS-22 and a standardized pain diagram (10 regions). Coronal/sagittal parameters were measured on EOS imaging. Univariable linear regressions examined SRS-22 Mental Health vs pain regions and radiographic variables; models were run unadjusted and adjusted for age, sex, and primary Cobb ($\alpha < .05$). **Results:** Forty-two patients (31 female; mean age 16.3 ± 2.3 years) were included, with a mean SRS-22 Mental Health score of 3.7 ± 0.66. Neck region pain (R1) was reported by 21.4% of patients and was significantly associated with lower Mental Health scores ($\beta = -0.54$, $p = .029$) in both unadjusted and adjusted models. No other pain regions or radiographic parameters demonstrated significant associations. **Conclusion:** Preoperative axial neck pain was independently associated with poorer mental health, whereas radiographic features were not. These exploratory findings support a biopsychosocial perspective in AIS and motivate routine preoperative screening for pain and mental health to identify at-risk patients. Confirmation in larger, multicenter longitudinal cohorts with predefined multiplicity control is warranted.

ID: AGS26/1077
P0129: A comparative study of surgical correction of idiopathic scoliosis with spinal pedicle screw in children

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Introduction: Surgical treatment of severe forms of thoracic idiopathic scoliosis remains an urgent and not fully resolved problem. When correcting idiopathic scoliosis, it is important to restore the frontal and sagittal profiles of the deformed spine, rotate the apical vertebra and maintain this result in the postoperative period. **Material and Methods:** the work is based on the analysis of the results of surgical treatment of 80 children diagnosed with thoracic idiopathic scoliosis grade 3-4: 12 male patients and 68 female patients aged 14 to 17 years. All patients (80 patients) were of the first type (Lenke 1); the sagittal contour in most of them was marked as normokyphosis. Patients were divided into 4 groups depending on the type of surgical correction. The choice of the technique used to correct spinal deformity in children with idiopathic thoracic scoliosis was determined by the initial size of the main curvature, its mobility, and the anatomo-anthropometric features of the vertebral arch roots comprising the curvature arch. **Results:** When comparing the effectiveness of surgical correction between the first and second groups, the correction of scoliotic deformity of the spine in patients of the first group (92.1 ± 7.1%) was greater than in the second group (81.8 ± 6.3%). TAt the same time, it should be emphasized that the magnitude of derotation in the first group (65.9 ± 9.5%) is significantly higher compared to patients in the second group (23.2 ± 4.3%). The magnitude of the correction of kyphosis and lordosis in both groups was the same, and clinically and radiographically improvement or complete recovery was noted. Following mobilizing interventions on the anterior parts of the vertebral bodies of the main deformity curve from the anterolateral approach and dorsal correction with a metal structure with transpedicular supporting elements, it was noted that the magnitude of the correction of scoliotic deformity of the spine in the third group of patients (78.1 ± 7.7%) was greater than in the fourth group (71.7 ± 17.4%), which could be explained by the fact that installed transpedicular screws on both sides of the deformed area increase the effect on the spinal column. It should also be emphasized that the percentage of derotation of the apical vertebra in patients of the third group (46.3 ± 11.9%) was significantly higher than in the fourth group (22.7 ± 8.8%). **Conclusion:** Using different levels and lengths for installation of transpedicular elements, the sequence of corrective manipulations as well as the use of the VCM system made it possible to individualize the approach and to correct all components of the deformity in three planes. A conducted study on surgical treatment in patients with idiopathic scoliosis showed that using transpedicular support elements through the whole curvature arch with VCM system, was significantly better in correction of the deformity (scoliotic arch and rotation of the apical vertebra), compared to those in whom pedicle screws were not installed over two or more vertebrae from the concave side of the curvature.

ID: AGS26/1178
P0130: Vertebral body tethering (VBT) vs brace treatment in patients with adolescent idiopathic scoliosis

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Introduction: Idiopathic scoliosis is always old and always young orthopedic problem. International standards include brace conservative treatment with specialized exercise therapy for growing spine. Dorsal surgery with instrumentation and fusion is recommended for bone growth ended patients. Mobile correction technologies as VBT has been actively developed inspite of large number of complications and reoperations (up to 60%). **Material and Methods:** Prospective observational study included 62 patients aged 16 to 21 who underwent anterior scoliosis correction (ASC) in the period from 2018 to 2022. The ASC technology included deformity arc stabilization by two cords with two screws into the vertebral body implantation and nucleotomy at the top of the deformity for a greater derotation. These particularities differ ASC from VBT. Lenke I was in all patients from this group (right-sided thoracic spinal deformity). All deformities in group were mobile according to functional radiographs, Risser was 4-5. The male to female ratio was 1:4. Literature data were used for comparative analyziz. Postural radiographs of the spine in two projections, traction test, right/left tilts were done for all patients. Measurement of the Cobb angle, assessment of bone age according to Risser, MRI of the entire spine, SRS-22 questionnaire, postoperative complications registration performed. **Results:** In 1 year after surgery the evaluation of the results was carried out. The PreOp deformity Cobb angle was 45.5° (33-58°), and PostOp Cobb was 24.5° (11-38°) respectively, and was assessed as a satisfactory correction. According to the SRS-22 questionnaire, 52 patients would agree to undergo such surgical treatment again, eight could not answer, one would refuse. Among postoperative complications, pneumothorax occurred in 7 patients, chylothorax in 1 patient. The total number of complications was 8 (12.9%). No cord breaks, deformity hypercorrection, or loss of correction occured. **Conclusion:** ASC technology can be alternative surgery for patients with failed brace treatment during growth with maintaining the spine mobility in the PostOp life. It

can provide higher satisfaction with the treatment, confirmed by the SRS-22 questionnaire. At the same time, the complications associated with the spine growth could be also eliminated with ASC technology comparable with VBT. The authors invite interested parties to join the study for growing patients undergoing brace treatment and using ASC technology for patients with Risser 4-5 while maintaining indications for surgical treatment, but minimizing the risks associated with spinal growth.

ID: AGS26/1216
P0131: Refining diagnostic criteria for atypical Scheuermann

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Introduction: Scheuermann's kyphosis is the most common cause of juvenile hyperkyphosis, typically involving the thoracic spine. An atypical variant, however, affects the thoracolumbar junction and may present with distinctive clinical and radiographic features, such as more severe back pain, neurological manifestations, and significant vertebral wedging. Although Sorensen's criteria remain the standard for diagnosis, the literature on atypical Scheuermann's disease is limited, with uncertainties regarding its characterization and prevalence. This study aims to assess the diagnostic approaches currently adopted by spine surgery specialists and to propose refined criteria to enhance early recognition and management of this underexplored condition. **Material and Methods:** A cross-sectional survey was distributed to members of the Brazilian Society of Spine Surgery. The questionnaire included 12 items assessing surgeons' knowledge, experience, and diagnostic preferences regarding both typical and atypical Scheuermann's disease. **Results:** A total of 36 spine surgeons participated (88.9% orthopedic surgeons, 11.1% neurosurgeons), with a mean of 8.9 years of experience. Most respondents (97.2%) had treated patients with Scheuermann's disease, and 83.3% identified the affected spinal segment as the main distinction between typical and atypical forms. Atypical Scheuermann's disease was perceived to present with more severe symptoms by 72.2% of participants. The most commonly used diagnostic imaging was standard lateral spine radiographs, with anterior wedging of $\geq 5°$ in three consecutive vertebrae as the most cited criterion. **Conclusion:** The current exploration of diagnostic criteria for atypical Scheuermann's disease underscores a critical need for standardization. While the established parameters for typical Scheuermann's kyphosis, as defined by Sorensen, provide a solid foundation for diagnosis, the lack of clarity and uniformity regarding the evaluation of atypical cases presents significant challenges for spine surgeons.

ID: AGS26/1230
P0132: Use of posterior apical dynamic distraction device in adolescent idiopathic scoliosis: 2 years follow-up

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Introduction: The Posterior Apical Dynamic Distraction Device (PADD) is a novel surgical technique that corrects scoliosis without spinal fusion, thereby preserving mobility. **Materials and Methods:** We conducted a cohort study of patients operated between July 2022 and December 2024 using a PADD. Clinical and radiographic parameters were assessed preoperatively, immediately postoperatively, and at 3, 12, and 24 months. Statistical analysis included t-test and ANOVA ($p < 0.05$). **Results:** Sixteen patients (13 females) were included, with a mean age of 14.4 years; 62.5% practiced sports. Nine patients had Lenke type 1 curves and seven Lenke type 5, with Risser 3-4 and Sanders 5-6. Mean follow-up was 16 months. Average surgical time was 77.8 minutes with blood loss of 80 cc. Patients were discharged at 48 hours, returned to school at 18 days, and resumed sports at 33 days. The main curve decreased from 46.3° to 22° postoperatively ($p < 0.001$) and remained stable at 1 year (22.4°; $p < 0.001$) and 2 years (27.45°; $p < 0.001$). The secondary curve decreased from 30.9° to 17.4° ($p < 0.001$) and remained stable at follow-up. T1-T12 height increased from 25.4 mm to 28.7 mm ($p = 0.22$). Kyphosis showed no significant variation. Lordosis decreased slightly postoperatively, then increased in Lenke 1 (52.4° to 62°) and Lenke 5 (45.8° to 53.7°; $p = 0.83$). Device expansion was from 26.6 mm to 39.6 mm at 1 year ($p < 0.001$), reaching 38 mm at 2 years ($p < 0.001$). **Conclusion:** The PADD technique achieves scoliosis correction while maintaining sagittal balance at 1- and 2-year follow-up. It represents a valid alternative for flexible Lenke 1 and 5 curves measuring less than 60°.

ID: AGS26/1240
P0133: Use of posterior apical dynamic distraction device in patients with scoliosis and lytic spondylolisthesis: report of three cases

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Introduction: Approximately 6.2% of patients with adolescent idiopathic scoliosis (AIS) present with concomitant lytic spondylolisthesis (LS). The coexistence of these diagnoses complicates the choice of fusion levels, since long fusions generate biomechanical overload in the adjacent unfused segments. In such cases, posterior apical dynamic distraction devices (PADD) emerge as an innovative alternative to preserve mobility and reduce overload. **Materials and Methods:** We present three cases of adolescents with combined diagnosis of AIS and L5-S1 LS: two with Lenke 5-like curves and one with Lenke 1. All were treated with PADD. Included patients had grade I and III lytic spondylolisthesis, curves < 30°, reducible, and Risser 3-4. **Results:** Mean age was 14.3 years. One patient had Ehlers-Danlos syndrome and another had Opitz G/BBB syndrome. The main curve decreased from 45.3° to 18.2°, while the secondary curve decreased from 31.5° to 19.4°. T1-T12 height increased from 24.9 cm to 26 cm. Two patients required additional surgery for LS: in one high-grade case, L4-S1 fusion with sacral osteotomy was performed, showing improvement in pelvic incidence (65.7° to 74.2°), kyphosis (5.3° to 27.5°), and lordosis (42.6° to 67.8°). In the low-grade LS case (L5-S1 fusion) and in the conservatively managed case, spinopelvic parameters showed no relevant changes. None presented sagittal imbalance. **Discussion:** In this series, PADD achieved significant correction of the Cobb angle, while maintaining sagittal parameters except in the high-grade LS case. Moreover, it allowed rapid functional recovery without complications. In patients with ligamentous laxity or syndromic diagnoses, this approach may offer biomechanical advantages by avoiding rigid constructs. **Conclusion:** PADD is a valid alternative for patients with AIS and LS, particularly in flexible curves and in those with comorbidities who may benefit from a less rigid approach.

ID: AGS26/497
P0134: Extending the Indications of Minimally Invasive Scoliosis Surgery in Idiopathic Scoliosis: Feasibility in Very Severe Curves Exceeding 80°

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Introduction: Minimally invasive scoliosis surgery (MISS) through a posterior approach has been shown to achieve comparable radiological outcomes and superior perioperative metrics when compared to conventional open scoliosis surgery in patients with adolescent idiopathic scoliosis (AIS). Despite these advantages, the application of MISS has remained largely restricted to cases with moderate to severe curve magnitudes. Its feasibility and efficacy in treating very severe curves exceeding 80° remain unestablished. **Material and Methods:** A total of 588 patients with IS who underwent MISS between 2015 and 2023 were included, each with a minimum follow-up period of two years. Included cases were divided into the three groups based on the main Cobb's angle: M group (n = 335, 45° ≤ Main Cobb's angle < 60°), S group (n = 216, 60° ≤ Main Cobb's angle < 75°), and VS group (n = 35, Main Cobb's angle ≥ 80°). Radiological parameters, operative data, and complications were compared across groups at the preoperative, postoperative, and final follow-up. **Results:** The mean operative time was significantly shorter in the M group (279.0 minutes) compared to the S (311.2 minutes) and VS (319.9 minutes) groups ($P < 0.001$). Estimated blood loss was also significantly lower in the M group (813.1 mL) compared to the S (986.6 mL) and VS (1000.0 mL) groups ($P = 0.006$), though there were no significant differences in postoperative transfusion rates. Radiologically, the mean preoperative Cobb angles were 52.9° (M), 66.2° (S), and 82.3° (VS) ($P < 0.001$). No significant differences were found among groups regarding correction rate, correction loss, coronal balance, sagittal vertical axis, thoracic kyphosis, or lumbar lordosis. Pleural effusion was the most common complication, associated with thoracoplasty, but incidence did not differ significantly across groups. **Conclusion:** MISS via a posterior approach demonstrated acceptable radiological and operative outcomes, even in patients with idiopathic scoliosis presenting with Cobb angles exceeding 80°. These findings support the feasibility of MISS as a viable surgical option in more severe cases, thereby suggesting an expanded indication for its application in the treatment of idiopathic scoliosis.

ID: AGS26/1350
P0135: Less for more or less for less? Preserving lumbar mobility by choosing LIV on L3 on patients that met criteria for L4 fusion in adolescent idiopathic scholiosis: our clinical experience

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Introduction: Treatment of AIS has always been a matter of concern among surgeons, especially regarding the limits of distal instrumentation, keeping in mind trunk balance, aesthethics and mobile lumbar segments. In this study we tried to follow up what happened with the adding on curve in patients with 3C, 4C, 5C and 6C Lenke that had criteria for LIV at L4 but were fused to L3 to preserve as much as possible lumbar mobillity and avoid disk degeneration without imbalancing the spine. **Material and Methods:** Radiological data of 12 patients who met the inclusion

criteria were documented. We included patients with Adolescent Idiopathic Scholiosis (3C, 4C, 5C and 6C Lenke curve), based on the relationship of L3 to CSVL on AP and right bending XRay and rotation of L3 on left bending. We included the patients that met the following criteria: L3 does not cross the CSVL on right bending, L3 had more than II Nash Moe rotation on left bending or L3 was barely touched by CSVL or not touched on AP Xray. We chose L3 as LIV, preserving lumbar mobility. We excluded patients with only thoracic curve, patients with other types of scholiosis and also patients with intramedullary pathologies on MRI. **Results:** To the patients analysed with a medium preoperative Cobb angle of 66 degree, during a mean follow up of 2.3 years, we observed a mean wedging of 6 degree (N < 5 degree) at LIV and a mean translation of 13 mm at LIV+1 from CSVL (N < 10 mm) and also an increasing postoperative lumbar curve from 23 degree to 29 degree. **Conclusion:** Even thought we had some decompensation, the balance of the spine was kept and we managed to preserve lumbar mobility in patients that met criteria for L4 instrumentation. We did not have any revision surgery to extend the implant at the analysed patients.

ID: AGS26/1362
P0136: Transposition of the spinal cord to rescue neurological function in severe spinal deformities

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Introduction: Severe kyphoscoliosis deformities are challenging conditions that may lead to progressive neurological deficits. Surgical correction is sometimes hindered by the patient's medical condition or the availability of infrastructure. Surgical correction further puts the cord at risk of neurological deterioration. Transposition of the spinal cord is a safe, reproducible procedure that saves cord function in selected cases. **Material and Methods:** Four patients with severe kyphoscoliosis deformities experienced deterioration of their neurological function perioperatively. Transposition of the spinal cord was done to rescue neurological function. The procedure involves resection of the concave side pedicles, ligation, and resection of the dorsal nerve roots (at least 4 nerve roots). The spinal cord is then mobilized and relocated outside the spinal canal lateral to the angular deformity. **Results:** All patients improved neurologically. At three months postoperative, the 4 patients were AIS E. The average operative time was 130 minutes. The average blood loss was 400 ml. Three patients had severe congenital kyphoscoliosis, and one patient had neglected early-onset deformity. Two patients had preoperative neurological deficits (ASIA Impairment Score) C, and two experienced intraoperative loss of SSEPs and MEPs with immediate postoperative AIS B. **Conclusion:** Transposition of the spinal cord is a safe, reproducible surgical procedure that rescues neurological function in selected severe angular kyphoscoliosis cases.

ID: AGS26/1458
P0137: Traditional dual growing rods treatment for early onset scoliosis in a pediatric high complexity Chilean hospital. Are we meeting the objectives?

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Introduction: Traditional growing rods treatment is a commonly used surgical growth sparing strategy for patients with early onset scoliosis. The objectives are to control the progression of the spinal deformity and maintain longitudinal spine and thoracic growth in children who have not reached skeletal maturity. This study will show the results of traditional dual growing rods treatment in a Pediatric High Complexity Chilean Hospital. **Material and Methods:** A retrospective observational descriptive study was conducted in our health center, including all the patients who underwent growing rods surgery between the years 2019 and 2025. The inclusion criteria were: two or more years of patient follow-up and a minimum of one lengthening surgery. The exclusion criteria were: incomplete records, non-traditional (magnetic) growing rods system or unilateral rod. Some of the variables included were the following: Age at the beginning and the end of the treatment (or up to date), sex, scoliosis etiology, number of lengthenings, interval between index surgery - first lengthening and between lengthenings (in months), average measure of the distraction procedure (in millimeters), Major curve Cobb angle (initial, initial with traction, after first surgery and final), thoracic height and T1-S1 measure in millimeters (initial, initial with traction, after first surgery and final), proximal and distal anchorage levels and complications during follow up. In all patients included in the study, the technique was dual growing rods construct using a parallel wedding band two-hole domino. For digital measurements Surgimap and local XERO Viewer software were used. **Results:** A total of 9 patients fulfill the study criteria. The average age at index surgery was 7.6 years (4-10), and 11 years (8-14) at the end of the treatment. 55.6% of the patients were women and 44.4% men. Regarding etiology; 4 patients had idiopathic scoliosis, 3 neuromuscular and 2 syndromic. The number of lengthenings was in average 2.6 (1-4), the interval between index surgery and first lengthening was 9.6 months (5-16) and between lengthenings was 14 months (9-25). The average distraction per procedure was 13 mm (11-15). The initial major cobb angle was in average

58° (36-99) and the average reduction in cobb angle at final follow up was 21° (7-44, SD 13.6). The increment in thoracic height was average 10.4 mm (8-13, SD 1.8) by year, and the difference between the final thoracic height and immediately post-index surgery was in average 10.7 mm (1-28, SD 8.6). The increment in T1-S1 distance was average 16.6 mm (12-22, SD 3) by year, and the difference between final T1-S1 distance and post-index surgery was in average 17.6 mm (8-32, SD 8). We should mention that 66% of the patients had some type of complication. **Conclusion:** This study shows that the objectives of growing rods treatment are fulfilled, despite the wide range in number of lengthenings and interval between them. None of the patients progressed in their scoliosis degree and the gainings in thoracic height and T1-S1 distance by year are more than historically describe by *Dimeglio et al.* for the range of 5-10 years (majority of the patients).

ID: AGS26/1462
P0138: Comparative evaluation of postoperative outcomes between the Rod-link system and conventional methods in the correction of adolescent idiopathic scoliosis deformity

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Introduction: Adolescent idiopathic scoliosis (AIS) affects 1-3% of individuals aged 10-18 years, particularly females, is characterized by coronal curvature and vertebral rotation with significant clinical and functional implications. Conventional surgical correction using rods and screws, while effective, carries neurovascular risks and is associated with prolonged recovery. The Rod-link system was developed to enhance the adaptability and efficacy of surgical correction. This study compares postoperative outcomes of the Rod-link system with traditional techniques in adolescents with AIS, providing local evidence that may inform clinical decision-making and optimize treatment protocols. **Material and Methods:** An analytical observational study was conducted in adolescents with AIS treated either with the Rod-link system or conventional techniques. A convenience sampling was applied between 2015 and 2024 at a fourth-level complexity hospital. Clinical, radiographic, and postoperative outcome variables were recorded using a structured data collection form, managed in Excel 365, and statistically analyzed with R version 4.3.1. Descriptive and comparative analyses were performed, applying parametric or nonparametric tests according to data distribution, with a significance level set at $p < 0.05$. **Results:** Forty-six patients (82.6% women) were included, with a median age of 14 years (IQR 13-15.8). Patients in the Rod-Link group were younger at surgery (13.7 vs. 15.2 years; $p = 0.049$), had a larger preoperative Cobb angle (68.4° vs. 49.1°; $p = 0.006$), and had a shorter surgical duration (378 vs. 430 minutes; $p = 0.035$) compared with conventional techniques. No differences were observed in intraoperative bleeding, postoperative hemoglobin, or hospital stay ($p > 0.05$). The use of hooks was more frequent in conventional techniques (37.5% vs. 4.5%; $p = 0.012$), with no differences in postoperative complications or neuromonitoring alarms. **Conclusion:** The Rod-Link system was applied in patients with more severe curves and was associated with a reduction in surgical time compared with conventional techniques. No differences were observed in bleeding, transfusion, postoperative hemoglobin, or hospital stay; postoperative complications were infrequent and similar between groups. However, the retrospective design, sample size, and convenience sampling restrict the generalizability of the findings. Prospective, multicenter studies with larger numbers of patients are needed to confirm these results and evaluate long-term clinical and functional outcomes.

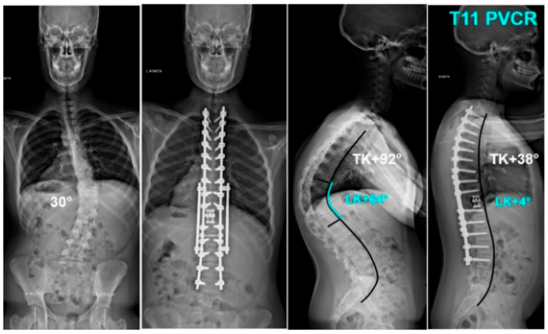
ID: AGS26/1575
P0139: Surgical treatment of severe and rigid Scheuermann's kyphosis with simultaneous gradual anterior column lengthening and posterior compression following PVCR: case series

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Hypothesis: Gradual anterior column lengthening and simultaneous posterior compression technique after PVCR achieves ideal restoration of regional and global sagittal alignment, prevents dural buckling and iatrogenic neurological deficit and eliminates the need for anterior surgery. **Study Design:** Case series. **Introduction:** Combined anterior-posterior surgery is considered the gold standard for surgical treatment for severe and rigid Scheuermann's kyphosis. Recently there has been a trend towards posterior-only surgery for Scheuermann's kyphosis. Among 3CO's only PVCR remains a valid option for correcting the severe and rigid kyphotic deformity. PVCR provides flexibility for angular deformity correction and circumferential decompression of the spinal cord. Gradual anterior column lengthening corrects the angular and global deformity while preventing dural buckling and iatrogenic neurological deficit. This study evaluates clinical and radiologic outcomes of PVCR in the surgical treatment of severe and rigid Scheuermann's kyphosis. **Methods:** Pts with Scheuermann's kyphosis treated with PVCR were included. Following PVCR, the correction

technique involved gradual anterior column lengthening with simultaneous posterior compression manuevers followed by placement of an expandable cage to the osteotomy site. Preop, postop and final f/up x-rays were evaluated for local kyphosis angle (LKA) and sagittal parameters. Health related quality of life was assessed by SRS-22r. **Results:** 10 pts with Scheuermann's kyphosis, with a mean age 22.4 (15-36) yrs and f/up 4.9 (2-11) yrs were included. Osteotomies performed at T8 (2pts), T9 (2pts), T10 (3pts), T11 (2pts), and T12 (1pts). Preop LKA of 64.6° (55-76) restored to 10.5°(83.8% Correction Rate) and preop thoracic kyphosis of 86.7° (79-102) corrected to 45.8° (47.1%). Preop LL of 74.6° (56-90) restored to 49.6° (47.1%). Preop 47.4° of kyphosis between T10-L2 levels restored to 4.2°. None of the pts had postop neurological defisit. Solid fusion was achieved in all pts without significant loss of correction in the sagittal plane at the final f/up. SRS-22r total scores improved from a mean of 3.58 to 4.64. **Conclusion:** Simultaneous gradual anterior column lengthening and spinal shortening provided by posterior compressions following PVCR allows ideal correction of thoracic and thoracolumbar kyphotic deformity, restores global sagittal alignment, prevents dural buckling and iatrogenic neurologic deficit and eliminates anterior surgery for the severe and rigid Scheuermann's kyphosis.



ID: AGS26/1608
P0140: Do less is more: achieving optimal outcomes with selective instrumentation and fusion of strategic vertebrae in adolescent idiopathic scoliosis

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Introduction: Scoliosis surgery is a complex and highly specialized procedure aimed at correcting abnormal curvature of the spine. This condition, known as scoliosis, can range from mild to severe and can significantly impact a person's quality of life. The purpose of this study is to provide a concise overview of scoliosis surgery, including its indications, surgical techniques, potential risks and complications, and post-operative care with minimum instrumentation. **Material and Methods:** From February 2009-July 2025, 181 cases underwent surgery. 108 were female and 73 were male and age ranged 14-38 years. The pedicle is a power nucleus of the vertebra and offers a secure grip of all 3 columns. Pedicle screw instrumentation ensures rigid fixation with improved 3D correction. Accurate placement of screws is important to reduce possible irreversible complication. All cases were corrected by transpedicular screws and rods with minimum instrumentation addressing strategic vertebre. 172 cases were managed by only posterior approach and 9 cases required both anterior releases, costoplasty, posterior stabilization as well. Fusion was done in selected segments. Total follow up time was about 10 years (6 months-7 yrs). All patients were assessed by deformity correction, cosmesis, and functional outcome. Use of Neuromonitor is an excellent & effective method for prevention of post operative neuro deficit. **Results:** 40% patients had average coronal plane cobb's angle measuring about 70^0 pre-operatively and 17.12^0 immediate post-operative period. 2% patients developed neurodeficit. 3 regained completely but other regaining her neurological deficit very slowly. There were malposition of screws in 13%, painful prominence of screws in 10%, superficial infection in 4%. 80% patients improved cosmetically. **Conclusion:** Scoliosis surgery is a valuable treatment option for individuals with significant spinal curvature. While it carries certain risks, advancements in surgical techniques and post-operative care have improved patient outcomes and overall success rates.

ID: AGS26/1610
P0141: Balancing motion and correction: mid-term outcomes of hybrid fixation in adolescent idiopathic scoliosis

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Introduction: Vertebral body tethering (VBT) provides growth-modulated correction for scoliosis while preserving segmental motion. In patients with double major curves or thoracic deformities accompanied by thoracolumbar/lumbar curves, selective thoracic fusion alone may not provide sufficient control. Extending fusion into the lumbar spine ensures correction but at the cost of motion loss. To balance correction and mobility, a hybrid approach-thoracic posterior fusion combined with thoracolumbar/

lumbar VBT-has recently gained popularity as a motion-preserving alternative. However, comprehensive series reporting mid-term outcomes of this technique remain limited. This study reports radiographic, patient-reported, pulmonary, and implant-survival outcomes of a consecutive hybridx fixation cohort. **Materials and Methods:** Prospectively maintained data were retrospectively analyzed at a single center. Outcomes included Cobb angles for the upper thoracic (UT), main thoracic (MT), and thoracolumbar/lumbar (TLL) curves at preoperative, first-erect, and latest follow-up. Patient-reported outcomes comprised SRS-22 Function, Pain, Self-image, and Mental Health domains from preoperative to latest follow-up. The minimal clinically important difference (MCID) was defined as 0.5× the preoperative SD. Pulmonary function tests (PFT) included percent-predicted FVC and FEV1. Complications, readmissions/reoperations, and time to first tether break were captured. **Results:** Twenty-five patients were analyzed (mean age 13.9 ± 2.5 years; 84% female). Preoperatively, median Sanders, CVM, and Risser were 5.5 [IQR 3-7], 4.0 [4-5], and 1.0 [0-3], respectively. Median follow-up was 25.3 months [24.2-29.2]. Lenke types were: Type 1: 43.5%, Type 2: 17.4%, Type 4: 4.3%, Type 5: 26.1%, and Type 6: 8.7%; lumbar modifiers: A: 4.3%, B: 26.1%, C: 69.6%. Preoperative flexibility was 48.8 ± 20.5% for UT, 56.8 ± 20.5% for MT, and 80.7 ± 18.9% for TLL. UT, MT, and TLL Cobb angles were 36.0 ± 11.1°, 61.8 ± 17.3°, and 50.9 ± 13.9° preoperatively; improved to 8.1 ± 5.0°, 7.8 ± 5.0°, and 12.8 ± 6.6° at first erect; and measured 8.8 ± 6.3°, 11.0 ± 8.7°, and 12.3 ± 8.3° at latest follow-up. SRS-22 self-image improved significantly (Δ +0.84, MCID achievement 67%, $p < 0.001$), while Function (Δ -0.16), Pain (Δ -0.16), and Mental Health (Δ +0.02) remained unchanged (all $p > 0.05$). PFT percent-predicted changes were -4.25 for FVC% and +0.21 for FEV1% ($p > 0.05$). Two mechanical complication occurred (tether break in 8%); no re-admissions or reoperations were recorded. **Conclusion:** In this consecutive hybrid fixation cohort with median follow-up exceeding two years, UT, MT, and TLL Cobb angles improved substantially and were maintained. Patient self-image improved with preservation of pulmonary function. The mid-term implant profile was favorable, with low mechanical complication rates and survival without tether break >95% at one year and >80% at two years. These results highlight hybrid fixation as a promising motion-preserving alternative, warranting confirmation in larger cohorts with longer follow-up.

ID: AGS26/1646
P0142: No rod breakage occur by cMIS anterior posterior correction fusion from thoracic level

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Introduction: Rod breakage can be prevented of cMIS correction and fusion by anterolateral access interbody fusion for the anterior spine from the thoracic level to the lumbar and sacral vertebrae, including the thoracic-lumbar junction.To evaluate the outcome of changing from L5/SPLIF to OLIF51 in cMIS deformity correction and fusion surgery by Mini-Open retropleural, OLIF25, mainly anterolateral interbody correction and fusion from the thoracic to lumbosacral spine. **Material and Methods:** 23 cased cMIS for ASD by Mini-Open retropleural, OLIF25, and OLIF51 or bil.PLIF from the thoracic to lumbosacral level, all PPS, iliac screw cantilever rod rotation correction were perfomed. Of 23 cMIS cases (M/F; 8/15, mean age 74.0y, mean follow up 23.4M) ,7 cases of cMIS (by Mini-Open retopleural, OLIF25, OLIF51 and all PPS, iliac screw, single rod cantilever technique correction) (M/F; 2/5, age 71.5y, f/u 7.0M) and 16 cases of cMIS (by Mini-Open retopleural, OLIF25, bilateral PLIF and all PPS, iliac screw, single rod cantilever technique correction) (M/F; 10/6, age 75.1y, f/u 28.8M) were compared for changes in standing global alignment before and after surgery, and changes in GLL, LLL, and LDI related to lumbar lordosis formation. **Results:** In both PLIF and OLIF51, there were zero rod breakages in any of the cases. The cMIS of OLIF51 (7 cases): operation time (min) 779.1 (1st 453.8 /2nd 325.4), blood loss (cc) 309.2 (1st 122.1 /2nd 187.1), PI-LL 34.1 → -0.98, C7-SVA 103.6 → 5.68, cobb angle 32.3 → 10.2, while the cMIS of L5/S bilateral PLIF (16 cases): operation time (min) 664.1 (1st 305.6 /2nd 358.5), blood loss (cc) 540.6 (1st 102.5 /2nd 438.1), PI-LL 36.7 → 5.06, C7-SVA 136.1 → 40.9, cobb angle 25.0 → 7.14. **Conclusion:** Rod breakage does not occur with cMIS deformity correction surgery performed across the thoracic junction, which is considered a biomechanical disadvantage. By switching to OLIF51, there was a tendency for a difference in LL.

ID: AGS26/1678
P0143: Correction of congenital kyphosis in skeletally mature patients not treated during childhood. Results and complications. Prospective study

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Introduction: Among congenital spinal deformities, congenital kyphosis is the leading cause of non-traumatic paraplegia in the adult population in the United States. Early management during childhood is therefore essential. In cases where patients reach skeletal maturity, surgical treatment becomes more aggressive and complex. The aim of the present study was to analyze the clinical and radiological outcomes of adolescents with congenital kyphosis treated by posterior vertebral column resection (PVCR) at a pediatric referral center for congenital spinal malformations. **Material and Methods:** All patients with congenital kyphosis

undergoing surgical treatment between 2017 and 2020 by the same surgical team were included. Patients with an open triradiate cartilage or with follow-up of less than one year were excluded. Variables collected included type of spinal anomaly, surgical details, presence of intraoperative neurophysiological events, complications, clinical outcomes, and radiological results assessed on pre- and postoperative full-spine radiographs. **Results:** A total of 10 patients were analyzed, with a mean age at surgery of 14.99 years (range: 13.62-15.25), 60% of whom were female. Statistically significant improvements were observed in the following radiological parameters pre- vs. post-PVCR: Cobb angle 19.8° (12.4-52.8) vs. 7.1° (1.4-17.23); thoracolumbar junction T10-L2 46.2° (35-53.13) vs. 2.95° (0-8.93); segmental kyphosis 60.85° (59.4-71.6) vs. 8° (7.3-19.15); pelvic tilt 9.35° (2.5-18.58) vs. 2.4° (-6.6-6.93); and sacral slope 32° (30-33.33) vs. 34.7° (34-37.63). Regarding complications, two patients (20%) presented intraoperative neurophysiological changes with clinical repercussions: one recovered completely, while the other improved partially to an ASIA C classification. **Conclusion:** PVCR is effective in restoring sagittal spinal alignment in adolescent patients with rigid deformity secondary to congenital kyphosis. However, it is a complex procedure with a risk of severe complications. To minimize risks, surgical correction should ideally be performed during childhood. In skeletally mature patients, we recommend thorough preoperative planning and that surgery be undertaken by experienced spine surgeons.

ID: AGS26/1682
P0144: Scoliosis in patients with autism spectrum disorder: comparative clinical, radiographic, and surgical analysis versus adolescent idiopathic scoliosis

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Introduction: Scoliosis associated with Autism Spectrum Disorder (ASD) remains poorly characterized, despite clinical features resembling neuromuscular scoliosis (NMS) more than adolescent idiopathic scoliosis (AIS). Axial hypotonia, ligamentous hyperlaxity, and congenital vertebral anomalies suggest a distinct musculoskeletal phenotype. However, curve patterns and surgical strategies for this population are not clearly defined. **Objective:** To compare clinical, radiographic, and surgical outcomes of posterior instrumented fusion in patients with severe scoliosis and ASD versus a matched AIS cohort. **Material and Methods:** A retrospective comparative cohort study included 8 ASD patients with severe scoliosis who underwent posterior instrumented fusion between 2021 and 2025. A matched cohort of 8 AIS patients was selected based on age, sex, and radiographic characteristics. Statistical analysis included descriptive measures and independent-sample t-tests, with significance set at $p < 0.05$. **Results:** Both groups were comparable in age (14.6 ± 1.2 years ASD vs. 15.0 ± 1.5 AIS; $p = 0.624$) and sex distribution (50% female in both). Preoperative Cobb angles showed no significant differences: main thoracic 69.4° ± 12.1 (ASD) vs. 70.2° ± 11.7 (AIS; $p = 0.956$); proximal thoracic 35.8° ± 9.5 vs. 39.1° ± 8.8 ($p = 0.376$); thoracolumbar 44.6° ± 10.7 vs. 47.2° ± 9.9 ($p = 0.527$). Kyphosis was 46.2° ± 8.3 vs. 44.9° ± 7.7 ($p = 0.558$). Intraoperative variables were also comparable: operative time 270 ± 38 min vs. 262 ± 41 min ($p = 0.697$); blood loss 980 ± 240 ml vs. 940 ± 220 ml ($p = 0.621$), corresponding to 22.3% ± 5.8 vs. 21.7% ± 6.1 of blood volume ($p = 0.891$). Instrumented levels were 11.2 ± 1.7 vs. 10.9 ± 1.9 ($p = 0.373$), with invasiveness index 12.1 ± 3.2 vs. 11.8 ± 2.9 ($p = 0.919$). One major osteotomy and one neuromonitoring alert were recorded in the ASD group (both $p = 0.302$). Postoperatively, mean hospital stay was 7.1 ± 1.8 days (ASD) vs. 6.5 ± 1.5 (AIS; $p = 0.222$). A clinical complication occurred in 1 ASD patient (12.5%) vs. none in AIS ($p = 0.302$). Radiographic outcomes showed comparable corrections: main thoracic Cobb 25.3° ± 6.9 vs. 24.7° ± 6.1 ($p = 0.433$), with correction rates of 63.5% ± 9.1 vs. 64.7% ± 8.7 ($p = 0.424$). Thoracolumbar Cobb was corrected to 18.6° ± 5.2 vs. 17.9° ± 4.8 ($p = 0.368$), with relative correction 58.3% ± 7.5 vs. 62.1% ± 6.8 ($p = 0.016$). **Conclusion:** In patients with ASD and severe scoliosis undergoing posterior instrumented fusion, clinical, intraoperative, and radiographic outcomes were largely comparable to AIS. A trend toward lower thoracolumbar curve correction was observed in ASD. These findings suggest conventional AIS surgical strategies may be applicable to ASD patients, although larger studies are required to validate these results and assess potential tailored perioperative adaptations.

ID: AGS26/1698
P0145: Scoliosis in patients with Down syndrome. Correlation between curve magnitude and functional ambulation level

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Introduction: Patients with Down syndrome (DS) have a higher incidence of scoliosis compared to the general population; however, it remains unclear whether gross motor function (GMF) influences the characteristics and severity of the deformity. Functional walking abilities, described by the Gross Motor Function Classification System (GMFCS), allow stratification of patients into five levels from greater to lesser functional ability. The aim of this study was to evaluate whether there is an association between GMF in patients with DS and spinal deformity.

Material and Methods: This prospective case series included all patients with a diagnosis of DS, yielding a final sample of 649, of whom 46 were identified with scoliosis (60.42% female; mean age 14.6 ± 2.33 years). Based on their functional walking abilities, patients were classified according to the GMFCS, and various radiological parameters in the coronal and sagittal planes were measured. The treatment modality for scoliosis (observation, bracing, or surgery) was recorded. A multivariate associative analysis was performed between radiological parameters and GMFCS level. **Results:** Twenty-two patients were classified as GMFCS level I, 23 as level II, and 1 as level III. Curve location was thoracic in 12 cases, thoracolumbar in 10, and lumbar in 24. A significant association was found between GMFCS level and curve magnitude: GMFCS I 18.92° (6.6-79), GMFCS II 36.65° (20.7), GMFCS III 42.2° ($p = 0.004$, $1\text{-}\beta = 0.879$). A cutoff point of 22.55° was identified (AUC = 0.915, $p < 0.005$, sensitivity = 0.91, specificity = 0.82). The relationship between patients requiring surgery and GMFCS level was also significant ($p = 0.036$). No significant associations were found between functional level and coronal imbalance (17.39 mm [13.48] vs. 17.01 mm [12.76] vs. 49 mm, $p = 0.07$) or sagittal imbalance (32.36 mm [21.49] vs. 36.04 mm [33.14] vs. 24.9 mm, $p = 0.91$), nor with other radiological parameters including CL C2-C7 ($p = 0.76$), TK T5-T12 ($p = 0.68$), TL T10-L2 ($p = 0.48$), LL L1-S1 ($p = 0.85$), PI ($p = 0.06$), PT ($p = 0.15$), and SS ($p = 0.51$). **Conclusion:** In this study, patients with poorer GMF presented with greater scoliosis curve magnitude and higher risk of requiring surgery. No associations were found between functional level and other radiological parameters or curve location.

ID: AGS26/1702

P0146: Comparative analysis of thoracic transverse diameter of spinal canal and pedicle width: implications for pedicle screw insertion in pediatric patient

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Introduction: Pedicle screw insertion is a routine procedure during scoliosis surgery. Various modalities facilitate the insertion of pedicle screws, such as robotic, navigation, C-arm guided, and freehand techniques. The freehand technique is widely used because it is cost-effective and more familiar to surgeon. However, this technique still has the potential for complications, especially in pediatric patient, due to anatomical size differences compared to adults' patients. This difference could have an impact on determine entry point for pedicle screw insertion at the thoracic level in pediatric patient. **Material and Methods:** We retrospectively evaluated the imaging data of 60 study subjects, consisting of 30 pediatric and 30 adults, who underwent thoracic computed tomography (CT). We measured the ratio of transverse diameters of spinal canal width (SCW) and bilateral pedicle width (PW) compared to total diameter of SCW plus bilateral PW from 1st thoracic vertebra to the 12th thoracic vertebra by using patient's CT. **Results:** Statistically, the results showed that the SCW ratio at all thoracic levels in pediatric population is wider than that in adults' population ($p < 0.05$; t-test), with the mean differences varying from 0.044 to 0.096. Additionally, the PW ratio at all thoracic levels in pediatric is smaller than adults' population ($p < 0.05$; t-test). **Conclusion:** Determining the entry point for pedicle screw insertion at the thoracic level in pediatric children needs to consider the wider SCW ratio and the smaller PW ratio compared to adults. We recommend that the entry point for pedicle screw insertion at the thoracic level in pediatric should be more lateral than that in adults.

ID: AGS26/1747

P0147: Three-column osteotomy versus halo-gravity traction combined with posterior column osteotomy in the treatment of dystrophic neurofibromatosis type 1 kyphoscoliosis: a retrospective comparative cohort study

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Introduction: Dystrophic neurofibromatosis type I (NF1) kyphoscoliosis presents unique challenges for corrective spinal surgery due to anatomical abnormalities. To compare the radiographic and clinical outcomes of dystrophic neurofibromatosis type 1 (NF1) kyphoscoliosis patients undergoing three-column osteotomy (3CO), halo-gravity traction (HGT), or posterior column osteotomy (PCO) and to evaluate their efficacy and safety in this cohort, different treatment strategies and their associated complication rates warrant further comprehensive investigation. **Material and Methods:** Dystrophic NF1 kyphoscoliosis were divided into 3CO, HGT, and PCO groups based on the surgical strategy. Radiographic parameters were measured preoperatively, postoperatively,

and at each follow-up. Intraoperative and postoperative complications were recorded for each patient, and patient-reported outcomes were assessed using the Scoliosis Research Society-22 (SRS-22) questionnaire. Differences among the three groups were analyzed. **Results:** A total of 9 patients were included in the 3CO, 22 in HGT group, 95 in PCO groups, respectively. Significant differences among the three groups were found in terms of operation time ($p = 0.011$), estimated blood loss ($p = 0.003$), and number of satellite rod techniques ($p = 0.013$). At preoperation, the Cobb angles of main curves were 84.3 ± 24.6° in 3CO group, 99.1 ± 24.3° in HGT group, 60.0 ± 16.8° in PCO group. At post-operation, significant post-operative improvements were found in the Cobb angles of the main curves, apical vertebral translation (AVT), segmental kyphosis (SK), and deformity angular ratio (DAR) in all three groups ($p < 0.001$). No significant correction loss was observed during the follow-up. Six complications were found in the 3CO group, 13 in the HGT group, and 40 in the PCO group. **Conclusion:** PCO, 3CO, and HGT could be applied to dystrophic NF1 patients. The 3CO is also associated with increased perioperative complications.

ID: AGS26/1811
P0148: Visual and vestibular anomalies in adolescent idiopathic scoliosis: a case-control study

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Introduction: Clinical observations in our unit have noted trunk decompensation and, in some cases, visual deviations in patients with adolescent idiopathic scoliosis (AIS). Previous studies have reported both visual anomalies, such as increased back surface abnormalities in children with visual deficiencies (Catanzariti, Jean F et al.,*Spine*, 2001), and vestibular anomalies, including asymmetric vestibular perception in AIS patients (Woo, Emma J et al., *Front Neurol*, 2019). Genetic analyses have also identified rare OTOP1 variants linked to subtle inner ear anomalies in AIS, and mouse models show that **OTOP1** loss causes vestibular defects, suggesting a potential role of vestibular dysfunction in scoliosis development (Sumalde, Angelo Augusto M et al., 2023, *Genes*; Tian, Lifeng et al., 2022, *Nat Commun*). Despite these findings, no studies have simultaneously assessed visual, vestibular, and postural factors in AIS. This study aims to fill that gap by analyzing their prevalence and potential correlations compared to a control group. **Material and Methods:** Prospective case-control study conducted in a tertiary pediatric hospital. Demographic data, family history of scoliosis and other clinical variables were collected. The vestibular evaluation included the Fukuda-Unterberger test and the Barany test. Visual function was analyzed using the cover test, cyclotorsion retinography, crossed ocular laterality, and MAIA microcampimetry. The KINDL questionnaire was also used to assess quality of life. **Results:** A total of 38 patients were included in the AIS group; the sex ratio was 34:4 (girls: boys) and the mean age 14.8 ± 1.32 years old. In the control group, 33 patients were included, with a sex ratio 30:3 and mean age of 14.2 ± 1.56 years old. Significant differences were found in family history of AIS ($p < 0.01$) and dyslexia ($p = 0.055$). Regarding the vestibular system, we did not find statistically significant differences in the Fakuda-Unterberger test ($p = 0.48$), but we did observe almost significant results in the Barany test ($p = 0.059$). In the visual system assessment, we found differences in the use of glasses (55.3% of AIS patients vs. 21.2% in the control group; $p = 0.003$). Regarding the cyclotorsion, in the AIS more patients presented incyclotorsion (26.3% vs. 12.5%) and excyclotorsion (21.1% vs. 6.2%) of the left eye ($p = 0.039$). However, only significant difference were found in the right eye macular integrity with the MAIA ($p = 0.04$). AIS patients reported lower KINDL ($p < 0.01$), specifically in well-being ($p = 0.01$), self-esteem ($p = 0.03$), and family ($p = 0.02$) domains. **Conclusion:** AIS patients exhibit a higher prevalence of visual and vestibular impairments, which can affect their posture and contribute to a reduced quality of life. These findings offer new insights into AIS etiopathology and suggest potential avenues for intervention.

ID: AGS26/1885
P0149: Re-evaluating the role of preoperative SSEP monitoring in low-risk idiopathic scoliosis patients

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Introduction: Corrective surgery for idiopathic scoliosis routinely incorporates the use of intraoperative neuromonitoring as standard practice to promptly detect and mitigate neurological deficits. Elective preoperative somatosensory-evoked potential (SSEP) testing in an outpatient setting prior to surgery is often conducted to establish baseline neurological function, which may be of particular benefit in high-risk patients. However, their value in low-risk patients with a normal MRI and clinical findings remains uncertain and may potentially introduce unnecessary costs and procedural delays. The aim of this study was therefore to evaluate the necessity of preoperative SSEP testing in low-risk idiopathic scoliosis patients, in order to optimise preoperative protocols,

efficiency, and resource utilisation. **Material and Methods:** This single-centre retrospective cohort study analysed idiopathic scoliosis patients undergoing corrective surgery between September 2019 and September 2024. All patients underwent a clinical examination, MRI and preoperative SSEP testing in an outpatient clinic setting. During surgery, intraoperative SSEP and motor-evoked potential (MEP) monitoring were utilised for every patient. Patients with abnormal or incomplete MRI scans or missing MRI reports were excluded. Correlations between preoperative SSEP findings and postoperative neurological outcomes were evaluated. **Results:** Of the 556 idiopathic scoliosis patients reviewed, 280 (50.4%, mean age: 17.4 ± 3.22 years) met the inclusion criteria. Exclusions were made due to unavailable MRI scans (n = 109), missing MRI reports (n = 77), and abnormal MRI findings (n = 89). One patient lacked preoperative SSEP data and was therefore excluded. Among the 280 included patients, 260 (92.9%) demonstrated reliable elective preoperative SSEP responses, while 22 (7.9%) had unreliable readings, comprising 17 with mild sensory responses and 5 with negative responses. Despite these unreliable readings, no postoperative neurological deficits were identified in any patient. Additionally, all 280 exhibited normal MEP following anaesthetization of the patient in the anaesthetic room. **Conclusion:** Based on the findings of this study, routine preoperative SSEP testing may be unnecessary in low-risk idiopathic scoliosis patients with normal neurological and MRI findings. In this cohort, no postoperative deficits were observed. Additionally, potential issues may be effectively identified through intraoperative monitoring. Hence, eliminating routine elective preoperative SSEP testing in these patients could streamline preoperative protocols and reduce costs without compromising safety.

ID: AGS26/1956
P0150: Novel insights in congenital scoliosis from the Paediatric Hospital "Aghia Sofia"

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Introduction: Congenital scoliosis is a rare but significant spinal deformity caused by anomalies in vertebral formation or segmentation during embryonic development. It affects approximately 1 in 10,000 children and presents unique management challenges due to its progressive nature and potential for associated anomalies. The primary causes include hemivertebrae (wedge-shaped vertebrae) and block vertebrae (fused vertebrae), resulting in spinal asymmetry and curvature. The severity of scoliosis is determined by the number, location, and type of vertebral anomalies, as well as their growth potential. Treatment strategies are individualized according to the progression of deformity, ranging from observation for mild and non-progressive curves to surgical interventions including in situ fusion, hemivertebra excision, or growth-friendly instrumentation for progressive or severe deformities. Early diagnosis and a multidisciplinary approach are crucial for effective management of congenital scoliosis, highlighting the importance of awareness and timely intervention in affected children. **Material and Methods:** We conducted a retrospective analysis of patients with congenital scoliosis treated at the "Aghia Sofia" Children's Hospital in Athens between 2017 and 2024. Medical records were reviewed for patient demographics, anatomical locations of anomalies, types of congenital vertebral malformations, surgical procedures performed, and clinical outcomes. All patients underwent comprehensive preoperative evaluation including radiographic assessment, MRI studies, and screening for associated anomalies. Surgical indications included progressive curves, significant cosmetic deformity, and risk of neurological compromise. Treatment strategies included posterior spinal fusion, hemivertebra excision, and growth-friendly instrumentation when appropriate. **Results:** Fourteen patients with complete data were identified (mean age 10.2 years, range 5.7-14.3 years) with equal gender distribution (50% female, 50% male). Hemivertebrae represented the most common anomaly (64.3%, n = 9), followed by congenital kyphosis (28.6%, n = 4). The thoracolumbar junction was the predominant location affected (92.9%, n = 13), with one case involving the isolated lumbar spine. Surgical management included posterior spinal fusion in all cases (100%), with hemivertebra excision performed in 50% of cases (n = 7). Growth-friendly instrumentation was utilized in one patient (7.1%) requiring staged management. One patient required revision surgery (7.1%) for extension of fusion. The most commonly affected levels for hemivertebrae were the thoracolumbar junction (T9-L5), with both thoracic and lumbar involvement observed. Associated congenital kyphosis was present in 28.6% of cases, predominantly at the thoracolumbar junction. No major perioperative complications were recorded, and all patients demonstrated satisfactory correction of spinal deformity at final follow-up. **Conclusion:** This series from a tertiary pediatric center demonstrates that congenital scoliosis predominantly affects the thoracolumbar junction, with hemivertebrae being the most common vertebral anomaly. Equal gender distribution was observed, contrasting with some literature reports of female predominance. Hemivertebra excision combined with posterior spinal fusion provided effective treatment in half of the cases, with excellent safety profiles and satisfactory deformity correction. The low revision rate and absence of major complications support the efficacy of individualized surgical management in pediatric congenital spine deformity. Early recognition and timely surgical intervention in progressive cases can achieve excellent clinical outcomes while preserving spinal growth and function. Our experience emphasizes the importance of specialized pediatric spine centers in managing these complex deformities and the need for long-term follow-up to monitor for potential complications and ensure optimal functional outcomes.

ID: AGS26/2313
P0151: Assessment of the use of tranexamic acid in the postoperative period in patients with scoliosis undergoing posterior spinal fusion

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Introduction: The posterior spinal fusion is the most commonly used surgical technique for the treatment of scoliosis in children and adolescents. However, the associated bleeding continues to be a challenge as intra or postoperative transfusions are linked to increased morbidity and mortality. Tranexamic acid has been employed intraoperatively in various surgeries, including scoliosis correction procedures. Therefore, the study aimed to evaluate the use of tranexamic acid in the postoperative period to reduce blood loss in patients undergoing surgical treatment for scoliosis correction. **Material and Methods:** A prospective, randomized, double-blind study was conducted on a cohort of 28 patients undergoing posterior spinal fusion for scoliosis treatment. The patients were divided into 2 groups based on the use or non-use of TXA (tranexamic acid) in the postoperative period: the control or SAT (without TXA) and the experimental or CAT (with TXA). Both groups received intravenous infusion of tranexamic acid at a dosage of 30 mg/kg during the surgical procedure. However, patients in the CAT group also received an additional dose of 10 mg/kg/h until removal of the suction drain, 48 hours post-procedure. The variables studied included demographic data (age, gender, weight, body mass index, and etiology of scoliosis), surgical factors (preoperative hemoglobin levels (g/dl), total surgery time (minutes), and amount of transfused blood products (ml)), and postoperative factors (total hospitalization time (days), amount of blood loss in suction drain per day (ml), total number of transfused blood bags, hemoglobin values (g/dl) on the 1st and 3rd days, and occurrence of postoperative complications). Statistical analysis was performed using R software version 4.02, and the comparison of means between groups was done using the Student's t-test or Wilcoxon test. The Chi-square test was used for categorical variables. **Results:** The results did not show a statistically significant difference regarding age, gender, etiology of scoliosis, Cobb angle value of the main scoliotic curve pre and post-operation, body weight, body mass index (BMI) between the SAT and CAT groups. Preoperative hemoglobin (Hb) ranged from 10.7 g/dl to 14.7 g/dl in the SAT group and from 11.1 g/dl to 16.2 g/dl in the CAT group. The total surgery time (minutes) was slightly longer in the CAT group (mean of 220.4 min) compared to the SAT group (mean of 182.5 min). However, the comparison of the results obtained was not statistically significant ($p = 0.1028$). Ultimately, the number of blood bags transfused in patients in each group did not show a statistically significant result ($p > 0.05$). Total blood loss (ml), total drain output (ml), total hospitalization time (days), Hb value on the first and third postoperative days, and the occurrence of complications also did not show a statistically significant difference between the groups. **Conclusion:** The intravenous administration of TXA in the 48 hours postoperative period of posterior spinal fusion surgeries for scoliosis correction in children and adolescents did not demonstrate a significant impact in reducing intraoperative bleeding rates and the need for blood transfusions.

ID: AGS26/2360
P0152: Examining the relationship between sleep quality, insomnia severity, and quality of life in adolescents with idiopathic scoliosis: a pilot study

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Introduction: Adolescent idiopathic scoliosis (AIS) is a three-dimensional structural deformity of the spine. AIS, one of the most common chronic musculoskeletal problems during adolescence, is significant in terms of its effects on sleep and quality of life. Sleep is a fundamental biological process that replenishes energy stores and facilitates physical and mental rest; chronic musculoskeletal disorders can negatively affect quality of life by leading to sleep deprivation. This pilot study aims to examine the relationships between sleep quality, insomnia severity, and quality of life in individuals with AIS. **Material and Methods:** This study included 12 individuals diagnosed with AIS (4 females, 33.3%; 8 males, 66.7%) with a Cobb angle of 10-45° who presented to the Central Hospital. The average age of participants was 16.00 ± 2.34 years, and the average body mass index (BMI) was 18.57 ± 2.24 kg/m^2. Quality of life was assessed using the Scoliosis Research Society-22 (SRS-22) questionnaire (function: SRS-1; pain: SRS-2; self-image: SRS-3; mental health: SRS-4; satisfaction with treatment: SRS-5). Insomnia severity was measured using the Insomnia Severity Index (ISI), and sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI); the

PSQI subscales are as follows: subjective sleep quality (PSQI-1), sleep latency (PSQI-2), sleep duration (PSQI-3), sleep efficiency (PSQI-4), sleep disturbance (PSQI-5), sleep medication use (PSQI-6), and daytime dysfunction (PSQI-7). Statistical analyses were performed using IBM SPSS 27.0 software. The relationships between the SRS-22, ISI, and PSQI scales were examined using bivariate correlation analysis with Spearman correlation coefficients. A significance level of $p < 0.05$ was accepted for all tests. **Results:** A strong and positive significant correlation was found between the ISI and PSQI total scores ($r = 0.78$; $p < 0.05$). At the subscale level, significant positive relationships were also found between ISI and PSQI-1 ($r = 0.60$), PSQI-4 ($r = 0.66$), and PSQI-5 ($r = 0.77$) ($p < 0.05$). On the other hand, a strong and negative significant correlation was observed between insomnia severity and the SRS total score ($r = -0.82$; $p < 0.05$). In the subscale analyses, significant negative correlations were determined between ISI and SRS-3 ($r = -0.78$), SRS-4 ($r = -0.84$), and SRS-5 ($r = -0.80$) ($p < 0.05$). Significant negative relationships were found between PSQI total and subscale scores and SRS-22 subscale and total scores ($r = -0.57$ to -0.75; $p < 0.05$). **Conclusion:** The findings indicate that an increase in insomnia severity is associated with a decrease in sleep quality. Specifically, as subjective sleep quality, sleep efficiency, and sleep disturbance parameters deteriorate, insomnia severity also increases. Increased insomnia severity is associated with a decline in individuals' quality of life; their self-image weakens, their mental health deteriorates, and their satisfaction with treatment decreases. Furthermore, while increases in PSQI scores in some subscales correspond to decreases in SRS scores, increases in SRS scores are associated with decreases in PSQI scores. In conclusion, increasing insomnia severity shows inverse relationships between PSQI and SRS scores, along with deteriorations in sleep quality and declines in quality of life.

ID: AGS26/2412
P0153: Restoration of thoracic kyphosis after AIS surgery

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Introduction: Restoration of the sagittal profile is a key task for achieving a stable result and improving the quality of life of patients with idiopathic scoliosis. Objective: To evaluate the achievement of target indicators of thoracic kyphosis in AIS surgery. **Material and Methods:** Retrospective analysis of AIS Lenke 1a ($n = 42$). Two groups of patients. Group 1: correction of deformity by standard rotation of the rod with enblock derotation. ($n = 22$). Group 2: correction by fixing the rod in the end screws and gradual translation on the rod. ($n = 20$). Lumbar lordosis, thoracic kyphosis before and after surgery and approaching the target indicators were assessed. **Results:** Thoracic kyphosis preop in group 1 was 14.5 [10.1-18.9], postop 14.5 [11.1-17.9], target 29 [25.4-32.6]. In the second group, respectively, preop 19 [14.1-23.9], postop 27.5 [25.5-29.5], target 31.5 [28.9-34.1]. Linear correlation showed that in the surgery performed in group 1, the thoracic kyphosis angle did not approach the target, while in group 2, the kyphosis angle indicators approached them. (Group 1 R^2 8.418e-006; $Y = 0.003034*X+30.46$; $p = 0.9898$. Group 2 R^2 0.5764; $Y=0.5846*X+7.787$; $p = 0.0001$). **Conclusion:** The use of some non-standard corrective maneuvers made it possible to bring the sagittal profile parameters closer to the target ones.

ID: AGS26/2484
P0154: Impact of curve severity and location on self-image and mental health in adolescent idiopathic scoliosis

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Introduction: Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity that can negatively affect physical and psychosocial well-being. The degree of spinal curvature, measured by the Cobb angle, may be associated with patient-reported quality of life. This study aimed to investigate the relationship between Cobb angle and Scoliosis Research Society-22 (SRS-22) questionnaire domains in non-surgical AIS patients. **Material and Methods:** A cross-sectional study was conducted among 120 AIS patients aged 10-18 years who had not undergone surgical treatment. Cobb angles were measured from standing posteroanterior spine radiographs by two independent spine specialists. Each patient completed the validated Thai version of the SRS-22 questionnaire, which assesses five domains: Function, Pain, Self-image, Mental Health, and Satisfaction. Pearson's correlation coefficients were used to examine the relationship between Cobb angle and SRS-22 domain scores. **Results:** The mean age of participants was 14.6 ± 2.1 years, with a mean Cobb angle of $34.2° \pm 10.8°$. The mean overall SRS-22 score was 3.8 ± 0.6. Cobb angle showed a significant negative correlation with the Self-image domain ($r = -0.48$, $p < 0.001$) and the Mental Health domain ($r = -0.31$, $p = 0.002$). Subgroup analysis revealed that patients with proximal thoracic curves reported the lowest scores in Self-image and Satisfaction (mean 3.2 ± 0.5), followed by those with thoracolumbar curves (mean 3.5 ± 0.6). Patients with main thoracic curves reported comparatively higher Self-image scores (mean 3.9 ± 0.5), indicating the least impact on appearance. No significant

correlation was observed between Cobb angle and Function (r = -0.12, p = 0.18) or Pain (r = -0.09, p = 0.26). **Conclusion:** Greater curve severity in AIS, as measured by Cobb angle, is associated with poorer self-image and mental health. Curve location also influences patient perception of appearance: proximal thoracic curves were associated with the greatest dissatisfaction, thoracolumbar curves with moderate dissatisfaction, and main thoracic curves with the least impact. These findings emphasize the importance of considering both radiographic severity and curve pattern when evaluating quality of life and counseling AIS patients.

ID: AGS26/2645
P0155: Precision without navigation: an innovative, squaring vertebra technique for safe pedicle screw instrumentation in scoliosis

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Introduction: The placement of pedicle screws in scoliosis correction relies heavily on either fluoroscopic navigation or complex intraoperative 3D navigation systems to mitigate the risks associated with altered spinal anatomy. While effective, these technologies present significant barriers, including high cost, increased radiation exposure, procedural complexity, and limited availability in resource-constrained settings. This study presents and evaluates the outcomes of a novel, structured technique designed to achieve a high degree of precision and safety in adolescent idiopathic scoliosis (AIS) without the use of any intraoperative navigation. **Material and Methods:** A prospective cohort study was conducted on 55 consecutive AIS patients who underwent posterior spinal fusion using the novel non-navigated technique. The technique is based on a meticulous step-by-step protocol utilizing consistent anatomical landmarks, specific entry points tailored to the deformed vertebrae, and a unique "graded probing" tactile feedback system to navigate dysmorphic pedicles. All screws were inserted using C-arm by making the each vertebra squared method. Postoperative precision was assessed objectively using a low-dose CT scan, with screw positions graded according to the established Gertzbein-Robbins classification system (Grade 0: within pedicle; Grade 3: >6mm breach). Major breaches (≥ Grade 2, >2mm) were considered clinically significant. Operative time, estimated blood loss, and any intraoperative or postoperative complications were also recorded. **Results:** On an average 16 pedicle screws were placed across each patients. Postoperative CT analysis revealed a High Percentage about 95.8% acceptable placement rate (Gertzbein-Robbins Grade 0 or 1). The rate of clinically significant breaches (Grade 2 or 3) was very Low Percentage about 2.1%, with no breaches resulting in neurological or vascular complications. The mean operative time was 240 minutes, and mean estimated blood loss was 150 ml. **Conclusion:** This innovative, structured C-arm based squaring vertebra technique demonstrates that a high degree of precision and safety in pedicle screw instrumentation for scoliosis surgery can be achieved reliably without navigation. The technique offers a viable, cost-effective alternative to navigated systems, potentially democratizing access to high-quality scoliosis care. Its reproducibility suggests it could serve as a valuable standard, particularly in settings where advanced technology is not available. Further comparative studies are warranted to validate these findings against current navigated standards.

Keywords: Scoliosis Surgery, Non-navigated, Cost-Effective, Squaring Vertebra.

ID: AGS26/2667
P0156: Halo-pelvic distraction as a bridge to definitive surgery in patients with severe kypho-scoliosis: experience from a lowresource setting

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Introduction: Halo-pelvic distraction (HPD) is a potential strategy for progressively reducing the magnitude of curves in patients with severe kypho-scoliosis (KS) and for optimizing care for patients waiting for definitive surgery. This study evaluates the effectiveness of HPD as a bridging intervention for patients with severe KS in environments with limited resources. **Methods:** A prospective study was conducted on 15 consecutive patients with severe, progressive KS who underwent preoperative HPD between 01/2024 and 08/2025. Cobb angle (CA), thoracic kyphosis (ThK), and T1-T12 height, were measured from standardized pre- and post-distraction radiographs. Clinical parameters, including weight and complications, were recorded. Paired t-tests were used for statistical analysis. **Results:** The study included 11 females and 4 males with severe, rigid KS and a mean age of 10 years 10 months (range, 9 - 14). Over a mean of 7 weeks (range, 37 - 79 days) of HPD, the mean thoracic CA decreased

by 37% (from 97° to 61°, $p < 0.001$) and ThK decreased by 34% (from 68° to 45°, $p < 0.001$). The T1-T12 height increased by an average of 5.0 cm (range 2.1 - 7.9). During HPD patients gained an average of 3 kg (range 1.5 - 7.5 kg), indicating improved nutritional status. Complications occurred in 3 out of 15 patients (20%): one case of transient sixth cranial nerve palsy and two pin site infections, all of which resolved conservatively. All patients were able to mobilize and care for themselves independently. Following HPD, 9 patients underwent posterior spinal fusion, and 6 underwent a growing rod construct. **Conclusion:** HPD appears to be an effective bridging strategy because it reduces curve magnitude and optimizes care for patients with severe KS who are awaiting definitive surgery. Additionally, the technique carries a low risk of complications, making it appealing in settings with limited resources.

Keywords: severe scoliosis, halo-pelvic distraction, delayed surgical care, resource limited settings, bridging therapy spinal deformity, waiting list management.

ID: AGS26/2710
P0157: Scoliosis development after neurosurgical surgery for chiari malformation type I or tethered cord syndrome: a retrospective study

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Introduction: The effectiveness of neurosurgical intervention to prevent scoliosis curve progression in patients with Chiari Malformation Type I (CM I) or tethered cord has been unclear. This study aims to increase knowledge of scoliosis development after neurosurgical intervention for CM I and tethered cord syndrome, with or without syringomyelia. **Material and Methods:** Retrospective single-center cohort study of 240 consecutive patients aged from 1 to 17 years, who underwent neurosurgery from 2014 and 2024. The main outcome was progress > 6 degrees, de novo scoliosis or the need for spinal fusion. Wilcoxon rank sum test was used to evaluate differences between treatments. Statistical significance was set at $p < 0.05$. **Results:** Two-hundred forty patients were identified, 57.5% were girls. The mean age at neurosurgery was 7.1 years. Seventy-seven patients were decompressed for CM I (32.1%) and 162 patients (67.5%) underwent detethering. Out of 240 patients, 10 (4.2%) had both CM I and tethered cord. Syringomyelia was presented in 71 patients (29.7%). Scoliosis was present in 58 patients (24.2%) prior to neurosurgical intervention, the majority (62.7%) being girls with a mean age of 10 years. Mean Cobb angle was 34.5^0 ($10\text{-}87^0$). After neurosurgical intervention, mean Cobb angle was 33.7^0 ($4\text{-}70^0$), ($p = 0.937$). Seven patients developed de novo scoliosis (2.9%) with a majority being boys (57.1%), where mean Cobb angle at follow-up was 16.1^0 ($6\text{-}38^0$). Seventeen patients (7.1%) underwent posterior spinal surgery after neurosurgery where 52.7% were girls. Mean Cobb prior neurosurgery was 49.8^0 ($24\text{-}87^0$) and reduced to 40.9^0 ($16\text{-}70^0$) after neurosurgery, however not significantly ($p = 0.201$). **Conclusion:** Our results indicate that scoliosis progression and de novo scoliosis after prophylactic neurosurgical intervention for CM 1 and tethered cord syndrome are prevalent. Prospective studies are warranted to further elucidate the prophylactic effect of neurosurgical intervention on scoliosis development.

ID: AGS26/2711
P0158: Impact of scoliosis surgery on breast asymmetry and trunk aesthetics in female patients

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Introduction: Surgical correction of Idiopathic Scoliosis affects body image, and there is growing evidence linking physical appearance to psychological well-being. The Truncal Anterior Asymmetry Scoliosis Questionnaire (TAASQ) was developed to document female patients' perceptions of their anterior trunk. This study aims to determine whether scoliosis surgery improves the appearance of the breasts and trunk asymmetry, as assessed by TAASQ, and identify factors that predict postoperative outcomes. We hypothesized that Surgical correction of scoliosis in female patients improves breasts symmetry and anterior trunk. Specific factors are predictive of satisfaction. **Material and Methods:** TAASQ responses from female IS patients who underwent surgery were reviewed. Mean Curve type, angular value, and hump measurements were analyzed. Mean pre-operative and 2 years post-operative differences in domain-specific and overall TAASQ scores were assessed using t-tests. **Results:** We reviewed the records of 218 patients, 148 of whom completed the TAASQ. The mean age at surgery was 15.2 ± 2.2 years. Mean curve values were 51° ± 15.1° (main thoracic), 49.2° ± 14.5° (thoracolumbar), and 35.1° ± 19.9° (proximal thoracic). The preoperative thoracic hump averaged 12.3° ± 5.5°, which improved to 6.5° ± 4.3° postoperatively, with a statistically significant difference. Preoperative overall TAASQ scores averaged 3.64 ± 0.68, rising to 4.13 ± 0.71 postoperatively ($p = 0.00$). Overall score being the sum of main domains divide by their number (3). Statistically significant improvements were observed across all TAASQ domains. **Conclusion:** Surgical

correction of scoliosis significantly improves the appearance of the breasts and anterior trunk in female IS patients, as assessed by the TAASQ. Pre- and postoperative factors can predict the likelihood of positive or negative outcomes, aiding in patient expectation management.

ID: AGS26/2726

P0159: Assessing the role of large language models in adolescent idiopathic scoliosis care: a comparison between ChatGPT and Google Gemini

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Introduction: The objective of this study is to evaluate the accuracy, applicability, comprehensiveness, and communication quality of responses generated by ChatGPT® and Google Gemini® in adolescent idiopathic scoliosis (AIS)-related scenarios, with the aim of assessing their potential utility as tools in patient management. **Material and Methods:** Six case-based questions reflecting common patient concerns related to adolescent idiopathic scoliosis were developed by orthopedic specialists. Responses generated by ChatGPT and Google Gemini were independently evaluated by 61 orthopedic surgeons using a standardized rubric assessing accuracy, applicability, comprehensiveness, and communication clarity, each rated on a 1-5 Likert scale. Comparative analyses between platforms were performed using the Mann-Whitney U and Wilcoxon Signed Rank tests. Additionally, open-ended feedback was collected to explore participants' perspectives on the potential and limitations of AI-based consultations. **Results:** ChatGPT outperformed Google Gemini in terms of accuracy ($p = 0.013$) in post-operative care scenarios. The results for applicability ($p = 0.119$), comprehensiveness ($p = 0.619$), and communication ($p = 0.240$) were not statistically significant. Orthopedic specialists rated both AI models significantly higher than residents in accuracy, applicability, and comprehensiveness. Most evaluators acknowledged the potential of AI to reduce physician workload and support patient guidance; however, concerns were raised regarding reliability, ethical implications, and the current limitations of AI in ensuring patient safety. **Conclusion:** ChatGPT® and Google Gemini® demonstrated moderate accuracy and communication quality in adolescent idiopathic scoliosis-related scenarios, with ChatGPT showing a modest advantage. Although both models show promising results as supportive tools for patient education and preliminary consultations, their current limitations in accuracy and comprehensiveness restrict their clinical reliability. Multidisciplinary collaboration is crucial to ensure effective applications of AI in orthopedic practice.

ID: AGS26/2797

P0160: Cardiopulmonary consequences of scoliosis and the role of VO_2 max in surgical recovery: a systematic review

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Introduction: Scoliosis alters thoracic anatomy, potentially impairing respiratory and exercise physiology. While pulmonary function tests (PFTs) are commonly assessed, they may not fully reflect the physiological burden of deformity. A range of parameters, including VO_2 max, ventilatory efficiency, lung volumes, and submaximal exercise tolerance, have been studied, but their trajectories with scoliosis progression remain unclear. **Materials and Methods:** We systematically searched PubMed, Embase, and Cochrane for studies reporting cardiopulmonary outcomes in paediatric scoliosis. Eligible studies included patients $\leq$ 18 years assessed with CPET, PFTs, or functional exercise testing. Outcomes extracted included VO_2 max, lung volumes, flow measures, and exercise tolerance. Due to heterogeneity in methods and outcomes, results were synthesised narratively following PRISMA guidance. **Results:** Across cohorts of the included studies, scoliosis severity correlated with declines in multiple functional domains. VO_2 max was reduced to as low as 28-34% of predicted despite preserved spirometry, with congenital scoliosis showing an inverse relationship between thoracic kyphosis and VO_2 max. Lung volumes and flows declined incrementally with curve progression, with meta-regression showing ~1% reduction in pulmonary function for every 2.6-2.9° increase in Cobb angle**.** Functional tests such as the six-minute walk correlated strongly with CPET-derived VO_2 max ($r = 0.431$, $p < 0.001$). Adolescents with scoliosis also demonstrated higher oxygen cost and lower ventilatory reserve during exercise compared with controls. Long-term follow-up after posterior spinal fusion revealed little evidence of sustained pulmonary recovery. **Conclusion:** A spectrum of cardiopulmonary parameters deteriorates with scoliosis progression. VO_2 max may provide the most integrative marker of physiological

burden, but prospective longitudinal data are required to establish its role in recovery after surgery.

ID: AGS26/2818
P0161: Impact of surgical waiting time on scoliosis severity and postoperative outcomes

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Introduction: The GES (Explicit Health Guarantees) system in Chile mandates timely treatment for scoliosis within 270 days; if unmet, patients must be referred to a secondary provider. Despite this coordinated approach, the public healthcare system-responsible for over three-quarters of the population-faces resource constraints, resulting in persistent waiting lists. In practice, there are often significant delays between GES activation and surgical intervention. Limited data exist on the impact of these delays on scoliosis severity and postoperative complications, and their clinical consequences have not yet been evaluated in our setting. **Material and Methods:** We conducted a retrospective observational study of patients who underwent surgery between 2016 and 2025 after being referred to our center as a secondary provider under FONASA (Chile's national public health insurance). Demographic data, notification and surgery dates, perioperative details, and complications were recorded. Preoperative and postoperative radiographic data were also analyzed. **Results:** A total of 203 patients were included (74.9% female), with a median age of 15 years (range: 4-26). The median waiting time was 413 days, with a maximum of 4,533 days (~12 years). The median preoperative curve magnitude was 56.2° (range: 8.0°-141.3°), with 14.3% of patients presenting with curves > 80°. Patients with curves > 80° experienced significantly longer waiting times (546 vs. 411 days; $p = 0.0431$). Male patients also had longer delays (551 vs. 401.5 days; $p = 0.0118$). The overall rate of unplanned reoperations was 8.8%, with no significant difference between those who waited longer than the median ($p = 0.0629$). **Conclusion:** Prolonged waiting times were associated with more severe spinal deformities, especially in patients with curves exceeding 80°. This may reflect either disease progression during the delay or greater barriers to surgical access for complex cases. Although complications such as reoperations did not significantly differ based on wait time, the trend suggests a potential clinical impact. These findings highlight that delayed surgical access under the GES framework may contribute to deformity progression. Reducing waiting times could improve clinical outcomes and reduce surgical complexity.

ID: AGS26/2891
P0162: Giant neurofibroma associated with severe kyphoscoliosis in a type I NF-I adolescent patient, surgical management: case report

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Introduction: Neurofibromatosis can be classified as type I (NF-I) and type II according to its clinical. Type I is associated with severe Kyphoscoliosis, which severe deformities, wedging, rotation, vertebral subluxation, penciling of ribs, enlargement of nerve root canal and pedicle defects as well of gigantic neurofibromas is a very challenging for the surgical spine team. Treatment involves a multidisciplinary team, staged surgeries with high risk neurological complications. **Material and Methods:** Case report in a fifteen-year old male, diagnosed with NF-I with a giant intramedullary neurofibroma associated with severe kyphoscoliosis in two-stage surgery. First stage surgery, previous surgery, selective embolectomy was performed to reduce bleeding. Careful dissection and posterior removal of the giant neurofibroma, transpedicular screw placement and an internal distraction rod. Second-stage kyphoscoliosis definitive correction via type 2 osteotomies. Posterior management of a postoperative deep wound infection with drainage, removal of bone grafts, and negative pressure systems were used to control E. Coli infection. IV antibiotic therapy was given and a cervicothoracic orthosis was used for protection. **Results:** A two-stage surgical procedure for the giant neurofibroma associated with kyphoscoliosis was performed. No neurological deficit was found in either procedure. Despite deep wound infection, removal of bone graft, adequate arthrodesis was achieved after 6 months and no recurrence of the neurofibroma. **Conclusion:** Severe spine deformities such as kyphoscoliosis in NF-I is still a challenge for spine surgeons. Giant neurofibromas can make it even difficult to approach, the use of embolization, temporary distraction rod and spine osteotomies are a safe way to achieve greater correction an minimize neurological impairment.

ID: AGS26/2904
P0163: The role of COL11A2 in pathogenesis and diagnosis of scoliosis: case report

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Introduction: Scoliosis is a complex spinal deformity with multifactorial etiology involving genetic, environmental, and biomechanical factors. Increasing evidence highlights the role of collagen-related genes, particularly *COL11A2*, which encodes type XI collagen, crucial for extracellular matrix integrity. Mutations in *COL11A2* have been implicated in skeletal dysplasias and may contribute to scoliosis pathogenesis. This study aimed to investigate potential *genetic* variants in two pairs of twins from different families who underwent different treatment strategies. **Material and Methods:** This retrospective study included two families, each consisting of twin sisters with scoliosis. Clinical diagnoses were established through physical and radiological examination. In Family 1, both twins underwent posterior instrumented spinal fusion. In Family 2, one twin underwent surgery, while the other was treated conservatively with a thoracolumbosacral orthosis (TLSO). All participants were subsequently referred for genetic evaluation. Genomic DNA was extracted from peripheral venous blood samples and sequenced using Twist Exome 2.0 (Twist Bioscience, USA) kits on a NextSeq1500 platform (Ilumina, USA). Reads were processed with Ilyome (Ilyome, Turkey), aligned to GRCh38, and variants called to VCF files. Variant classification followed ACMG and ACGS guidelines. Written informed consent was obtained from all participants. **Results:** In Family 1, both affected twin sisters were identified to carry a heterozygous *COL11A2:c.4705C>G* variant, classified as a variant of uncertain significance (VUS) with criteria PM2 and PP3. Both underwent posterior spinal fusion for scoliosis. In Family 2, two affected twin sisters carried a heterozygous *COL11A2:c.2464A>T* variant, also classified as a VUS (PM2). One twin underwent surgery, while the other was managed conservatively. No other pathogenic or likely pathogenic variants relevant to scoliosis were detected. In both families, the variants were consistently present in affected individuals. **Conclusion:** *COL11A2* is a gene associated with the extracellular matrix and plays a physiological role in spine formation. Besides the multifactorial and polygenic background of scoliosis, previous studies have highlighted that musculoskeletal collagen genes, such as *COL11A2*, occupy a critical place within this polygenic framework. In line with the literature reporting that rare variants in *COL11A2* may be implicated in the etiology of scoliosis, our study identified rare variants in this gene in four affected individuals from two unrelated families. These results may suggest the potential value of larger-scale genetic studies to clarify the role of collagen-related genes in the complex molecular architecture of scoliosis. Integration of genetic screening into clinical practice may enable earlier diagnosis, risk stratification, and personalized management strategies for scoliosis patients.

ID: AGS26/2946
P0164: Determining the lowest instrumented vertebra (LIV) in selective thoracic fusion: a comparative analysis of radiographic criteria to prevent coronal decompensation

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Introduction: Selective thoracic fusion for adolescent idiopathic scoliosis (AIS) aims to correct the main curve while preserving the maximum number of lumbar mobile segments. The primary challenge lies in selecting the lowest instrumented vertebra (LIV) to avoid postoperative coronal decompensation. This study evaluates the impact of LIV selection based on different radiographic criteria on mid-term coronal balance. **Materials and Methods:** This multicenter retrospective study included 150 patients with Lenke 1 AIS who underwent selective thoracic fusion with a minimum 3-year follow-up. Patients were divided into two groups based on the LIV selection criterion: Group A (n = 78), where the LIV was the stable vertebra, and Group B (n = 72), where the LIV was the end vertebra. Analysis focused on curve correction, spontaneous lumbar curve correction, and coronal balance (C7-CSVL distance). Coronal decompensation was defined as a C7-CSVL distance > 2 cm. **Results:** Thoracic curve correction was comparable between the two groups (68% vs 70%, p = 0.67). Spontaneous lumbar curve correction was also similar. However, the rate of coronal decompensation at 3 years was significantly lower in Group A (LIV = Stable Vertebra) than in Group B (LIV = End Vertebra): 3.8% versus 19.4% (p = 0.002). An average of 0.8 fewer lumbar levels were instrumented in Group B, but this difference did not have a significant impact on SRS-22 functional scores (p = 0.31). **Conclusion:** In selective thoracic fusion for Lenke 1 AIS, selecting the stable vertebra as the lowest instrumented vertebra drastically reduces the risk of coronal decompensation at mid-term follow-up, without compromising overall functional outcomes. Although this strategy may involve extending the fusion by one level, it ensures better postoperative alignment and should be considered the gold standard to minimize balance-related complications.

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P0165: Comprehensive review of surgical kyphectomy techniques for gibbus deformity in myelomeningocele: a systematic review

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Introduction: Gibbus deformity describes a significantly pronounced structural kyphosis of the spine resulting from the anterior collapse of vertebrae. While the indication for surgery is typically kyphosis > 70°, in severe cases of myelomeningocele, the apex of deformity may reach nearly 180°. Due to the severity of curvature and poor prognosis without surgery, multiple techniques have been proposed in the literature to tackle extreme curve correction in young children and adolescents. The goal of this systematic review is to describe various kyphectomy techniques, including vertebral column fixation, pelvic fixation, and growth-friendly construct implementation. **Material and Methods:** A systematic literature review was performed on **s**tudies reporting surgical details in the treatment of Gibbus deformity (Cobb > 70°) with kyphectomy and instrumentation in patients with myelomeningocele. Surgical techniques were categorized as vertebral column fixation, pelvic fixation, or growth-friendly constructs. Studies reporting only cases with traditional methods, including posterior instrumentation with pedicle screws, sublaminar wires, hooks, and sacroiliac screws, were excluded. Indications, clinical reasoning, and notable surgical details associated with each method were summarized. Additional data on the number of study participants, the ages of patients, and the country of origin were collected. **Results:** A total of 37 studies meeting the inclusion criteria were identified, representing 18 countries. Patients' age ranged between 23 months and 16 years and study size ranged from 1 to 59 patients. Fifteen studies reported alternative vertebral column fixation techniques. These included combined anterior + posterior fixation (3 studies), titanium cage placement (2), lag screw fixation (2), plating vertebra with ACDF plates (2) or dynamic compression plates (1), Illizarov constructs (1), Steinmann nails (1), and tibial strut grafting (1). Alternative pelvic fixation methods were described in 17 studies. The Warner-Fackler method (curved rod passed anteriorly through the S1 foramen) was most common (11 studies), followed by the Dunn-McCarthy technique (curved rod over the sacral ala; 6), Luque-Galveston technique (curved rod impacted laterally into the iliac wings; 3), and trans-lumbosacral rod impaction (2). Mayfield technique (double square-holed hooks placed on sacral ala), Roger-Jackson intrasacral distal rod insertion, and use of an "ACM plate" (curved hook impacted through three vertebral bodies and secured proximally with pedicle screws) were each described in 1 study. Eleven studies focused on growth-preserving fixation strategies for skeletally immature patients. Sliding growing rods with pedicle screws were the most common approach, featured in 9 studies. Dual rib-to-iliac growing rods were used in 2 studies. Both the Luque trolley system and magnetically controlled growing rods were described in a single study each. **Conclusion:** Patients with Gibbus deformity present multiple surgical challenges with respect to methods of construct fixation and stabilization in the setting of severe kyphosis, particularly in skeletally immature patients. No standard of care has been established, and many surgeons have adopted novel and alternative techniques in the setting of extreme curve correction. This review provides a comprehensive summary of surgical kyphectomy techniques for Gibbus deformity in myelomeningocele.

ID: AGS26/2999
P0166: Building a VBT team & performing the first case

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Introduction: Vertebral body tethering (VBT) offers a non-fusion, motion-preserving surgical option for adolescent idiopathic scoliosis (AIS). While widely practiced in select international centers, VBT had not been established in Malaysia due to regulatory, institutional, and team-related challenges. This study describes the stepwise journey of developing a local VBT program, adapting a surgeon-led model, and successfully performing the country's first VBT case. **Material and Methods:** Following fellowship training and exposure to mature VBT teams abroad, a systematic strategy was undertaken to build local capacity. Steps included regulatory approval, collaboration with implant providers, participation in regional training (Singapore National University Hospital), and structured team education using simulations and sawbone models. A streamlined workflow was adapted for Malaysia, emphasizing a spine-surgeon-led approach without dedicated thoracic or vascular surgeons. The first AIS patient was carefully selected (Lenke 1, Risser 0, flexible curve). Surgical planning, intraoperative workflow, and postoperative protocols were standardized. **Results:** The inaugural case was performed on November 30, 2024. Key intraoperative strategies included thoracoscopic access, controlled tether tensioning, and optimized fluoroscopy use. Postoperative recovery was uneventful, with early mobilization and chest tube removal by day 2. At 6 months follow-up, correction was maintained (40° to 16°). To date, 11 VBT cases have been successfully completed nationwide, including 2 double-sided and 1 hybrid VBT, supported by a traveling multidisciplinary team. **Conclusion:** The successful establishment of Malaysia's first VBT program demonstrates that with structured planning, targeted training, and adaptive team models, it is feasible to overcome regulatory and institutional barriers. A surgeon-led approach provides a practical framework for centers without thoracic or vascular surgery support. This milestone paves the way for broader regional adoption of motion-preserving scoliosis surgery.

ID: AGS26/3024
P0167: S1 vertebral bone quality score independently predicts proximal junctional kyphosis after posterior hemivertebra resection with transpedicular instrumentation

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Introduction: Proximal junctional kyphosis (PJK) is a prevalent postoperative complication after posterior hemivertebra (HV) resection. Previous research has demonstrated a strong correlation between the development of PJK and reduced bone mineral density. The vertebral bone quality (VBQ) score, derived from magnetic resonance imaging, is considered a predictive and evaluative tool for bone mineral density. However, obtaining accurate magnetic resonance imaging signal intensity at the L1-L4 vertebrae is challenging in patients with HV. Consequently, a novel S1 VBQ score has been proposed, which exhibits high accuracy. This study aimed to evaluate the efficacy of S1 VBQ scores in predicting the incidence of PJK in these patients. **Material and Methods:** We conducted a retrospective analysis of patients diagnosed with HV who underwent posterior HV resection with transpedicular instrumentation at our department from 2010 to 2020. Comprehensive demographic and radiographic data were collected. To identify potential preoperative risk factors for the incidence of PJK, we utilized the least absolute shrinkage and selection operator method. Subsequently, a multivariate logistic regression model was constructed to evaluate the risk factors identified through the least absolute shrinkage and selection operator analysis. Cutoff values were determined through receiver operating characteristic analysis to assess the predictive value of the S1 VBQ score for PJK. **Results:** A total of 88 patients met the inclusion criteria, with 14 patients (15.9%) developing PJK. Five potential risk factors were selected, including S1 VBQ scores, Risser sign, thoracic kyphosis, pelvic tilt, and proximal junctional angle. The multivariate logistic regression model demonstrated that the S1 VBQ score is an independent risk factor for predicting PJK. The area under the receiver operating characteristic curve (area under the curve) for S1 VBQ scores was 0.770 with an optimal threshold of 2.793 (sensitivity: 78.6%, specificity: 67.6%). **Conclusion:** A higher S1 VBQ score is an independent risk factor for PJK, with a diagnostic accuracy of 77%. The S1 VBQ threshold of 2.793 was found to be effective in identifying PJK.

ID: AGS26/3060
P0168: Staged correction of severe kyphosis using modified halopelvic Ilizarov assembly and definitive surgery

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Introduction: Severe kyphotic deformities of spine pose significant surgical and functional challenges to orthopedic surgeons due to compromised pulmonary function, neurological risk, and technical difficulty during surgery. The halopelvic device, though historically underutilized, offers a powerful means of gradual, controlled preoperative correction by applying sustained distraction forces across the deformity. While we have previously reported successful outcomes in patients with kyphoscoliosis managed with our modified Ilizarov halopelvic distraction device presurgical, limited evidence exists regarding its role in isolated severe kyphotic deformities. The current study presents series of our patients with severe thoracic kyphosis who underwent corrections prior to definitive surgery through our modified Ilizarov halopelvic assembly demonstrating significant radiological and functional improvements. **Material and Methods:** Patients with severe thoracic kyphosis were managed preoperatively using a modified halopelvic Ilizarov distraction assembly. Detailed clinical evaluation, including pulmonary function testing, was performed, and full-length scoliosis series radiographs were obtained to assess thoracic kyphosis along with spinopelvic parameters prior to assembly application and during two-year follow-up. The modified Ilizarov construct consisted of a pelvic component and a halo ring, with distraction applied at a rate of 2-3 mm/day over 6-12 weeks. Radiographic measurements of kyphotic angle and spinopelvic parameters were compared before distraction, after distraction, and following definitive surgical correction. **Results:** Total of 30 patients with average age & BMI of 14.3 ± 8.5 years & 20.5 ± 8.5kg/m^2 were included in the study after informed consent and ethical approval of the institution. Mean ± SD of kyphosis was 97.7 ± 25.4. Correction obtained through modified halopelvic assembly before surgery was almost 32% ($p = 0.001$) with improvement in height ($p = 0.003$). Apical vertebral translation was also improved significantly ($p < 0.05$). Further improvement in all the parameters was obtained after definitive surgery with improvement in FEV1 & FVC. **Conclusion:** The modified halopelvic assembly provided significant preoperative correction of severe kyphosis, improving both sagittal alignment and patient height, with additional enhancement of apical vertebral translation. Definitive surgery further augmented these corrections and was associated with measurable improvement in pulmonary function (FEV_1 and FVC). These findings highlight the effectiveness of a staged approach using halopelvic distraction followed by surgery in achieving substantial deformity correction and functional gains in patients with severe kyphotic deformities.

ID: AGS26/638
P0169: Posterior angular correction method with limited apical fusion and fusionless posterolateral vertebral tethering can reduce the number of levels fused and preserve lumbar range of motion in posterior pediatric scoliosis surgery

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Introduction: In standard posterior pediatric scoliosis surgery, spinal fusion is usually done with fixation placed above, through and below the structural curve(s) resulting in the fusion of disc

levels outside of the structural curves. i.e., non-structural disc levels (nSDL), that are flexible and often correct completely with side bending (SB). A posterior angular correction (PAC) surgical method with limited apical fusion and fusionless posterolateral vertebral tethering (PLVT) of nSDL can reduce the number of levels fused and save range of motion (ROM), especially in the lumbar spine. **Materials and Methods:** The PAC method is based on the observation that posterolateral compression of rods placed transversely into the pedicle screw tulips of the same vertebra in adjoining vertebrae can change the adjoining disc angle. Tulips of a dual tulip iliac connector line up longitudinally when the connector is placed transversely in the pedicle screw tulips of the same vertebra and capture the angular correction for fusion. The angular correction can also be captured with polyethylene terephthalate or sublaminar bands placed through the closed heads of iliac connectors placed transversely for PLVT. After IRB approval, we prospectively collected the results for the first 31 patients treated using the PAC method (avg 42.3 mo., min. 36). The number of levels fused for each patient is compared to matched historical standard posterior fusion control (MHC). Radiographic measurements from 3-mo. and final f/u assess for adding on phenomenon (AO) and SB xrays at pre-op and at f/u determine the T12L5 SBROM. SRS 22r was scored pre-op and at each f/u. Statistical analysis done with the t-test. **Results:** Three patients were lost to follow up, leaving 28 patients (2 Lenke 1A, 1 1B, 3 1C, 4 2A, 1 2B, 2 2C, 3 3C, 2 4C, 6 5C and 4 6C curves). Avg age was 15.9 +/- 2.3 yrs, pre-op main curve was 56o+/-10o, and post-op main curve was 19.9o+/-12o for avg correction of 64%. The number of levels fused (avg 5.1+/-1.9) was less than in the MHC (avg 11.1+/-1.9) (p<.0001). Pre-op (32.5 o +/- 11.6 o) and post-op (36.8 o +/- 13.4 o) SB ROM were similar (p=.25). Lowest fused vertebra (LFV) was usually the superior vertebra of the nSDL as determined by SB xrays. Lowest instrumented vertebra (LIV) was generally the last substantially touched vertebra by the central sacral vertical line and the disc levels between LFV and LIV were treated with fusionless PLVT. There were two complications. In one, bilateral pedicle screws at the LFV were found to be broken with intact screws below. At 4-year f/u, the deformity correction did not change significantly, and revision surgery has been deferred. In the second, AO was seen when LFV was one level proximal to the superior vertebra of the nSDL. SRS-22r score at final f/u was 4.5/5 and pre-op was 4.0/5 (p<.001). **Conclusion:** The PAC method with limited apical fusion of SDL and PLVT of nSDL appears to be safe and results in significantly fewer levels fused compared to MHC and preserves lumbar SB ROM in AIS with diverse Lenke classifications.

ID: AGS26/3088
P0170: From high risk to safer outcomes: halo-pelvic traction vs. direct fusion in rigid kyphoscoliosis

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Introduction: Severe & rigid kyphoscoliotic deformities present major surgical challenges due to their stiffness, pulmonary compromise, and high risk of neurologic injury. Halo-pelvic traction (HPT) offers a gradual, staged correction strategy that can reduce curve rigidity, improve sagittal and coronal alignment, and potentially enhance surgical safety. Our modified halopelvic Ilizarov distraction device has achieved promising results in correcting severe spinal deformities without significant risk to neurology with fewer complications and good patient compliance. The current study compares radiological, surgical, and clinical outcomes between staged HPT followed by definitive fusion and direct fusion-only surgery in adolescents with severe kyphoscoliosis. **Material and Methods:** Patients diagnosed with severe (> 85° Cobb angle) adolescent idiopathic kyphoscoliosis were included in the study after institution ethical approval. Patients were divided into two groups: HPT Group underwent 6 weeks of HPT followed by final fusion, while non-HPT Group underwent direct fusion without modified halopelvic traction. Radiological parameters including AP cobb and lateral angles, fulcrum view angles, osteotomy types, surgical time, intraoperative neuromonitoring signals, and postoperative complications were analyzed. **Results:** A total of 68 patients were included (36 HPT, 32 non-HPT). Mean age was higher in the HPT group (15.58 ± 1.13 vs. 14.34 ± 1.04 years, $p < 0.001$), with 50% males compared to 31.2% in non-HPT group. Severe curves (Cobb's > 100°) were more frequent in HPT group (75% vs. 18.8%). Preoperative deformity was greater in HPT group (AP Cobb 112.19° vs. 92.69°, $p < 0.001$; lateral Cobb 82.22° vs. 48.44°, $p < 0.001$; fulcrum angle 89.11° vs. 65.84°, $p < 0.001$). Postoperatively, AP Cobb correction was 75.2% (29.2°) in HPT group vs. 66.2% (38.0°) in non-HPT group, while sagittal plane correction was significantly superior in HPT group (69.97% vs. 49.97%, $p = 0.002$). Coronal correction was comparable (67.13% vs. 72.56%, $p = 0.054$). In curves < 100°, both groups achieved similar correction. No neuromonitoring signal loss occurred in HPT group, whereas three events occurred in non-HPT group (two recovered intraoperatively). One postoperative mortality due to pulmonary complications was reported in non-HPT group. Mean surgical time was shorter in HPT group (366 vs. 414 minutes). Osteotomy distribution showed fewer high-grade osteotomies in HPT group (Type 3-4 in 2 patients) versus non-HPT group (4 patients), despite greater deformity severity. **Conclusion:** For large, rigid adolescent kyphoscoliotic deformities, a staged approach with halo-pelvic traction prior to fusion achieves superior sagittal plane correction, reduces the need for high-grade osteotomies, ensures safer neuromonitoring, and facilitates more efficient surgery even in more severe curves. Fusion-only surgery, by contrast, carries higher neurologic risks and demands more invasive corrective techniques.

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P0171: Return to sport after posterior spinal fusion in adolescent idiopathic scoliosis: a retrospective analysis and literature review

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Introduction: Adolescent idiopathic scoliosis (AIS) is the most common structural spinal deformity in young patients. Surgical treatment with posterior spinal fusion using pedicle screws allows deformity correction while preserving as much motion as possible. One of the main concerns of patients and their families is the return to physical activity after surgery. However, there are no clear guidelines and limited evidence regarding the appropriate timing and the expected level of participation after surgery. **Material and Methods:** A retrospective, cross-sectional observational study was conducted. Patients diagnosed with AIS who underwent posterior spinal fusion between 2014 and 2023, with a minimum follow-up of 2 years, were included. Clinical and surgical data, as well as return to physical and school activities, were analyzed through surveys and medical record review. **Results:** A total of 25 patients were included, with a mean age of 14 years. All underwent surgery with pedicle screws. Preoperatively, 84% engaged in physical activity, and 96% resumed sports after surgery. The mean time to return was 9.28 months. Fifty-six percent changed discipline, mostly by personal choice. No significant differences were found in frequency or competitive level before and after surgery. No associations were found between fusion levels, upper or lower instrumented vertebra, and return to sports. All patients resumed school/work activities, with a mean time of 6.16 weeks. **Conclusion:** Return to physical and school activities after posterior spinal fusion for AIS is high. No surgical factors were identified as determinants. Larger studies with longer follow-up are required.

ID: AGS26/3189

P0172: Recurrent dorsal spinal arachnoid cyst in a 13-year-old patient: case report and surgical management

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Introduction: Spinal arachnoid cysts are rare lesions, particularly in the pediatric population. They may cause progressive neurological deficits due to spinal cord compression. Recurrence after surgical excision is uncommon but poses a significant therapeutic challenge. We report the case of a 13-year-old boy with a recurrent dorsal arachnoid cyst successfully managed by re-operation. **Material and Methods:** A 13-year-old male with no past medical history presented with progressive gait disturbance and bilateral lower limb weakness evolving over 2 months. Neurological examination revealed paraparesis (3-/5 on the left, 3+/5 on the right), pyramidal signs, but no sensory level or sphincter dysfunction. Spinal MRI demonstrated a posterior dorsal extradural cystic lesion extending from D5 to T12, isointense to cerebrospinal fluid and without contrast enhancement, displacing the spinal cord anteriorly. The patient underwent laminectomy and complete excision of the arachnoid cyst, confirmed histologically. **Results:** Postoperatively, the patient experienced partial neurological improvement but persistent lower limb pain and left L5 weakness (2/5). At 14-month follow-up, gait had improved but new urinary leakage episodes were reported. Neurological examination revealed spastic paraparesis with brisk reflexes, bilateral Babinski sign, and no sensory level. MRI confirmed recurrence of the cyst at the same location. The patient underwent re-operation via the previous dorsal midline approach. Intraoperatively, a large cystic cavity was found with two dural defects (median and left lateral). Both foramina were closed with 4-0 sutures reinforced with aponeurotic grafts, achieving watertight closure. Postoperative recovery was uneventful, and at 1-month follow-up the patient was asymptomatic with complete resolution of symptoms. **Conclusion:** Spinal arachnoid cysts in children are rare but should be considered in cases of progressive spastic paraparesis. While surgical excision usually provides good outcomes, recurrence may occur due to dural defects. Meticulous identification and closure of dural communications are essential to prevent recurrence. Our case highlights the importance of long-term follow-up and tailored surgical strategy in managing pediatric spinal arachnoid cysts.

ID: AGS26/3235

P0173: Surgical management of diastematomyelia: a bicentric retrospective study of 13 cases over 10 years

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Introduction: Diastematomyelia is a very rare malformation, accounting for 3.8% of congenital spinal anomalies, with a prevalence of approximately 1 in 5,000 live births (0.02%). **Material and Methods:** We conducted a retrospective bicentric study including all patients who underwent surgical treatment for diastematomyelia over a 10-year period in two neurosurgery departments in Tunisia. Clinical, radiological, surgical, and postoperative data were analyzed. **Results:** Thirteen patients were identified, including 9 children and 4 adults, with a mean age of 6 years in children and 58 years in adults. The sex ratio was 0.44. Clinical manifestations included scoliosis (7 cases), motor deficits

(7), cutaneous stigmata such as a hair tuft (6, including 4 with hair tuft), urinary disturbances (4), and spinal or radicular pain (4). MRI and CT imaging were performed in all cases, revealing 10 type I and 3 type II diastematomyelia. Associated dysraphic anomalies were present in 10 patients. Postoperative complications were observed in 4 cases: intraoperative hemorrhage with anemia (1), cerebrospinal fluid leak (1), wound infection (1), and transient motor deficit (1). Neurological outcomes were favorable, with motor deficits and pain improving in all patients; two patients achieved complete motor recovery, while sphincter dysfunction improved in only one case. **Conclusion:** Diastematomyelia, or split cord malformation, is a rare form of occult spinal dysraphism. Diagnosis is often suggested by cutaneous markers and neuro-orthopedic manifestations. Surgery remains the treatment of choice, aiming to prevent irreversible neurological sequelae and improve functional outcomes.

ID: AGS26/3456

P0174: Case report and scoping review in the management of congenital scoliosis and derived surgical complications

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Introduction: The surgical management of congenital scoliosis includes a wide variety of procedures depending on the subtype, age, and characteristics of the deformity. Associated complications can range from infection of the surgical site, mechanical complications, material complications to neurological complications, and others. They can occur in combination or in isolation, with varying degrees of severity, or can be either perioperative or postoperative. The literature covering this topic is usually reserved to individual experiences managing these complications. Currently, the management of these patients poses a challenge for the spine surgeon. **Material and Methods:** This is a case presentation of a 13-year-old patient. Previously diagnosed with congenital scoliosis. She had a history of multiple surgical and non-surgical procedures, including cast application, bracing, lengthening system application, and subsequent associated surgical procedures. Posterior fixation resulted in infection as an associated complication requiring hardware removal and follow-up, developing a severe kyphotic deformity. Due to the challenges experienced with this case, a scoping review was done trying to summarize what the literature offers to the spine surgeon regarding the different management approaches to resolve this type of complications (centered around congenital scoliosis). **Results:** The patient underwent multilevel posterior instrumentation associated whit osteotomies and vertebrectomy (for severe kyphoscoliosis) in two surgical stages. The patient has been followed up with clinical and radiographic examinations demonstrating satisfactory progress. **Conclusion:** Infection management as a complication of deformity correction surgery in congenital scoliosis deformities usually follows a similar timeline: Hardware removal, transient management either with a varying type of orthosis, cervical traction or follow up. In many cases, leading to a progression in the severity of the deformity. Once infection management is complete, the resulting deformity may require extensive definitive management, such as multi-level posterior instrumentation associated with multiple osteotomies and/or vertebrectomies.

ID: AGS26/47

P0174.1: Factors Affecting Radiological Improvement in Brace Treatment of Adolescent Idiopathic Scoliosis Patients

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Introduction: Adolescent idiopathic scoliosis (AIS) is a complex three-dimensional spinal deformity occurring between ages 10 and 18. Bracing is the main conservative treatment for Cobb angles between 20° and 45°, but patient-related factors, especially joint laxity, may affect outcomes. This study evaluates the impact of joint laxity and other patient factors on radiological improvement after bracing. **Material and Methods:** A retrospective study of 52 AIS patients treated with bracing from 2017 to 2024 was conducted. Demographics, radiographs, SRS-22r scores, and Beighton scores were analyzed. Cobb angle changes were measured at 6, 12, and 18 months. The effects of brace wear time and exercise adherence on radiological outcomes were assessed. **Results:** 67.3% of patients were female, mean age 15.96 years. Average daily brace wear was 17.8 hours. Mean Cobb angle decreased significantly from 26.7° to 17.8° at 18 months ($p < 0.001$). 59.6% achieved ≥8° correction, with higher brace compliance and quality of life scores ($p < 0.001$). Additional symptoms, Lenke classification, and brace wear duration affected success ($p < 0.05$). No significant relation was found between Beighton score, exercise duration, Risser stage, initial Cobb angle, and correction. **Conclusion:** While our performance was found to be significant in terms of preserving the change

amount of the large Cobb angle in patients with no additional complaints and an SRS score of >4.5, it showed a significant difference in percentage, although not significant, in terms of separation status in patients with a Beighton score of ≥4 and a Risser stage of ≥2. Conservative treatment in adolescent idiopathic scoliosis is accepted as an effective and safe intervention method. However, this effectiveness reaches its maximum level when combined with patient motivation, quality of life, social support and individualized approaches, not only with physical interventions. This study has made an original and holistic contribution to both clinical practice and literature by summarizing many factors that give direction to treatment. Conservative performance is possible not only by giving a brace to the disease; but also by reading it correctly, supporting it in a readable and holistic way.

Deformity-thoracolumbar (Adult)

ID: AGS26/138
P0175: Large intrathoracic meningocele: a case report

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Introduction: Intrathoracic meningocele is a saccular protrusion of the meninges through a dilated intervertebral foramen or a bony defect of the vertebral column. They usually remain asymptomatic, but back or radicular intercostals pain, cough, and dyspnoea are possible manifestations. Kyphoscoliotic deformity of the thoracic spine is often associated. Seventy per cent of the intrathoracic meningoceles reported in the literature occurred in patients with neurofibromatosis. Giant intrathoracic meningoceles associated with neurofibromatosis are rare, and standard treatment in these cases remain controversial. The purpose of this case is to emphasize this entity via a review of the literature. **Material and Methods:** A 23-year-old female, with a history of anemia since early age, presented with exertional dyspnoea. Thisdyspnoea began 2 months before admission, and it slowly increased in severity. Physical examination found multiple "cafe au lait" spots on the back and on the abdomen, cutaneous neurofibromas, and a right kyphoscoliosis. The neurological examination showed a pyramidal syndrome on the two inferior limbs. The Magnetic resonance imaging (MRI) showed a large right Intrathoracic meningocele at the level of of D3-D4. The patient was operated through a drainage of the CSF contained in the meningocele via a thoracoperitoneal shunt. Postoperative course was uneventful. A radiological control through CT scan confirms the right emplacement of the catheter. Clinical symptoms had progressively disappeared after surgery. **Results:** Congenital meningocele is rare and usually associated with generalized mesenchymal dysplasia, such as NF-1 or Marfan syndrome. In the thorax, lateral meningoceles are more frequent because the paravertebral muscles are relatively weak and the pressure gradient between cerebrospinal fluid and thorax is high. Kyphoscoliosis in NF-1 is characterised by the predominance of kyphosis associated with scoliosis; acute posterior angulation is a typical sign as it was in the case reported here. The vertebral bodies are frequently so deformed and attenuated at the apex that it may be impossible to identify them on routine radiographs, and severe angulation of the spine is responsible for paraplegia. Meningoceles should be differentiated from tumors, especially those that commonly arise from the posterior mediastinum, such as neurofibroma, neuroblastoma, and ganglioneuroma. **Conclusion:** Intrathoracic meningoceles are rare. They are often associated to a neurofibromatosis, but this association is seldom within giant forms. Kyphoscoliosis associated tomeningoceles occuring on the convex side of the scoliosis are allways associated during these malformities. Surgery is recommended in symptomatic cases (neurological expression or dyspnea…). Athoracoperitoneal shunt is often proposed, with satisfactory clinical results.

ID: AGS26/142
P0176: Intradural Schwannoma associated to a degenerative lumbar stenosis: what to do?

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Introduction: Schwannoma is a common intradural slow-growing, benign and encapsulated tumor that originates from the myelin sheaths of the nerve fibers. However, a lumbar schwannoma complicating the symptoms of spinal stenosis is an extremely rare association. **Material and Methods:** We describe the case of a woman presenting a lumbar schwannoma in association with spinal stenosis, and report our approach and experience regarding it. **Results:** A 53 year-old woman presented due to the progressive onset of a lumbar pain that was irradiating to both inferior legs, associated to neurogenic claudications and genitosphincteric disorders. Neurological examination did not show motor or sensitive deficit, but rectal examination found a perianal anesthesia. Magnetic resonance imaging showed lumbar spinal stenosis due to flavum ligament hypertrophy and disc herniations, as well as an intracanalar expansive lesion with homogeneous contrast enhancement regarding the L2 pedicle. The patient underwent surgery. Peroperative, we proceeded through a posterior screw instrumentation from L3 to L5, followed by a decompression

of the stenotic segments. Afterwards, we performed a L2 laminectomye in order to remove the tumor. Postoperative course was uneventful. Pathologic examination defined the tumor as a schwannoma. After a 1 year follow up, the patient reported a total regression of her pain, and recovered a nearly full control of her sphincteric functions. **Conclusion:** The present study highlights that lumbar schwannoma is a possible etiology complicating the symptoms of patients with previous lumbar spinal stenosis. It is important to treat both pathologies to improve the patients' symptoms

ID: AGS26/161
P0177: Comparison of hook and vertebroplasty for the prevention of proximal junctional failure: hook may be the preferable option

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Introduction: Proximal junctional failure (PJF) is a severe and increasingly recognized complication following long-segment fusion for degenerative sagittal imbalance (DSI), associated with substantial morbidity and compromised functional outcomes. The pathogenesis of PJF is multifactorial, involving mechanical, biological, and patient-specific factors. Adjunctive strategies aimed at reinforcing the proximal junction, such as vertebroplasty (VP) and hook fixation at the uppermost instrumented vertebra (UIV), have been proposed to mitigate PJF risk. However, comparative data on their clinical effectiveness in preventing PJF remain limited. This study aims to compare the effectiveness of vertebroplasty and hook fixation in preventing PJF in patients undergoing long-segment fusion for DSI. **Material and Methods:** A total of 139 consecutive patients with DSI who underwent posterior spinal fusion from T9/T10 to the pelvis at a single institution between 2016 and 2022 were included. Only patients with a minimum of 2 years of postoperative follow-up were analyzed. Patients were categorized into three groups based on proximal junctional intervention: vertebroplasty (n = 21), hook (n = 47), and control (no proximal intervention, n = 71). The primary outcome was the incidence of PJF. Secondary outcomes included the incidence of proximal junctional kyphosis (PJK), distal junctional failure, rod breakage, and radiographic changes in global sagittal alignment parameters, including pelvic incidence-lumbar lordosis mismatch, thoracic kyphosis, pelvic tilt, and C7 sagittal vertical axis. Surgical procedures included long-segment posterior spinal fusion from T9/T10 to the pelvis. Interbody fusion from L2 to S1 was performed using posterior lumbar interbody fusion or oblique lumbar interbody fusion techniques, based on anatomical considerations and surgeon preference. Proximal junctional interventions were performed at the discretion of the attending surgeon and consisted of either vertebroplasty or hook fixation applied at the UIV. Patient demographics, surgical variables, and radiographic outcomes were compared across the three groups. Multivariate logistic regression analysis was conducted to identify independent risk factors for PJF, adjusting for age, sex, BMI, osteoporosis status, number of rods, instrumentation type at the UIV, and sagittal alignment parameters. All statistical analyses were performed using appropriate parametric or non-parametric tests, with a significance threshold of $p < 0.05$. **Results:** The overall incidence of PJF was significantly lower in the intervention group (vertebroplasty or hook) compared to the control group (5.9% vs. 21.1%, $p = 0.009$). Among the intervention subgroups, hook fixation demonstrated a numerically lower PJF rate (4.3%) compared to vertebroplasty (9.5%), although this difference was not statistically significant ($p = 0.544$). Multivariate analysis revealed that hook fixation exerted the strongest protective effect against PJF (OR 0.036, $p = 0.015$), followed by vertebroplasty (OR 0.077, $p = 0.033$). The incidence of PJK did not significantly differ across groups ($p = 0.640$). **Conclusion:** Both vertebroplasty and hook fixation effectively reduced PJF incidence following long-segment fusion for DSI, with hook fixation demonstrating a trend toward superior efficacy. These findings highlight the importance of optimizing proximal construct dynamics and suggest that hook fixation may be a preferable adjunctive strategy for mitigating PJF risk

ID: AGS26/192
P0178: Optimization of spinal alignment strategies in low pelvic incidence patients: a computational modeling approach

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Introduction: Sagittal balance is a key determinant of spinal health, particularly in patients with low pelvic incidence (PI < 45°). Surgical planning for these patients requires optimizing spinopelvic parameters to achieve biomechanically favorable postural alignment. However, current alignment strategies may not consistently achieve ideal sagittal profiles, leading to potential compensatory mechanisms or postoperative complications. This study aims to evaluate the effectiveness of three alignment strategies in low PI patients based on compliance with key sagittal alignment criteria. **Material and Methods:** A cohort of 20 patients with PI < 45° underwent computational modeling of three sagittal balance strategies: PI-LL = 10° (less_curve), PI-LL = 0° (ideal_curve), and PI-LL = -10° (more_curve). Each strategy was evaluated using

three alignment goals: C2PL = 0 mm, T1PA = 10°, and T1PA = 15°. Plans were assessed based on compliance with three key criteria: T1 slope between 15°-35°, T1 pelvic angle (T1PA) < 20°, and C2PL between +9 mm and -33 mm. Compliance rates were calculated for each condition and strategy. **Results:** The analysis revealed that compliance rates varied significantly across strategies. The highest compliance was achieved in the C2PL = 0 mm strategy within the PI-LL = -10 subgroup, with a compliance rate of 61.90%. The lowest compliance was observed in the T1PA = 10° strategy for the PI-LL = -10 subgroup, with a compliance rate of only 4.76%. The T1PA = 10° and 15° strategies struggled to achieve the required T1 slope and C2PL alignment simultaneously. The most challenging criterion to satisfy was T1 slope (15°-35°), which failed in up to 71.20% of cases, particularly in T1PA strategies. **Conclusion:** The findings suggest that current alignment strategies may not fully accommodate the sagittal alignment needs of low PI patients. The T1 slope parameter was the most difficult to optimize, indicating potential gaps in thoracic compensation or spinal alignment adjustments. The C2PL constraint was also a major limiting factor in T1PA-based strategies, suggesting that global sagittal balance needs further refinement. Future studies should explore the role of additional compensatory mechanisms such as thoracic kyphosis and pelvic tilt to improve alignment predictability.

ID: AGS26/193
P0179: The middle ground mystery: unraveling spinal alignment challenges in average pelvic incidence

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Introduction: Sagittal balance is critical for spinal health, particularly in patients with average pelvic incidence (PI = 45°-60°). Surgical strategies aim to optimize spinopelvic parameters to achieve biomechanically favorable postural alignment. However, alignment goals may not always be met due to unaccounted compensatory mechanisms, leading to suboptimal surgical outcomes. This study evaluates the effectiveness of three alignment strategies in patients with average PI, focusing on compliance with key sagittal alignment criteria. We hypothesize that none of the three alignment strategies (PI-LL = 10, PI-LL = 0, PI-LL = -10) will achieve full compliance with all sagittal alignment criteria, and that some strategies will be more prone to failure in specific parameters, particularly T1 slope and C2PL. **Material and Methods:** A cohort of 20 patients with PI between 45° and 60° underwent computational modeling of three sagittal balance strategies: PI-LL = 10° (less_curve), PI-LL = 0° (ideal_curve), and PI-LL = -10° (more_curve). Each strategy was tested using three alignment goals: C2PL = 0 mm, T1PA = 10°, and T1PA = 15°. Plans were analyzed based on three criteria: T1 slope between 15°-35°, T1 pelvic angle (T1PA < 20°), and C2PL between +9 mm and -33 mm. **Results:** The analysis revealed that compliance rates varied significantly across strategies. The highest compliance was observed in the C2PL = 0 mm strategy, which achieved 53.66% compliance, whereas the lowest compliance was found in the T1PA = 10° strategy, at only 2.44%. The most frequently failed parameter was T1 Slope 15°-35°, with failure rates exceeding 85% in some cases. Patients with average PI showed difficulty in maintaining sagittal alignment when relying on T1PA-based strategies, leading to suboptimal T1 slope and improper C2PL positioning. The inability to achieve correct alignment increases the risk of compensatory mechanisms, which may contribute to postoperative lumbar strain, early degeneration, and adjacent segment disease. **Conclusion:** These findings highlight that current alignment strategies may not fully address sagittal balance in patients with average PI. The challenges in achieving ideal alignment suggest that additional compensatory mechanisms, such as thoracic kyphosis and lumbar adjustments, should be integrated into spinal realignment strategies. Future research should explore multi-segmental compensations to enhance patient-specific surgical planning.

ID: AGS26/206
P0180: The suction sign: an intraoperative audible marker for adequate intradiscal release and improved radiographic correction

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) has been described as a less morbid alternative compared to traditional open approaches for degenerative lumbar pathology. One challenge associated with MIS-TLIF is reliable assessment of intraoperative disc release to achieve surgical correction and address segmental deformity. The suction sign is a confirmatory intraoperative auditory phenomenon that can be produced by toggling a blunt instrument in the disc space once sufficient annular release and segmental mobility has been achieved. This audible feedback may provide a novel method to predict adequate intraoperative annular release and subsequent postoperative radiographic corrections. The objective of this study was to characterize the intra- and postoperative corrections in anterior disc height (ADH), posterior disc height (PDH), segmental lordosis (SL), and slip angle (SA) among suction sign positive patients.

Material and Methods: From January 2023 to September 2024, clinical and radiographic data of suction sign positive patients were retrospectively collected through chart review and analyzed. The suction sign was documented intraoperatively in each case. Pre-, intra-, and postoperative radiographic measurements of ADH (mm), PDH (mm), SL (degrees), and SA (degrees) were performed by two trained, independent readers. Descriptive and inferential statistics were performed. **Results:** Of the 25 suction sign positive patients, 15 (60%) underwent MIS-TLIF and 10 (40%) underwent mini-open TLIF. Fifteen (60%) patients were male, mean age was 52.1 ± 14.8 years, mean body mass index (BMI) was 29.1 ± 5.2, and mean follow up was 5.8 ± 4.4 months (range: 0.4-14.7 months). Inter-reader agreement was considered substantial ($k > 0.75$) for all radiographic measurement categories. Mean ADH and PDH significantly increased intra- (ADH: 14.0 ± 2.3, $p < 0.0001$; PDH: 8.8 ± 1.4, $p < 0.0001$) and postoperatively (13.0 ± 2.6, $p < 0.0001$; PDH: 8.2 ± 1.3, $p < 0.0001$) compared to preoperatively (ADH: 7.8 ± 3.7, PDH: 5.1 ± 1.8). Mean ADH significantly decreased postoperatively (13.0 ± 2.6, $p = 0.0001$) compared to intraoperatively (14.0 ± 2.3). There were no differences in PDH intraoperatively vs. postoperatively (8.8 ± 1.4 vs. 8.2 ± 1.3, $p = 0.005$). SL and SA significantly improved intra- (SL: 19.5 ± 9.5, $p = 0.0005$; SA: 12.5 ± 6.3, $p < 0.0001$) and postoperatively (SL: 18.1 ± 8.0, $p = 0.0005$; SA: 11.7 ± 4.7, $p < 0.0001$) compared to preoperatively (SL: 13.3 ± 8.0; SA: 5.3 ± 5.7). Correction was maintained in SL and SA intraoperatively vs. postoperatively (SL: 19.5 ± 9.5 vs. 18.1 ± 8.0, $p = 0.05$; SA: 12.5 ± 6.3 vs. 11.7 ± 4.7, $p = 0.18$). **Conclusion:** Patients with a positive suction sign demonstrated significant radiographic improvements in ADH, PDH, SL, and SA intra- and postoperatively following TLIF compared to preoperatively. These findings may offer reassuring evidence that the suction sign can be employed as a useful and novel audible marker in determining adequate intraoperative disc release prior to instrumentation and deformity correction.

ID: AGS26/261
P0181: The effectiveness and safety of high and low dosages of intraoperative intravenous tranexamic acid during surgical treatment of adult spinal deformity: a network meta-analysis

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Introduction: Intravenous tranexamic acid (TXA) is increasingly used during adult spinal deformity (ASD) correction to reduce blood loss, yet optimal intraoperative dosing and comprehensive safety remain uncertain. Prior syntheses pooled heterogeneous regimens and emphasized venous thromboembolism alone, limiting dose-response and broader adverse-event insights. We therefore conducted an ASD-specific network meta-analysis comparing high-dose, low-dose, and no-TXA strategies to clarify efficacy and safety and inform perioperative decision-making. **Material and Methods:** We performed a Bayesian network meta-analysis of studies from PubMed, Embase, and CINAHL comparing high- (30-50 mg/kg loading; 3-10 mg/kg/h), low- (10-20 mg/kg loading; 0.5-2 mg/kg/h), and no-TXA regimens in ASD surgery, reporting mean difference (MD) or risk ratio (RR) with 95% confidence intervals (CI). **Results:** Eight articles (three randomized studies and five observational studies) were included. Patients (n = 1,016; mean age = 59 years; mean operated levels = 12.2; mean operative time = 384 minutes) were divided into the High TXA group (n = 223), Low TXA group (n = 539), or No TXA group (n = 254) based on TXA dosage with sufficient transitivity. For effectiveness, the High TXA group had a high probability of being the best treatment (> 90%) and the No TXA group had a high probability of being the worst treatment (> 90%) for minimizing total intraoperative EBL and EBL per vertebral level. Compared to the No TXA group, there was a statistically significant decrease in EBL per vertebral level and total EBL for the High TXA group (MD = -60.9 mL and -602.0 mL) with no statistically significant difference for the Low TXA group (MD = -31.3 mL and -387.0 mL). There was no statistically significant difference in EBL per vertebral level or total EBL between the High TXA group and the Low TXA group. For safety, none of the groups had a high probability of the best or worst treatment for minimizing TXA-related complications with no statistically significance difference in risk between groups. The total TXA-related complication rate was 10.8% for the High TXA group, 8.6% for the Low TXA group, and 12.7% for the No TXA group, suggesting similar risk. Rates for venous thromboembolism (2.4%-3.6%), stroke (0.4%-0.5%), and cardiac complications (4.2%-6.7%) were similar between groups. Certainty of evidence was very low. **Conclusion:** Intraoperative high dose IV TXA during surgery for ASD may be associated with greater effectiveness in reducing total EBL (MD = -602.0 mL) and EBL per level (MD = -60.9 mL) without a concomitant increase in total TXA-related complications compared to no TXA, but not compared to low dose IV TXA, based on very low certainty of evidence derived from eight comparative studies. Additionally, this study found that specific complication rates for VTE (2.4%-3.6%), stroke (0.4%-0.5%), and cardiac complications (4.2%-6.7%) were similar between groups, potentially indicating similar risk profiles between high-dose TXA, low-dose TXA, and no TXA during surgery for

ASD. Surgeons should cautiously incorporate this evidence on a case-by-case basis while considering the unique risk-benefit profile for each patient. These results for ASD appear consistent with the wider literature for all-type spine surgery for high-dose TXA.

ID: AGS26/305

P0182: Does a diagnosis of osteoporosis increase the incidence of mechanical and junctional failures in older patients undergoing ASD surgery?

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Introduction: Adult spinal deformity surgery (ASD) is associated with a nearly 50% risk of mechanical complications. It has long been established that the majority of patients are female, and with the higher prevalence of osteoporosis within this demographic, it may be that there is a greater incidence of mechanical complication within the same group. The purpose of this review is to analyze the medical, surgical and implant related adverse events in osteoporotic patients undergoing multilevel ASD surgery. **Material and Methods:** Patients > 60 years of age undergoing ASD surgery > 5 levels were prospectively reviewed from 12 international centers. Bone health, medical and surgical management was at the discretion of the treating surgeon. Baseline bone mineral density (BMD) was performed using femoral neck DXA studies, with results categorized according to the WHO criteria. Patients were divided into 3 groups based on their pre-operative BMD and analyzed for peri-operative adverse events. **Results:** 219 patients were analyzed for review. 80.4% were female and 143 underwent pre-op femoral neck BMD testing with 52 having normal bone density, 68 osteopenia and 23 osteoporosis. Of the patients with osteoporosis, 82.6% were female with a rate of 60.9% in the Asian patients, 34.8% in the North American patients, and 4.3% in European patients. Patients with osteoporosis had a significantly lower BMI (22.8 ± 3.8 kg/m2) than osteopenic (24.6 ± 4.8 kg/m2) and normal BMD (27.3 ± 6.0 kg/m2) $p < 0.001$. Surgical features were similar in each group except for levels fused which greater in the osteoporotic group (11.3 ± 5.5 vs 9.7 ± 4.8 vs 7.2 ± 4.4 levels, $p = 0.001$). At up to 5 years post-op, the rod fracture rate was 3.8%, 11.8% and 4.3% in each group, although the difference was not significant. The PJK rate was 34.8%, 29.4% and 23.1% in each group, a non-significant difference. Medical and surgical adverse events rate was similar in each group. **Conclusion:** Patients with osteoporosis aged over 60 years undergoing > 5 level fusions for ASD had a lower BMI, longer constructs and a higher rate of PJK. Rod fracture and implant related complications were similar in each group.

ID: AGS26/318

P0183: Assessing pain as a primary outcome measure in the surgical treatment of adult spinal deformity in patients over 60 years of age with 2 and 5 year outcome data from the prospective evaluation of elderly deformity (PEEDS) study

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Introduction: Back and leg pain are key motivators for surgery in patients with Adult Spinal Deformity (ASD), yet they are infrequently assessed as a primary outcome measures. This study evaluates pain outcomes in patients over 60 undergoing multilevel fusion for ASD, using multiple validated Patient Reported Outcome Measures (PROMs) with 5-year data. **Material and Methods:** A prospective, international, multi-center study enrolled patients ≥ 60 years undergoing spinal deformity surgery with ≥ 5-level instrumented fusion. Patients were evaluated preoperatively and at 10 weeks, 1 year, and 2 and 5 years using the Numeric Rating Scale (NRS) for back and leg pain, and pain-related subscores from the Oswestry Disability Index (ODI), Scoliosis Research Society-22r (SRS-22r), and EQ-5D. **Results:** 219 patients met inclusion criteria (mean age 67.5 years, 80.4% female). Baseline pain was predominantly back-dominant (mean NRS back: 6.1; leg: 4.3). At 2 years, significant pain reduction was observed: mean NRS back 2.7, NRS leg 2.3. AT 5 years, the pain reduction was largely maintained with NRS back 2.9, NRS leg 2.6. Over 80% showed improvement in NRS back pain, 76.7% on SRS-22r pain, and 70.3% on ODI pain. Despite this, 15.1% experienced worse leg pain, and 5.7% reported worsened back pain. At 5 years, 53.3% of patients had improvement in NRS back pain, 46.6 on SRS-22r Pain and 48.6% in ODI pain. Patients with higher baseline pain had the greatest improvement, while those with low initial scores were more likely to deteriorate. At 2 years, 64.9% achieved an acceptable symptom state (PASS), compared to 18.1% preoperatively. There were no significant differences in outcomes across age groups. **Conclusion:** Surgical treatment for ASD in patients over 60 results in meaningful and durable improvements in back and leg pain at 2 and 5 years, with most patients reporting only mild or no pain.

ID: AGS26/429
P0184: Prediction of L1 pelvic angle can be improved by using both morphologic and positional parameters

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Introduction: Pelvic incidence (PI) - lumbar lordosis (LL) mismatch is widely used as a marker of sagittal balance, but lordosis frequently extends above L1 and is poorly predicted by PI alone. Assessment of the true arc of the lordotic segment of the lumbar spine and association to PI is challenging and unreliable. The first goal of this study is assessment of the true arc of the lordotic segment of the lumbar spine and association with PI. The L1 pelvic angle (L1PA) is a positional property that can be used to help qualify sagittal alignment, is easily measured intraoperatively, is directly affected by lordosis distribution and becomes a fixed property when the lumbar spine is fused. PI has also been shown to more reliably predict L1PA than it predicts LL. The second goal of this study is predicting L1PA in young, healthy, asymptomatic individuals from spinopelvic and femoroacetabular positional and morphologic parameters. **Material and Methods:** Healthy volunteers with no hip or spine pathology were recruited (N = 500). Full body EOS scans and 3D reconstructions of the pelvis were obtained. Femoroacetabular parameters (acetabular anteversion (AA), acetabular inclination (AI), femoral version (FV)) and spinopelvic parameters (PI, LL, L1PA, pelvic tilt (PT), sacral slope (SS)) were calculated and recorded. Lumbar lordosis from L1 to S1 (L1S1) and from the cranial end of the lumbar lordotic segment to S1 (trueLL, calculated from raw coordinates) were obtained and compared to PI by linear regression. Associations between L1PA and spinopelvic and femoroacetabular parameters were tested using linear regression analyses. **Results:** 377 volunteers (age 28.90 ± 5.1, 57% F, BMI 24.8 ± 4.2) were included. The cranial end of LL was above L1 for 57% of participants. PI and LL-L1S1 were statistically significantly associated by linear regression ($R2 = 0.361$, $p < 0.001$), as were PI and trueLL ($R2 = 0.339$, $p < 0.001$). Polynomial regression did not provide a better fit. LL was poorly predicted by PI alone ($R2 = 0.34$). Using stepwise regression, L1PA could be reasonably predicted by PI alone ($R2 = 0.62$, L1PA = 0.47PI-18, Mdn PI = 48.6, IQR = 13.5), and improved with inclusion of AA in the model ($R2 = 0.67$, L1PA = 0.44PI+0.34AA-22, Mdn AA = 14.4, IQR = 4.9). Substituting PT and SS for PI further

improved predictability (R2 = 0.79, L1PA = 0.25SS+0.75PT-12, Mdn SS = 39.4, IQR = 10.2, Mdn PT = 9.6, IQR = 8.8). **Conclusion:** The conventional L1-S1 measurement does not accurately capture the lordotic curvature in the majority of healthy, asymptomatic volunteers. We furthermore identified strong relationships between morphologic spinopelvic and femoroacetabular parameters in defining sagittal balance of the young healthy spine via L1PA. The inclusion of positional parameters (PT and SS) resulted in much improved prediction of L1PA. Future work should focus on improving understanding of factors affecting sacropelvic positioning. Our study provides a foundation for studying changes in alignment with aging and associated compensatory mechanisms. This can ultimately help guide restoration of not only individualized spinopelvic alignment but acetabular orientation in THA as well, potentially reducing the need for revision surgery.

ID: AGS26/481
P0185: Predictive value of the global alignment and proportion (GAP) score for mechanical complications after adult spinal deformity surgery: a systematic review

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Introduction: Mechanical complications (MCs) frequently occur following adult spinal deformity (ASD) surgery. The Global Alignment and Proportion (GAP) score was developed to personalize sagittal alignment targets based on pelvic incidence. However, the predictive accuracy of the GAP score remains a topic of debate. This article systematically reviews the evidence regarding the performance of the GAP score, its modifications, and related factors. **Material and Methods:** Following the PRISMA guidelines, a comprehensive search was conducted across PubMed/MEDLINE, Embase, Scopus, and Cochrane databases for studies published from January 2017 to July 2025. The inclusion criteria included studies involving adult patients with Adult Spinal Disorder (ASD) that reported GAP scores, along with outcomes related to mechanical complications-such as proximal junctional kyphosis/failure, rod fracture, and implant failure-and/or patient-reported outcomes (PROs). Data on demographics, surgical techniques, GAP categories, rates of mechanical complications, and predictive metrics were systematically collected and qualitatively analyzed. Additionally, findings from existing meta-analyses were integrated into the review. **Results:** Thirty-two studies involving over 5,700 patients met the inclusion criteria. The reported incidence of MC ranged from 17.6% to 61%. The predictive accuracy of the GAP score was inconsistent, with AUC values ranging from 0.53 to 0.86. Some cohorts showed no significant relationship between GAP categories and MCs, while others demonstrated a clear gradient. A meta-analysis of 1,617 patients revealed a significantly higher risk of MCs for disproportioned patients, with an odds ratio (OR) of approximately 2.6-2.8. The GAP score did not predict MCs in circumferential MIS cohorts, but its predictive value improved in open construct cohorts. The modified GAPB, which includes BMI and BMD, showed better accuracy (AUC approximately 0.885 versus 0.798). Machine-learning models that integrated GAPB variables achieved prediction accuracies over 73%. Bone quality, indicated by low HU at UIV/UIV+1, and sarcopenia emerged as independent predictors even in proportioned patients. The associations between these factors and PROs were mixed, indicating a possible trade-off between radiographic perfection and surgical morbidity. **Conclusion:** The GAP score has limited, context-dependent predictive value for mechanical complications after ASD surgery. It should not be used as a sole algorithm. Multifactorial models that incorporate radiographic alignment (GAP), bone quality, muscle condition, BMI, and surgical approach provide better risk stratification. Future research should focus on large prospective studies and advanced predictive analytics to support personalized surgical planning.

ID: AGS26/562
P0186: Establishing the timeline for pelvic tilt stabilization after adult spinal deformity surgery

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Introduction: Pelvic tilt (PT) plays a crucial role in sagittal alignment and functional outcomes after adult spinal deformity (ASD) surgery. However, the timeline for PT stabilization postoperatively remains unclear. This study aims to determine

the time point at which PT stabilizes and whether other sagittal alignment parameters follow similar trends, providing insight into postoperative alignment progression. **Material and Methods:** ASD patients who underwent a fusion from the upper thoracic region (T1-T5) to the pelvis and met their targeted L1 pelvic angle (PA) (L1PA = 0.5PI - 19 ± 2) goal immediate postoperative mark were evaluated. Radiographic parameters were measured at immediate postop (iPO), 6 weeks (6W), 6 months (6M), 1 year (1Y), and 2 years (2Y) post-operatively. The changes in PT, C7 sagittal vertebral axis (SVA) and C2 SVA over these time points were assessed. Statistical significance was determined via paired t-tests. **Results:** 43 patients met our inclusion criteria. PT significantly increased from iPO to 6W (15.58 vs 19.65 [p = 0.0373]). There was no other significant increase between measured time intervals (6W:19.65, 6M: 19.33, 1Y: 21.03, 2Y: 19.63). Similarly, C7 SVA and C2 SVA exhibited a decrease from iPO to 6W (C7 SVA: 52.25 vs 23.85mm, p = 0.001, C2 SVA: 89.88 vs 49.23mm, p = 0.0003), after which they stabilized with no significant change occurring between time intervals. **Conclusion:** This study demonstrates that PT, C7 SVA, and C2 SVA stabilize at the 6-week postoperative point and remain consistent through 2 years in ASD patients aligned to L1PA criteria. This has significant implications for postoperative monitoring and long-term alignment expectations. Future studies should explore whether other early postoperative sagittal alignment changes could predict long-term clinical outcomes.

ID: AGS26/563
P0187: Predictors of functional recovery after ASD surgery: an evaluation using SRS function PASS+ criteria

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Introduction: Functional recovery after adult spinal deformity (ASD) surgery varies, with some patients recovering faster than others. The Scoliosis Research Society physical function (SRS-PF) score combined with PASS+ criteria marks clinically meaningful recovery. This study aims to identify factors predicting both recovery likelihood and timing in ASD patients. **Material and Methods:** Patients undergoing fusion of ≥ 7 levels for ASD with pelvic fixation and at least 2 years of follow-up were included. Demographic, clinical, radiographic, and SRS outcome scores were collected at 6 weeks, 6 months, 1 year, and 2 years postoperatively. The cohort was divided into PASS+ (score > 3.3) and PASS- groups. Variables were compared using parametric tests. To study recovery timing, the PASS+ group was subdivided into those achieving PASS+ by 6 months and those at 1 or 2 years, identifying factors linked to faster recovery. **Results:** 143 patients were included in this study with 67% reaching PASS+ by 2 years. On univariate analysis, male sex (p = 0.04), higher Modified 5 frailty index (MFI5) (p = 0.0058), higher sagittal vertebral axis (SVA) (p < 0.01), lower lumbar lordosis (p = 0.04), and less Cobb angle correction (p = 0.01) were all associated with being SRS-PF PASS-. However, multivariate analysis showed no significant predictors for PASS+ versus PASS- status. In the PASS+ cohort, 49% patients became PASS+ by 6 months and 51% at 1 year or 2 years. Univariate analysis showed ASD patients with shorter length of stay (p = 0.03), lower estimated blood loss (p = 0.01), shorter operative time (p = 0.034), lower MFI5 (p = 0.02), and lower C2 SVA (p = 0.04) were more likely to reach PASS+ in 6 months. Multivariate analysis showed MFI5 was the strongest predictor of recovery time, with higher frailty indicating delayed recovery (p < 0.01). **Conclusion:** Patient-specific and radiographic factors may influence whether ASD patients achieve PASS+ physical function. Among those who recover, frailty significantly affects the timing, highlighting its importance in predicting functional recovery speed.

ID: AGS26/567
P0188: Staged OLIF combined with posterior column osteotomy and posterior internal fixation for the correction of adult spinal deformity: a retrospective study focusing on intervertebral derotation and lateral slippage

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Introduction: Adult spinal deformity (ASD) is usually rigid and requires a combined anterior-posterior approach for deformity correction. The objective of this research is to evaluate the effects of OLIF and posterior column osteotomy(PCO) combined with posterior internal fixation for intervertebral derotation and lateral listhesis correction. **Material and Methods:** In this retrospective study, 36 consecutive patients diagnosed with ADS were included, with a mean age 67.14 years, who underwent two stages surgery: Stage1.OLIF ; Stage 2. PCO combined with posterior internal fixation between 2019 and 2024. The follow-up time were at least 18monthes.The full-spine anteroposterior and lateral X-rays, as well as lumbar CT and MRI were obtained to measure the Cobb angle, lateral slip distance, vertebral rotation, spino-pelvic parameters, sagittal vertical axis (SVA), the distance between the C7 plumb line and the central sacral vertical line (C7PL-CSVL) preoperatively, postoperatively(stage1, stage2)

and at the final follow-up. **Results:** Significant three-dimensional correction was observed following the first-stage OLIF and the second-stage PCO combined with posterior internal fixation. Radiological assessments were done preoperatively, postoperatively (stage1, stage2) and at the final follow-up. The Cobb angles decreased from 26.27°to 11.50°; 6.02°; 7.16° ($p < 0.001$). The lumbar lordosis(LL) increased from 27.72° to 36.94°; 37.48°;37.39° ($p < 0.001$). The lateral slip distance decreased from 9.12mm to 5.35 mm; 3.73 mm; 3.44 mm ($p < 0.001$). The axial rotation angles decreased from 8.92°to 6.96;2.48°; 2.39° ($p < 0.001$). PI 45.23°; 45.19°; 44.72°:43.72°. PT 22.98°; 18.85°; 17.74°; 17.35° ($p < 0.001$). SS 27.25°; 26.33°; 24.66°; 25.39° ($p < 0.001$). PI-LL 22.50°; 8.26°; 5.24°; 5.53° ($p < 0.001$). SVA(mm)48.31; 27.26; 27.26; 16.58 ($p < 0.001$).C7PL-CSVL (mm) 11.07;6.09; 10.74;6.12 ($p < 0.001$). **Conclusion:** This study demonstrated that: First-stage OLIF was efficient for partially vertebral derotation and lateral listhesis correction as well as improving the sagittal spinopelvic parameters simultaneously. PCO may be needed to obtain sufficient correction of coronal and sagittal deformity in ASD with severe coronal and sagittal imbalance.

ID: AGS26/624
P0189: Lumbar lordosis distribution in adult spinal deformity: targets based on pelvic morphology

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Hypothesis: Thresholds for realignment of the lumbar lordosis distribution index (LDI) based on variations in pelvic morphology will lead to better outcomes. **Study Design:** Retrospective. **Introduction:** The LDI is an important constituent of achieving adequate correction of adult spinal deformity (ASD). While previous literature has evaluated LDI, targets can vary based on pelvic morphology that remains to be evaluated in the ASD population. **Methods:** Operative ASD patients fused from at least L1 and proximal to the pelvis with two-year follow-up were included. Patients were stratified into three categories based on pelvic incidence (PI) [P1: PI < 45°, P2 PI 45-60°, P3 PI > 60°]. LDI was assessed based on: L4-S1 lordosis/L1/S1 lordosis. LDI based on Lafage et al and GAP were evaluated. Thresholds were determined by conditional inference tree (CIT) analysis. **Results:** 334 patients met the inclusion criteria. Overall, 49% had mechanical complications, with 32% considered major and 22% undergoing re-operation for mechanical complications. 54% had PJK, while 13% developed PJF. No difference in mechanical complication rate when meeting Lafage LDI (48 vs 49%, p = .8) or GAP LDI targets (46 vs 51%, p = .4). CIT analysis determined thresholds based on PI (all $p < .05$). PJK rates were reduced in P1 (low PI) if LDI was corrected to > 0.6. While those in P2 (mid PI), with PT < 23° had reduced rates of early PJF when LDI was corrected to > 0.4. In P3 (high PI) with preoperative PT < 48°, reduced rates of PJF if postoperative LDI was < 85%, while reduced major mech comp with LDI < 68. **Conclusions:** Correction of lumbar lordosis distribution based on pelvic morphology reduced rates of PJK and PJF. Reduced rates of PJK were seen with thresholds for LDI correction of at least 60% for low PI, and lower than 85% in those with high IP.

ID: AGS26/626
P0190: The economic and clinical burden of poor bone health in adult spinal deformity surgery

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Introduction: Osteoporosis is commonly comorbid with adult spinal deformity (ASD), with a reported a prevalence of 14.4-28.6%. The cyclical relationship between ASD and poor bone health poses a significant challenge to healthcare systems. **Methods:** This is a retrospective analysis of a prospectively enrolled clinical trial. Operative ASD patients ≥18Y with complete BL and 2Y data included. Bone quality categorized per the American Association of Clinical Endocrinology for DEXA and clinical features. Cohorts: O (untreated osteopenic/osteoporotic) and NO (treated or normal). DRG reimbursements calculated using established data. QALYs calculated using ODI converted to SF-6D and employed an annual 3% discount rate to calculate surgical cost-effectiveness with linear regression extrapolating QALY data out to 5Y. **Results:** Among the 1142 (21.5% O; 78.5% NO) included (62.5 ± 14.7Y; 67%F; BMI 27.6 ± 5.5 kg/m^2; CCI 1.1 ± 1.7), 16.6% had a formal diagnosis of osteoporosis, but 17.1% of osteoporotics and 76.1% of osteopenics were undiagnosed. 193 patients were treated 54.4% with PTH, 20.2% bisphosphonates, 19.2% Denosumab, and 4.1% Romosozumab. Surgical details: OR time 403 ± 143mins, LOS 7.3 ± 5.1d, EBL 1278 ± 1177 mL, Levels Fused 12 ± 4. O had higher revision rates (9.0 v 6.7%). O was also 2x more likely to develop radiographic PJK (2.0, [1.1, 3.8], p = .029) and 3.4x as likely to require revision for PJK (3.35, 1.4, 8.1], p = .007). Similarly, O was 2.5x more likely to develop a radiographic VBF (2.5, [1.2, 5.1], p = .017) and 3.8x more likely to require revision for VBF (3.8, [1.6, 9.3], p = .003). Cost calculations

Table 1. Cost Calculations

Value	Equation	Populated equation	Result
Cost Burden	(O Cohort Revision Rate) x (Mean Cost of Revision Surgery) x (O Cohort)	(9.0%) x ($95,117.73) x (245)	$2,097,334.92
Revisions Prevented	(O Cohort Revision Rate - NO Cohort Revision Rate) x (NO Cohort)	(9.0% - 6.7%) x (897)	21 Revisions Prevented
Reduction in Revision Costs	(Revisions Prevented) x (Mean Cost of Revision Surgery)	(21 Revisions Prevented) x ($95,117.73)	$1,997,472.33
PJK Cost Avoidance	(O Cohort PJK Revision Rate - NO Cohort PJK Revision Rate) x (NO Cohort) x (Mean Added Cost of Revision for PJK)	(4.5% - 1.2%) x (897) x ($21,004.24)	$621,746.51
VBF Cost Avoidance	(O Cohort VBF Revision Rate - NO Cohort VBF Revision Rate) x (NO Cohort) x (Mean Added Cost of Revision for VBF)	(3.3% - 0.6%) x (897) x ($27,988.25)	$677,847.43
Aggregate Cost Avoidance	(Reduction in Revision Costs) + (PJK Cost Avoidance) + (VBF Cost Avoidance)	($1,997,472.33) + ($621,746.51) + ($677,847.43)	$3,297,066.27

located in Table 1. DRG reimbursement for index surgeries averaged $94,442.93, while revision surgeries averaged an additional $95,117.73 per case. The added cost burden for O was $2,097,334.92 for revisions alone. The cost avoidance totaled $3,675.66 per patient in the NO cohort, with an aggregate saving of $3,297,066.27. In the extrapolated dataset, NO had higher surgical cost-effectiveness at Y3 (22,202.39 v $23,777.64, p = .008), Y4 (14,994.04 v $16,057.86, p = .008), and Y5 (11,319.11 v $12,122.20, p = .008). **Conclusion:** Our findings highlight the clinical and economic burden of poor bone quality in ASD surgery. Proactive management can potentially to mitigate complications, reduce revisions, and lower healthcare costs.

ID: AGS26/627
P0191: A tale of two planes: the impact of coronal deformity on sagittal alignment in adult spinal deformity

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Introduction: Adult spinal deformity (ASD) impacts both sagittal and coronal alignment, yet the role of coronal deformity in achieving sagittal alignment and its link to postoperative complications is underexplored. This study examines how the severity of coronal deformity affects postoperative alignment and complication rates. **Material and Methods:** This is a retrospective analysis of a prospectively enrolled database of 899 ASD Patients. ASD Patients ≥18Y with complete baseline (BL) and up to 2-year (2Y) follow-up data included. Sagittal parameters: SAAS criteria, sagittal vertical axis (SVA), and vertebral-pelvic angles. Coronal parameters: maximum Cobb angle (MCA), pelvic obliquity (PO), sacral obliquity (SO), C7 plumb line (PL), leg length discrepancy (LLD), and coronal inclination (Inc). Patients were stratified into three groups for each coronal parameter: Low (L): 0-25th, Moderate (M): 25th-75th, and Severe (S): 75th-100th percentiles. Multivariate analysis (MVA) was used to control for BL sagittal deformity and demographic factors. **Results:** 800 included (60.9 ± 14.6y, 75%F, 27.4 ± 5.7kg/m2, CCI 1.7 ± 1.7). Surgical characteristics: OR time 346mins, LOS 7.6days, EBL 1299mL, levels fused 10.6. BL Radiographics: MCA 38.2 ± 21.7°, PO 2.5 ± 2.0°, SO 4.6 ± 3.6°, PL 34.9 ± 32,9mm, LLD 8.4 ± 7.0mm, and Inc 3.7 ± 3.6°. Differences in coronal parameters are detailed in Table 1. At BL, 29.9% of patients met PT, 13.1% met PI-LL, and 22.1% met SVA goals. At 6W postoperatively, 26.2% met PT, 22.8% met PI-LL, and 29.7% met SVA goals. MVA demonstrated that patients in S for MCA were 1.7x less likely to achieve PI-LL alignment at 6W than L (OR: 1.71, [1.1, 2.8], p = 0.39). At 1Y, those in M and S MCA cohorts were 1.7x (OR: 1.68, [1.1, 2.6], p = 0.024) and 1.8x (OR: 1.75, [1.1, 3.0], p = 0.041) less likely, respectively, to meet SVA goals compared to L. Similarly, those in the M PL group were 1.8x less likely to achieve PT alignment at 2Y (OR: 1.82, 95% CI: [1.1, 3.0], p = 0.023). Patients in the S MCA group were 1.9x more likely to experience a major complication (OR: 1.93, [1.2, 3.2],

Table 1. Baseline Coronal Parameters Based on Severity Cohort

	Cohort		
Parameter	L (n = 200)	M (n = 400)	S (n = 200)
MCA (°)	12.8 ± 4.2	36.0 ± 9.7	67.6 ± 11.8
PO (°)	0.4 ± 0.3	2.1 ± 0.8	5.2 ± 1.7
SO (°)	0.9 ± 0.5	4.0 ± 1.3	9.5 ± 3.0
PL (mm)	6.0 ± 3.5	26.9 ± 9.4	80.0 ± 34.0
LLD (mm)	1.4 ± 0.9	7.0 ± 2.5	18.1 ± 5.7
Inc (°)	0.6 ± 0.3	2.8 ± 1.0	8.6 ± 3.8

p = 0.011) and 1.8x more likely to experience a minor complication (OR: 1.78, [1.1, 2.8], p = 0.11) compared to L. Additionally, those in S for PO had a 1.7x increased likelihood of a major complication compared to L (OR: 1.74, [1.1, 2.8], p = 0.024). **Conclusion:** Severe coronal deformity decreases the likelihood of achieving sagittal alignment and increases the risk of complications. These findings emphasize the need for targeted preoperative strategies to address coronal deformity and optimize surgical outcomes.

ID: AGS26/628
P0192: Impact of obesity on alignment in adult spinal deformity: a 3-year category-based analysis

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Introduction: The impact of obesity on global spinopelvic alignment is poorly understood. This study investigated the effect of body mass index on achieving alignment targets and compensation mechanisms after corrective surgery for adult spinal deformity (ASD). **Material and Methods:** This is a Retrospective cohort study of 899 consecutive ASD patients. Inclusion criteria were operative ASD patients (coronal Cobb angle ≥ 20°, SVA ≥ 50 mm, PT ≥ 25°, and/or thoracic kyphosis > 60°) who underwent ASD corrective surgery, > 18 yrs with complete baseline (BL) and 3-year (3Y) radiographic and HRQL data. Patients were stratified by body mass index into normal BMI, overweight, and obese groups (< 25, 25-30, and > 30). Postoperative alignment was compared with age-adjusted ideal values. Prevalence of patients who matched ideals and unmatched (undercorrected/overcorrected) was assessed. Means comparison tests assessed differences in baseline demographics, surgical details, and perioperative outcomes between normal BMI, overweight, and obese patients. Additionally, multivariable logistic regression and ANCOVA assessed differences in outcomes while accounting for age, CCI, frailty, baseline deformity, and invasiveness. **Results:** 340 ASD patients met inclusion criteria (Age: 59.0 ± 15.0; F = 78%; CCI: 1.6 ± 1.7). 91 patient were obese. 126 were overweight. 123 has a normal BMI. In terms of demographics, O has significantly higher CCI (2.1 vs 1.7 vs 1.2; p < 0.001), m-ASD-FI (11.4 vs 5.5 vs 4.2; p < 0.001), age (63.2 vs. 58.5 vs. 56.3; p = 0.004), less female (69% vs 74% vs 89%; p < 0.001). In term of surgical details, overweight significantly higher decompression rate (66% vs Obese: 59% vs N:61%; p = 0.013). No significant difference in osteo rate, number of level of fusion, ISSG invasiveness, EBL, Op time, SICU admission rate, and LOS. In terms of radiographic, obese patient shows a loss of correction PI-LL over time (6.3 at 3Y vs 2.5 at 6W), whereas normal BMI (-0.8 at 3Y vs -3.0 at 6W) and overweight (3.7 at 3Y vs 2.3 at 6W) held. obese patient shows a loss of correction PT over time (23.2 at 3Y vs 20.1 at 6W), whereas normal BMI (18.1 at 3Y vs 15.7 at

Table 1. Temporal Comparison of Spinopelvic Alignment Parameters Across Body Mass Index Cohorts

Sagittal Spinopelvic Alignment Parameters	Body Mass Index Groups (BMI)	Baseline	3 Year	*P* Value
Sagittal vertical axis [SVA] (mm)	Obese (≥30)	100.0 ± 69.1	43.7 ± 55.1	**< 0.001***
	Overweight (25-30)	56.4 ± 66.0	28.2 ± 48.5	**< 0.001***
	Normal (< 25)	44.0 ± 69.5	18.1 ± 53.1	**0.0013***
	P value	**< 0.001***	**0.002***	
T1 pelvic angle (°)	Obese (≥30)	28.6 ± 12.9	13.7 ± 10.3	**< 0.001***
	Overweight (25-30)	21.7 ± 17.6	17.6 ± 10.7	**0.027***
	Normal (< 25)	17.2 ± 12.9	13.7 ± 10.3	**0.0203***
	P value	**< 0.001***	**< 0.001***	
Pelvic tilt (°)	Obese (≥30)	27.0 ± 10.3	23.2 ± 9.9	**0.0129***
	Overweight (25-30)	23.5 ± 10.1	21.8 ± 10.1	0.184
	Normal (< 25)	19.4 ± 11.4	18.1 ± 10.1	0.346
	P value	**< 0.001***	**< 0.001***	
Pelvic incidence minus lumbar lordosis (°)	Obese (≥30)	23.1 ± 19.5	6.3 ± 13.9	**< 0.001***
	Overweight (25-30)	14.6 ± 19.7	3.7 ± 13.8	**< 0.001***
	Normal (< 25)	8.2 ± 20.7	-0.8 ± 14.2	**< 0.001***
	P value	**< 0.001***	**< 0.001***	
Maximum Thoracic kyphosis (°)	Obese (≥30)	-51.3 ± 17.9	-60.0 ± 18.0	**0.0015***
	Overweight (25-30)	-51.5 ± 18.1	-59.2 ± 17.2	**< 0.001***
	Normal (< 25)	-51.3 ± 18.8	-57.7 ± 16.9	**0.006***
	P value	0.987	0.602	

*Statistical significance.

6W) and overweight (21.8 at 3Y vs 19.3 at 6W) held. At 3 years, obese patients exhibited the most pronounced thoracic kyphosis in the unfused region compared to the overweight group and normal BMI respectively (-27° vs -24° vs -19°; p = 0.009). They also experienced the greatest loss of correction in unfused thoracic kyphosis over 3 years (-9.1° vs -7.7° vs -6.2°; p = 0.045). At 3 years, the obesity group demonstrated the highest prevalence of mismatched pelvic tilt (PT) sagittal modifier (60.4% vs. 57.1% vs. 43.1%; p = 0.021) and mismatched sagittal vertical axis (SVA) modifier (52.7% vs. 40.0% vs. 26.8%; p < 0.001), compared to the other categories. In term of global alignment, obesity has the lowest Roussely match rate at 1Y (37.2% vs 52.1% vs 56.3%; p = 0.023), 2Y (37.5% vs 39.6% vs 55.1%; p = 0.35). The multivariant analysis demonstrated obesity has lower odd of achieving SVA matching at 3Y (OR: 0.48; 95% CI: 0.27-0.82; p = 0.008), PT matching at 3Y (OR: 0.69; 95%CI: 0.53-0.91; p = 0.009). **Conclusion:** Obesity significantly impacts both spinopelvic alignment in adult spinal deformity correction. At 3 years postoperatively, obese patients demonstrated greater loss of alignment correction, particularly in pelvic tilt and sagittal vertical axis modifiers, and more pronounced thoracic kyphosis compared to normal and overweight patients. These findings highlight the challenges in achieving and maintaining optimal alignment in obese patients undergoing ASD corrective surgery, underscoring the need for tailored surgical strategies and intensive postoperative management in this population (Table 3).

ID: AGS26/636
P0193: Spino-pelvic fixation using the dual sacral alar iliac screw technique for geriatric patients with spinal deformity: preventing distal instrumentation failure

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Introduction: We introduced the dual sacral alar iliac (S1AI + S2AI: DAI) screw technique as a preventive measure against S2 alar iliac (S2AI) screw failure following spino-pelvic fixation (SPF) for adult spinal deformity in geriatric patients, and we evaluated its efficacy. Background context: Japan, which is facing an unprecedented super-aged society, is experiencing a continuous increase in surgical treatment opportunities for elderly patients with spinal deformities. The S2AI screw provides a stable pelvic anchor for spino-pelvic correction and fusion. However, the lumbosacral junction poses a high risk of nonunion or pseudarthrosis in elderly patients with poor bone quality. Postoperative complications may include rod fracture and S2AI screw failure. **Material and Methods:** We conducted a retrospective comparative analysis of distal mechanical failure in two groups of geriatric spinal deformity patients (aged over 65) who had undergone corrective surgery and had a minimum follow-up period of two years. Twenty-eight patients in the S2AI-only group served as historical controls, and we compared them with 29 patients in the DAI group. The S2AI-only group included 23 female patients with a mean age of 73 years and a mean follow-up period of 92 months. The DAI group included 24 female patients with a mean age of 74 years and a mean follow-up period of 44 months. Both groups underwent thoracolumbar-pelvic fixation with multiple rods and sacral alar iliac screws. All cases involved fusion from T8 or T9 to the sacrum/pelvis. **Results:** Preoperative spino-pelvic radiographic parameters showed no significant difference in deformity severity: PI-LL (S2AI: 37°, DAI: 34°), PT (S2AI: 31°, DAI: 29°), and SVA (S2AI: 119 mm, DAI: 122 mm). Immediately after surgery, both groups showed significant improvements in PI-LL, PT, and SVA: S2AI: 0°, 14°, and 10 mm, respectively; DAI: 7°, 19°, and 32 mm, respectively. There was no statistical difference between the groups. However, at the final follow-up, the PI-LL (S2AI: 11°, DAI: 8°) and PT (S2AI: 30°, DAI: 22°) in the DAI group maintained the immediate postoperative correction. Meanwhile, the S2AI group showed statistically significant deterioration. In the S2AI group, seven cases of screw failure were identified: five cases of S2AI screw neck fracture and two cases of set screw pop-up. These failures occurred, on average, one year and five months after surgery. Two cases required additional surgery due to buttock pain caused by L5/S pseudarthrosis. In contrast, the DAI group had one case of a set screw popping up, but there were no clinical symptoms. **Conclusion:** While the multiple rod technique is useful for preventing rod fractures in geriatric patients undergoing SPF for thoracolumbar kyphoscoliosis, we experienced multiple cases of instrumentation failure with S2AI screws alone. Consequently, we introduced the DAI screw technique for geriatric patients with spinal deformity, which has achieved favorable middle-term postoperative outcomes. The DAI screw method effectively maintains postoperative correction and prevents distal instrumentation failure.

ID: AGS26/651
P0194: Machine-learning models for the prediction of ideal surgical outcomes in patients with adult spinal deformity

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Introduction: Adult spinal deformity (ASD) surgery can reduce pain and disability. However, the actual surgical efficacy of ASD in doing so is far from desirable, with frequent complications and limited improvement in quality of life. The accurate prediction of surgical outcome is crucial to the process of clinical decision-making. Consequently, the aim of this study was

to develop and validate a model for predicting an ideal surgical outcome (ISO) two years after ASD surgery. **Methods:** We conducted a retrospective analysis of 458 consecutive patients who had undergone spinal fusion surgery for ASD between January 2016 and June 2022. The outcome of interest was achievement of the ISO, defined as an improvement in patient-reported outcomes exceeding the minimal clinically important difference, with no postoperative complications. Three machine-learning (ML) algorithms - LASSO, RFE, and Boruta - were used to identify key variables from the collected data. The dataset was randomly split into training (60%) and test (40%) sets. Five different ML models were trained, including logistic regression, random forest, XGBoost, LightGBM, and multilayer perceptron. The primary model evaluation metric was area under the receiver operating characteristic curve (AUROC). **Results:** The analysis included 208 patients (mean age 64.62 years (SD 8.21); 48 male (23.1%), 160 female (76.9%)). Overall, 42.8% of patients (89/208) achieved the ideal surgical outcome. Eight features were identified as key variables affecting prognosis: depression, osteoporosis, frailty, failure of pelvic compensation, relative functional cross-sectional area of the paraspinal muscles, postoperative sacral slope, pelvic tilt match, and sagittal age-adjusted score match. The best prediction model was LightGBM, achieving the following performance metrics: AUROC 0.888 (95% CI 0.810 to 0.966); accuracy 0.843; sensitivity 0.829; specificity 0.854; positive predictive value 0.806; and negative predictive value 0.872. **Conclusion:** In this prognostic study, we developed a machine-learning model that accurately predicted outcome after surgery for ASD. The model is built on routinely modifiable indicators, thereby facilitating its integration into clinical practice to promote optimized decision-making.

ID: AGS26/660
P0195: What degree of malalignment justifies performance of three column osteotomy in revision lumbar spinal fusion?

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Hypothesis: The extent of malalignment in revision surgeries for complex spinal deformity can justify the use of 3CO.
Study Design: Retrospective cohort multicenter study. **Introduction:** While the use of three column osteotomy (3CO) in complex spinal deformity is associated with improved outcomes and acceptable complication rates, we have yet to compare outcomes after 3CO based on varied degrees of preoperative malalignment and determine when 3CO is warranted. **Methods:** Revision complex spinal deformity patients who were fused from at least L1 and proximal to S1 and below with available baseline and 1 year (1Y) follow-up were isolated. Patients were stratified by whether they had 3CO (3CO+) and those that did not (3CO-). 3CO- cohort was further assessed based on development of complications and regional failure. Analysis controlled for age, gender, BMI, CCI, frailty, baseline deformity (PT, PI-LL, TPA, C7-PL), and levels fused. Multivariable regression determined which sagittal parameters were predictive of good outcomes. Conditional inference tree (CIT) was used to determine thresholds. **Results:** 132 CADS patients met inclusion, with no significant difference in age, gender, BMI, CCI, and frailty. Deformity at baseline was significantly worse in 3CO+. Despite fewer levels fused in 3CO+ (10.7 vs 13.3, $p < .05$) cohort, there was higher EBL (2.2L vs 1.2L, $p < 0.001$), increased rates of massive blood loss (13% vs 1%, $p = 0.008$), LOS (9.9 vs 6.6 days, $p < 0.001$), SICU admission (87 ± 35% vs 60 ± 49%, $p = 0.007$), discharge to SNF or rehab. Differences amongst cohorts in 1Y radiographic alignment, with 3CO- cohort having worse PT (24.2° vs 19.6°, $p = 0.008$) and TPA (21.5° vs 16.3°, $p = 0.01$). Parameters predictive of mechanical complications were: increasing PT (OR: 1.325 [1.003-1.750], $p = .048$) and increasing TPA (OR: 1.064 [1.012-1.119], $p = .016$). Thresholds values for baseline deformity associated with favorable outcomes in 3CO+ were: PT < 15.3° ($p = 0.047$), PI-LL < 47.5° ($p = 0.026$), TPA < 33.2° ($p = 0.047$). **Conclusion:** The use of three-column osteotomy in revision complex spinal deformity surgery is associated with improved alignment by 1 year relative to those that did not. Threshold values for radiographic parameters were found to be PT < 15.3°, PI-LL < 47.5°, and TPA < 33.2° being associated with favorable outcomes when using a 3CO.

ID: AGS26/697
P0196: Outcomes of adult spinal deformity surgery in octogenarians - How old is too old?

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Introduction: The safety and efficacy of spinal deformity surgery in elderly patients have not been well established. This study aims to compare outcomes of adult spinal deformity surgery in patients aged 80 and older with those aged 65 and younger. **Material and Methods:** Patients who underwent fusion surgery involving ≥ 5 spinal levels for spinal deformity between 2017 and 2023 at two institutions were included. Revision surgeries following previous

fusions ≥ 4 levels were excluded. Patients were divided into two groups: elderly (≥ 80 years) and younger (50-65 years). Background factors, surgical details (fusion level, duration, blood loss), pre- and one-year post-operative radiographic parameters (PI, LL, PT, SVA), and patient-reported outcome measures (PROs: NRS for back and leg pain, ODI, EQ-5D), satisfaction at two years, 30-day complications, and rates of proximal junctional failure (PJF), rod breakage, and reoperation within two years. **Results:** Forty-four elderly patients and 29 younger patients were included. Significant differences were found in smoking history (0% vs. 9%, p = 0.04), ASA classification (2.4 vs. 2.0, p = 0.001), and osteoporosis treatment history (82% vs. 34%, p < 0.001). Surgical extent and operative time were similar, but blood loss was lower in the elderly group (883 vs. 1355 mL, p = 0.005). Preoperative PI-LL (46° vs. 32°, p = 0.007), PT (36° vs. 28°, p = 0.002), and SVA (147 vs. 92 mm, p < 0.001) were significantly worse in the elderly group. Postoperatively, PI-LL was similar (19° vs. 10°, p = 0.11), but PT (29° vs. 23°, p = 0.005) and SVA (84 vs. 53 mm, p = 0.03) remained higher in the elderly group. Only leg pain was significantly worse preoperatively in the elderly group (4.7 vs. 2.7, p = 0.02), but all PROs and satisfaction at two years showed no significant differences. PJF occurred more frequently cpncc in the elderly group (31% vs. 10%, p = 0.04), while rod breakage (5% vs. 3%, p = 0.72) and reoperation rates (21% vs. 13%, p = 0.44) were similar. **Conclusion:** Despite more severe preoperative deformity and higher PJF risk, patients aged 80 and above achieved comparable surgical outcomes and satisfaction to younger patients. Careful patient selection and thorough preoperative counseling are essential for safe and effective surgical intervention in this population.

ID: AGS26/717
P0197: Social media as a window into patient experience: sentiment analysis of 14,596 posts in spinal deformity forums

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Introduction: Spinal deformities span pediatric and adult populations and are associated with pain, disability, and progressive dysfunction. Although tools such as the SRS-22 and ODI are used to measure patient-reported outcomes, they may not fully reflect long-term psychosocial burden or treatment dissatisfaction. Social media platforms such as Reddit offer a unique, anonymous space for patients and caregivers to share their experiences with spinal deformities. With this broad repository of data and advances in artificial intelligence, we aimed to analyze sentiment and engagement in Reddit posts about pediatric and adult spinal deformities to explore how social media may supplement traditional patient-reported outcomes. **Material and Methods:** We performed a retrospective, cross-sectional mixed-methods analysis of ~69,000 Reddit posts from 2014-2024 across 36 spine and health-related forums. Posts containing spinal deformity keywords were extracted and categorized into four groups: surgery-related, pain management, physical therapy and rehabilitation, and general discussion. Sentiment was classified as negative vs positive/neutral using NLP-based analysis. Post metadata (length, date, upvotes, and comments) was also collected and associations with sentiment were explored. **Results:** A total of 14,596 posts were analyzed. Overall, 82.0% of posts were positive/neutral and 18.0% were negative. Pain management and surgery-related posts had the highest negative sentiment (26.0% and 23.6%). Posts longer than 351 words were negative 30.9% of the time, and highly upvoted posts were negative 24.9% of the time. Negative posts received more comments over time, showing people increasingly engaged with difficult experiences. Post types remained stable over the decade, while post volume increased 47% annually after 2018, with 5,961 new posts in 2024 alone. Recent years showed a decline in negative sentiment in pain-related posts but a rise in surgery-related discussions. **Conclusion:** This is the first large-scale sentiment analysis of spinal deformity discussions on social media. While most posts were positive or neutral, surgery and pain-related content showed higher negative sentiment, often reflecting unmet expectations and emotional burdens. Findings highlight a potential disconnect between published outcomes and patient experiences. Social media offers valuable insights that may enhance counseling, set realistic expectations, and support patient-centered care for spinal deformities.

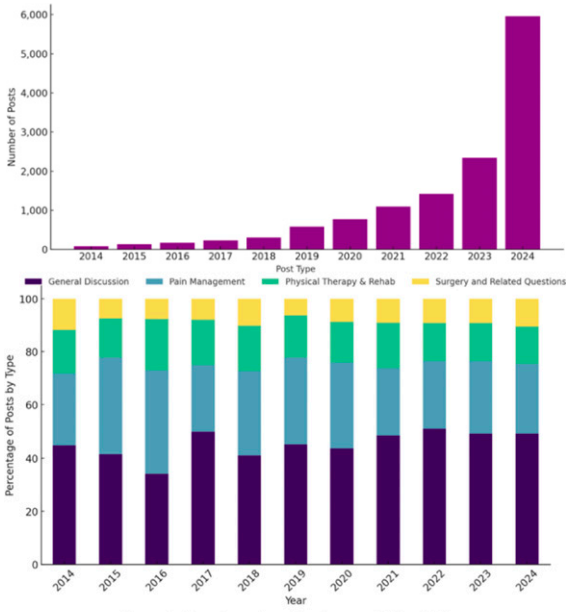


Figure 2: Percentage of post type by year, 2014 – 2024.

ID: AGS26/754

P0198: Staged anterior and posterior reconstruction for post-traumatic L5-S1 spondyloptosis with paravertebral abscess and preserved neurologic status: a case report

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Introduction: High-grade spondylolisthesis (spondyloptosis) with concurrent infection presents a complex surgical challenge. This report details the management of a case of L5-S1 spondyloptosis with a large paravertebral abscess following remote trauma in a neurologically intact young male. **Material and Methods:** A 20-year-old male presented with acute-on-chronic debilitating low back pain and immobility, following a motorcycle accident five months prior. Notably, his neurologic examination was intact throughout. Examination revealed a fixed lumbar deformity, tenderness at L5-S1, a palpable left iliac fossa mass, and associated anemia. Imaging confirmed near-complete L5-S1 spondyloptosis with large paravertebral abscesses. **Results:** Management involved a two-stage procedure: a left pararectal retroperitoneal approach for abscess debridement, L5 corpectomy, and anterior interbody cage placement, followed by posterior instrumented fusion from L4 to S1. Microbiological analysis of the intraoperative biopsy confirmed Mycobacterium tuberculosis, and appropriate anti-tuberculous therapy was initiated. The patient's neurologic status remained intact post-operatively. His recovery was excellent: he was able to sit independently at 2 months and had returned to normal, unassisted walking by the 3-month post-operative mark. **Conclusion:** This case highlights that severe spinal destruction from tuberculosis, even to the degree of spondyloptosis, can occur without neurologic compromise. A combined surgical approach for radical debridement and 360-degree fusion, coupled with targeted antimicrobial therapy, can achieve outstanding functional results, preserving and facilitating a full neurologic and mechanical recovery.

ID: AGS26/795

P0199: Neuromonitoring changes in three-column osteotomies (3CO) for spinal deformity correction surgery were associated with a high rate of denovo neurological deficits

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Introduction: 3CO are associated with high rate of neurological complications. Intraoperative Neuromonitoring (IONM) provides real-time feedback on nerve function and has been shown to increase safety of complex spinal deformity surgeries. Anticipating high- risk steps and responding appropriately to IONM is crucial for ensuring patient safety. **Material and Methods:** The study is a post hoc analysis of data from a prospective multicenter international observational study (Spine Deformity Intraoperative neuromonitoring: SDIM), where 20 international centers prospectively documented IONM (EMG, SSEP and MEP) alerts, demographics, radiographic findings, and surgical events of patients (10-80 years) undergoing spinal deformity surgery. Patients included had a major Cobb > 80° or underwent a Schwab type 2-6 osteotomy. The data from alerts that occurred following 3COs were reviewed. The results included univariate analysis of baseline and radiological characteristics, incidence of IONM alerts and postop neurological status. **Results:** 20 out of 146 (13.7%) patients undergoing 3CO had an alert during surgery and 12 (60%) developed postop de novo motor deficit. The risk factors for alerts in 3CO patients include revision surgery ($p < 0.05$), higher coronal Cobb ($p < 0.05$), anterior spinal fusion ($p < 0.05$). Pts with alerts had longer duration of surgery ($p < 0.05$) and less sagittal corrections ($p < 0.05$) likely in attempts to resolve the IONM changes. Risk factors for motor deficit at postop were presence of baseline motor deficit ($p < 0.05$), revision surgery ($p < 0.05$) and longer duration of surgery ($p < 0.05$). Patients with alerts had decreased baseline MEP and SSEP signal, and were more likely to have postop neurological ($p < 0.001$) deficits. All pts had loss of MEP, and the event preceding the alert being osteotomy/release (71.4%) and correction/rod placement (28.6%). The most frequent response in these patients was to elevate blood pressure, give blood and further decompression. 71.4% of alerts recovered to baseline compared to 92.9% of alerts in patients without postop motor deficit. **Conclusion:** 60% of 3CO pts sustaining IONM

alerts had new neurological deficits. Revision surgery, higher coronal Cobb and anterior surgery had a higher likelihood of IONM alerts in patients undergoing 3CO. Osteotomy/release and correction/rod placement were most often associated with MEP alerts in performing 3CO. Patients with IONM alerts during 3CO had lesser sagittal corrections and increased operative time in response to these alerts. The high rate of neurological deficits likely results from a mechanical mechanism of the neurological injury.

ID: AGS26/799
P0200: Does adult spinal deformity surgery accelerate hip osteoarthritis?

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Introduction: Hip-spine syndrome is widely acknowledged, but the impact of extensive spinal fusion on the hip joints remains debatable. It is uncertain whether this issue arises from preexisting biological factors or altered biomechanics. Furthermore, there is a lack of high-quality, international prospective cohort studies to thoroughly evaluate this concern. **Material and Methods:** Retrospective data analysis from international multicenter prospective cohort study (PEEDS) of patients > 60 years old indicated for > 5 level spinal fusion. All patients had baseline radiographs and patient reported outcomes. Preop, 2 yr and 5 yr imaging was obtained and analysed for presence of hip arthroplasty. **Results:** Global preop prevalence was 16/187 (8.5%), 2 yr incidence 2/153 (1.3%), 5 yr 5/88 (5.6%). Europe preop prevalence was 2/30 (6.7%), 2yr incidence 0/24, 5 yr 1/8 (12.5%); Asia preop prevalence was 3/64 (4.7%), 2 yr incidence was 2/63 (3.2%), 5 yr 1/49 (2%); North America preop prevalence was 11/93 (11.8%), 2 yr incidence 0/66, 5 yrs 3/31 (9.7%). There were noted gender differences in prevalence, preop prevalence for women was 14/148, (9.5%), preop prevalence for men was 2/39, (5.1%); incidence at 2 yr for women was 1/122, (0.8%), for men was 1/31 (3.2%); 5 yr incidence for women was 5/77 (6.5%), no new THA was recorded for men at 5 years. Previous ASD studies have reported varied prevalence of THA (Sing: 3.35%, Weinstein: 4.2%, Bedard: 4.6%, Kress: 16.4%, Buckland: 20.2%) The overall prevalence rate in the US was reported by Kremers as 0.83%. In this study, the preop prevalence is higher than the general US population based on Kremers data. **Conclusion:** In this retrospective analysis of international prospective multicenter study data, the preop prevalence of THA is on par with other reported studies and higher than general prevalence of the US population, suggesting a potential role of ASD in hip osteoarthritis prior to spinal fusion.

ID: AGS26/818
P0201: Evaluation of multimodal analgesia with specialist nurses as the main body in adult patients with degenerative scoliosis during perioperative period-A multicenter prospective controlled study

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Introduction: To explore the analgesic effect of multi-modal analgesia program with specialist nurses as the main body on adult degenerative scoliosis patients during perioperative period, and to observe the applicability of multi-modal analgesia program, so as to provide scientific guidance for clinical nursing and provide high-quality nursing services for patients. To explore the role and significance of specialist nurses in pain management system. **Material and Methods:** A prospective, non-randomized controlled study was conducted in 69 patients with adult degenerative scoliosis diagnosed preoperatively in three hospitals between January 2016 and June 2018. According to the exclusion criteria, 15 patients were excluded from the study. Fifty-four patients underwent posterior long-segment fixed orthopedics were selected, including 30 patients in the experimental group, 13 males and 17 females, aged 54-70 years, with an average of aa+bb years. In the control group, 24 patients were treated with conventional on-demand analgesia, 11 males and 13 females, aged 55-68 years, with an average of aa+bb years. The VAS score, Ramsay sedation score (4, 8, 12, 24, 48 hours after operation), S-AI state anxiety scale score (36 hours before and after operation), patient satisfaction rate (satisfaction rate = (satisfaction + general)/total number of cases (100%) and recovery after operation (first functional forging) were compared between the two groups. To evaluate the effect of multimodal analgesia with nurses as the main body on adult patients with degenerative scoliosis during perioperative period. **Results:** Visual analogue score (VAS) and sedation score of multimodal

analgesia group were significantly lower than those of routine nursing group at each time point after operation ($p < 0.05$). The satisfaction rate of postoperative analgesia in experimental group was significantly better than that in control group. There was no significant difference in S-AI state anxiety scale score between experimental group and control group before operation, and there was a score of 36 hours after operation. Significant difference ($p < 0.05$). For patients with multimodal analgesia, the anxiety score of 36 hours after operation was significantly lower than that before operation ($p < 0.05$); there was no significant difference between 36 hours after operation and that before operation in the routine nursing group ($p > 0.05$). The time of first functional exercise in the experimental group was significantly earlier than that in the control group ($p < 0.05$), and the length of hospitalization was shorter than that in the control group ($p < 0.05$). The incidence of adverse reactions in the experimental group was 1.7%, and that in the control group was 8.4%. There was a significant difference between the two groups ($p < 0.05$). **Conclusion:** Nurse-based multi-modal analgesia can significantly relieve acute pain, improve patient satisfaction, reduce the incidence of adverse reactions, and optimize the quality of medical and nursing services in adult patients with degenerative scoliosis during perioperative period. It can also alleviate anxiety and psychological pressure of patients and shorten hospitalization. Time, speed up rehabilitation exercise, prevent bedridden complications, and promote rapid recovery of patients.

ID: AGS26/834
P0202: Adult spinal deformity correction durability: does the lifespan of the construct vary among different osteotomy techniques?

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Introduction: Osteotomies play a critical role in correcting adult spinal deformity (ASD). However, as surgeons perform more aggressive osteotomies, the constructs used must withstand greater biomechanical loads, which can increase the risk of complications such as rod or screw fracture, pseudoarthrosis, and screw pull-out. Moreover, long and rigid constructs predispose patients to proximal junctional kyphosis/failure (PJK/PJF) and other mechanical complications, many of which may ultimately require revision surgery. This study evaluates a cohort of ASD patients treated with four different osteotomy techniques and compares their time to revision. **Material and Methods:** We retrospectively analyzed 146 patients who underwent posterior fusions for ASD correction between 2016 and 2022, considering only patients with ≥ 1 year of follow-up. Patients were stratified based on the osteotomy that contributed most to sagittal alignment correction: interbody disc osteotomy (IDO), pedicle subtraction osteotomy (PSO), anterior column realignment (ACR), or Ponte osteotomy. Revision-free survival time was analyzed using Kaplan-Meier curves, with follow-up extending from the index surgery to either revision or last available follow-up. Group differences were evaluated using the log-rank test. **Results:** A total of 146 patients underwent ASD correction with IDO (n = 23), PSO (n = 21), ACR (n = 32), or Ponte (n = 70) osteotomies. Groups were comparable in age, BMI, preoperative disability, and preoperative spinopelvic parameters. Kaplan-Meier analysis of revision-free survival up to 1,500 days (50 months) after surgery demonstrated no significant differences among the four osteotomy groups (Log-rank [Mantel-Cox] $\chi^2 = 2.483$, df = 3, $p = 0.478$). The IDO group maintained the most stable curve, with the highest probability of remaining revision-free during the first 18 months postoperatively. The first reoperations occurred in the Ponte group, followed sequentially by the ACR and PSO groups. Within the first year, 1 reoperation (4.8%) was recorded in the PSO group, 2 (6.3%) in ACR, and 6 (8.6%) in Ponte ($p = .516$). **Conclusion:** Although differences did not reach statistical significance, IDO demonstrated the highest early revision-free survival, most likely due to the more harmonious correction achieved, while Ponte osteotomies showed the earliest failures, in accordance with the lowest corrections achieved by such techniques, followed by ACR and PSO. These findings highlight the potential benefits of IDO in maintaining alignment stability and reducing the risk of early reoperations. Larger, long-term studies are needed to validate these observations and guide osteotomy selection for optimizing construct durability and patient outcomes.

ID: AGS26/845
P0203: Prediction of positional spinopelvic parameters in a young, healthy population is improved using the sacro-acetabular angle

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Introduction: With increasing awareness of the importance of normal spinal alignment and its restoration in spine surgery, an increasing number of spinopelvic parameters have been

identified, with variable importance. Many of these parameters are positional and involved in compensatory posture. While restoration of these angles is crucial to achieving good outcomes in the correction of spinal deformity, morphologic properties have failed to reliably predict positional properties either intra or post operatively. One of the most important morphologic parameters remains pelvic incidence (PI), which has been demonstrated to be predictive of expected lumbar lordosis (LL) and L1 pelvic angle (L1PA). The morphology leading to rotation of the pelvis around the femoral heads however, remains incompletely defined. The sacro-acetabular angle (SAA) is a morphologic parameter defined by the angle subtended by a line extending along the S1 superior endplate and a line connecting the anterior and posterior walls of the acetabulum. Version and inclination of the acetabulum define the safe arc of motion of the hip joint, necessary for both upright posture and mobilization. The version of the pelvis is limited by this orientation of the acetabulum and its articulation with the femoral head. We postulate that SAA can be used to help predict the preferred position and tilt of the pelvis, which can in turn be used to predict other positional parameters. **Material and Methods:** Full length EOS images of healthy, asymptomatic adult volunteers between 20 and 40 years old from the community were performed and segmented using the Keops® online platform. Subjects' demographic and radiographic parameters were measured and recorded. Clinical characteristics included age, gender, BMI and ethnicity. Radiographic spinopelvic parameters measured include SAA, PI, L1PA, pelvic tilt (PT), sacral slope (SS), LL, and Roussouly morphotype. SAA was determined using the sagittal image, and calculated as an average of bilateral SAA. Correlation between SAA and subjects' demographics and spinopelvic parameters were analyzed using linear regression analyses. **Results:** One hundred and eighty-seven subjects met initial inclusion criteria. Mean for SAA was 73.6 ± 8.9. There is significant correlation between SAA and SS (SS = 0.71*SAA -12.5; r^2 = 0.64) (Figure 1). Using stepwise linear regression, prediction of SS is improved when SAA and PI were both used as continuous variables (SS = 0.31*PI +0.46*SAA -9.2; r^2 = 0.71). **Conclusion:** This initial analysis shows promise that SAA can be utilized in conjunction with PI to predict normative sacral slope. This is the first step to better predict expected positional parameters using morphological parameters, and improve our understanding of overall spinal alignment as a continuous rather than categorical transformation. The significance of restoration to expected positional parameters still needs further study.

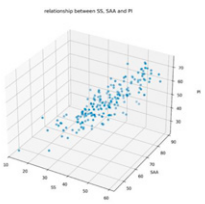


Figure 1: Relationship between sacral slope, sacro-acetabular angle and pelvic incidence, SS = 0.31*PI +0.46*SAA -9.2; r^2 = 0.71.

ID: AGS26/939

P0204: Deformity correction through minimally invasive anterior column release vs conventional posterior osteotomies: a study examining length of stay, disability, and discharge outcomes in a cohort with over one year of follow-up

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Introduction: Corrective spinal deformity procedures often require resection of posterior or middle column elements, leading to significant surgical morbidity, prolonged hospitalization, and increased complication risks. Anterior column release (ACR), performed via a retroperitoneal approach, has been proposed as a less invasive alternative that may reduce hospital length of stay (LOS). However, evidence supporting this potential advantage remains limited. This study evaluates a large cohort of adult spinal deformity (ASD) patients to compare LOS and functional outcomes between ACR and traditional posterior approaches. **Material and Methods:** We retrospectively reviewed 146 patients who underwent posterior spinal fusion extending from L2 or above to the pelvis for ASD correction between 2016 and 2022, including only those with ≥ 1 year of follow-up. Demographic data, LOS, and disability scores were collected. Comparisons were first made between the ACR group and the overall non-ACR cohort. To better contextualize ACR's performance relative to other osteotomy techniques, subgroup analyses were performed based on the highest-order osteotomy performed during correction. **Results:** Of 146 patients, 32 underwent ACR and 114 underwent non-ACR approaches. Baseline characteristics, including age, BMI, and preoperative Oswestry Disability Index (ODI), were similar between groups. ACR patients had a higher proportion of males and significantly shorter instrumented constructs compared with non-ACR patients (6.97 ± 2.41 vs. 9.04 ± 2.86 levels, $p < 0.001$). LOS was comparable between the ACR and non-ACR groups (9.88 ± 4.93 vs. 8.87 ± 4.27 days, $p = 0.400$). Further subgroup analyses by osteotomy type confirmed these findings; LOS for ACR remained slightly longer (9.88 ± 4.93 days) compared with other osteotomy groups, but the differences were not statistically significant ($p = 0.680$). Postoperative ODI scores and ODI changes were similar between groups ($p = 0.300$ and $p = 0.294$, respectively). Most patients in both groups were discharged home (p =

0.725). **Conclusion:** ACR is an effective alternative to traditional posterior approaches for correcting thoracolumbar deformities that require fusion from the pelvis to L2 or above. While minimally invasive strategies are typically associated with shorter LOS, our analysis demonstrates that this benefit does not extend to patients undergoing ACR, likely due to the higher frequency of staged procedures in this population. At one-year follow-up, functional outcomes were comparable between ACR and non-ACR cohorts, suggesting similar overall recovery despite differences in surgical technique.

ID: AGS26/962
P0205: Paraspinal muscle quality as a predictor of proximal junctional kyphosis

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Introduction: Proximal junctional kyphosis (PJK) remains a significant complication following adult spinal deformity correction, with rates ranging from 20-40%. The role of paraspinal muscle quality in PJK development has been understudied despite its potential importance in maintaining spinal alignment. **Material and Methods:** We conducted a retrospective cohort study comparing 22 patients who developed PJK with 28 patients who did not develop PJK following four levels fusion surgery for adult spine deformity. Key measures using pre-operative MRI included the Sarcopenia Index (total psoas area / vertebral body area) at the upper instrumented vertebra (UIV) and L4 levels, and Goutallier classification (grades 0-4) to quantify fat infiltration in the erector spinae and multifidus muscles at the UIV, L4/5, and L5/S1 levels. Statistical comparisons were made using the Mann-Whitney U test. **Results:** No statistically significant differences were found between cases (n = 22) and controls (n = 28) for any measured variable. The Sarcopenia Index at L4 was nearly identical between groups (Cases: 1.78 ± 0.65 vs. Controls: 1.80 ± 0.53, p = 0.938). Similarly, comparisons of psoas muscle cross-sectional area at the UIV and L4 levels showed no significant differences (all p-values > 0.18). Analysis of Goutallier grades revealed no significant differences in fat infiltration at any spinal level or muscle group (all p-values > 0.18), though both groups demonstrated the expected anatomical pattern of increasing fat infiltration in the lower lumbar levels. **Conclusion:** These findings suggest that other biomechanical, surgical, or patient-specific factors may play a more dominant role in the pathogenesis of this complication. The findings indicate that routine screening for sarcopenia alone may not be sufficient for PJK/PJF risk stratification.

ID: AGS26/971
P0206: Can postoperative changes in pelvic incidence occur after adult spine deformity surgery? When do they occur, and what factors influence them?

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Introduction: Restoring appropriate sagittal balance is a fundamental goal in adult spinal deformity (ASD) surgery. Pelvic incidence (PI) forms the anatomical basis for sagittal realignment and has traditionally been considered a fixed anatomical parameter. However, recent evidence suggests that PI may undergo postoperative changes, potentially affecting the achieved sagittal alignment. This study aimed to review the literature on postoperative changes in PI following ASD surgery and to identify potential radiological and surgical predictors of such modifications. **Material and Methods:** Studies reporting postoperative PI changes in ASD patients were systematically reviewed. Inclusion criteria required use of standing full-spine or full-body X-rays for spinopelvic measurements. The primary outcome was the prevalence of significant PI changes (> 5°). Subgroup and metanalyses were performed to identify radiological and surgical predictors, including sacropelvic fixation, fusion length, preoperative PI value, and sagittal vertical axis (SVA). **Results:** Thirteen studies (1055 patients) met the inclusion criteria. All included studies assessed spinopelvic parameters using standing full-spine X-rays, except for one that used full-body standing X-rays, demonstrating moderate\high reproducibility in PI measurement (ICC: 0.71-0.96). While the mean absolute PI value remained stable postoperatively, 46.3% of patients experienced significant changes (> 5°). Factors associated with significant PI variations included preoperative lumbar lordosis (p = 0.02 I2 = 96.2%) preoperative PI-LL mismatch (p = 0.005 I2 = 95.1%), and preoperative SVA (p = 0.03 I2 = 97.6%). Sacropelvic fixation reduced PI instability, whereas prolonged anterior imbalance and compensatory pelvic retroversion increased the likelihood of PI shifts. Interestingly, patients with extreme PI values-whether high or low-were prone to postoperative changes in PI, with an increase in low PI or decrease in high PI. Long-term follow-ups indicated that PI changes could not recover or increase in patients without sacropelvic fixation and in patients with

higher preoperative PI values if they experience a decrease in PI postoperatively. **Conclusion:** The current evidence challenges the traditional view of pelvic incidence as a fixed parameter in ASD surgery, especially in patients with marked sagittal imbalance or extreme PI values. Recognizing that PI may change under specific preoperative or surgical conditions could help refine alignment targets and optimize postoperative realignment in selected subgroups of patients.

ID: AGS26/1209
P0207: Updating the coronal imbalance classification for degenerative scoliosis: a relook into the type A subtype

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Introduction: The purpose of this study is to propose a refined coronal imbalance classification with subgroup analysis of degenerative scoliosis (DS) patients with Type A coronal pattern and to ascertain its implications on postoperative coronal imbalance (CIB). **Material and Methods:** A total of 239 DS patients who underwent spinal correction surgery were recruited in this study. Patients were divided into Type A, B, and C based on the Nanjing coronal imbalance classification system. Patients with Type A coronal imbalance were further divided into three subtypes according to the coronal balance distance (CBD) and the tendency of trunk inclination: Type Aa, CBD $\leq$ 1 cm; Type Ab, CBD > 1 cm, and C7 Plumb Line (C7PL) shifted to the concave side of the curve; Type Ac, CBD > 1 cm and C7PL shifted to the convex side. The Scoliosis Research Society (SRS)-22 questionnaire scores were analyzed, and the incidence of postoperative CIB was compared across groups. **Results:** The incidence of postoperative CIB is 23% (32/139) in the Type A group, 18% (11/60) in the Type B group, and 58% (23/40) in the Type C group ($p < 0.001$). Among patients with Type A coronal alignment, 54 patients were Type Aa, 46 patients were Type Ab, and 39 patients were Type Ac. After surgery, 32 patients had a postoperative coronal imbalance, with 5 patients in Type Aa (9%), 5 patients in Type Ab (11%), and 22 patients in Type Ac (56%). Postoperative coronal malalignment was found to be more prevalent in Type Ac patients ($p < 0.001$). **Conclusion:** Patients with Type Ac coronal imbalance are at greater risk of postoperative CIB following surgery compared with patients with Type Aa and Type Ab alignment. The modified coronal imbalance classification highlights the high risk of CIB in Type Ac, similar to the Type C coronal imbalance pattern. These findings provide a more comprehensive delineation of coronal alignment phenotypes and introduce a refined system for stratifying the risk of postoperative CIB.

ID: AGS26/1212
P0208: Modified intradiscal osteotomy: a versatile technique in adult spinal deformity surgery

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Introduction: Adult spinal deformity is a complex entity which can involve sagittal and coronal malalignment. An increase in ASD prevalence has been reported, being > 60% in population > 60 years old. Both sagittal and coronal malalignment had been associated with less health-related quality of life. ASD surgery stills a challenge, multiple improvements in osteotomy techniques have been described mainly for sagittal balance correction. Here we describe a modification to the intradiscal osteotomy technique described by Ramey, through a combined posterior and lateral approach aiming a non-structural intersomatic fusion, achieving a partial correction of the main curve avoiding postoperative malalignment and also increasing segmental lordosis. **Material and Methods:** It is a technical report in which we present a modification to the intradiscal osteotomy technique. The objective of this modification is to optimize the coronal alignment through a non-structural intersomatic fusion, with a less invasive technique and also gaining lordosis in the intervertebral segment. **Results:** A midline incision is made and the muscular plane is dissected until the facet joints of the targeted level are located. A total facetectomy is then performed. Subsequently, using de fluoroscopy, the intervertebral disc of the target segment is located in lateral projection. The anterior and posterior borders of the vertebral bodies and the disc space are marked. A 2 cm transverse incision is made, the external oblique fascia is incised and blunt dissection is used to dissect the external oblique, internal oblique and transverse muscle until reaching the fascia transversalis which we also incised to enter the retroperitoneum. The initial dilator is placed on a previously planned trajectory according to patient anatomy, vertebral level and Moro classification of zones. Electrostimulation is performed through the dilator to verify that we are not close to or over any lumbar plexus branch. Once in a safe area, under fluoroscopic control, the initial dilator is impacted to reach the disc space. Then, the working sleeve is placed and the initial dilator is removed. A drill, disc rongeur and disc shaver are used to perform discectomy and preparation of end plates. Finally, the allograft or autograft selected according to the patient's characteristics is placed though the working sleeve with and impactor to achieve the non-structural intersomatic fusion without horizontalizing the endplates of the intervertebral segment. **Conclusion:** This

modified technique is useful in adult spinal deformity surgery, in the coronal plane it allows us to perform a partial correction of the main curve without horizontaling completely the vertebral endplates of the segment. This is especially useful in the superior arch of the main curve in coronal curves where complete horizontalization of L4 coronal tilt is not achieved and we need to make a match between the fractional and the main curve to avoid postoperative over correction of the main curve and coronal malalignment. In the sagittal plane combining it with a Ponte or Smith-Peterson osteotomy we can achieve up to 5-10° of lordosis in the segment.

ID: AGS26/1220
P0209: Comparison of transverse process hooks versus pedicle screws at the upper instrumented vertebra in adult spinal deformity surgery involving three-column osteotomy

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Introduction: In adult spinal deformity (ASD) surgery involving three-column osteotomy and pelvic fixation, the fixation technique at the upper instrumented vertebra (UIV) may influence junctional integrity and long-term outcomes. This study compares transverse process hook (TPH) versus pedicle screw (PS) fixation at the UIV. **Material and Methods:** A retrospective review was conducted on 132 ASD patients who underwent three-column osteotomy and pelvic fixation with a minimum 2-year follow-up. Patients were categorized by UIV fixation method: TPH or PS. Patient-reported outcome measures (PROMs) including Visual Analog Scale (VAS), Oswestry Disability Index (ODI), and SF-36 were recorded preoperatively and at 6, 12, and 24 months postoperatively. Rates of proximal junctional kyphosis (PJK), proximal junctional failure (PJF), and reoperation were compared. **Results:** PROMs were comparable between the TPH and PS groups at all time points. PJK was observed in 25.7% of patients in the TPH group and 31.1% in the PS group ($p < 0.05$). PJF occurred in 12.0% (TPH) versus 17.0% (PS) ($p = 0.21$). Reoperation rates were high in both groups, 31.8% for TPH and 37.0% for PS, with no statistically significant difference ($p = 0.38$). **Conclusion:** While PROMs were similar between groups, the use of pedicle screws at the UIV was associated with a significantly higher rate of PJK compared to hooks. These findings suggest that transverse process hooks may help reduce junctional complications. However, this did not translate into a lower reoperation rate, highlighting the multifactorial nature of surgical failure in complex ASD reconstructions.

ID: AGS26/1233
P0210: Comparison of the predictive efficacy of the C - GAP score for postoperative mechanical complications in patients with degenerative and idiopathic adult spinal deformity

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Introduction: Compare the predictive efficacy of the C-GAP (Chinese ethnicity-tailored GAP, C-GAP) score for postoperative mechanical complications in patients with degenerative and idiopathic adult spine deformity (ASD). **Material and Methods:** A retrospective analysis was conducted on 98 patients with adult spinal deformity (ASD) who underwent posterior spinal orthopedic internal fixation in our hospital from January 2017 to December 2022 and were followed up for more than 1.5 years. Among them, there were 16 males and 82 females, with an average age of 43.47 ± 14.73 years and an average follow - up time of 21.47 ± 9.62 months. According to the patients' past medical history and imaging features, the ASD patients were divided into the idiopathic adult spinal deformity group (IS group, 47 cases) and the degenerative adult spinal deformity group (DS group, 51 cases). The immediate postoperative sacral slope (SS), pelvic tilt (PT), pelvic incidence (PI), lumbar lordosis (LL), distal lumbar lordosis (DLL), global tilt (GT), sagittal vertical axis (SVA), and thoracic kyphosis (TK) of the patients were measured by standing full - spine anteroposterior and lateral x - ray films, and the C - GAP score was calculated. The IS group and the DS group were further sub - grouped according to the C - GAP score: the coordinated group P (C - GAP score 0 - 2 points), the moderately uncoordinated group MD (C - GAP score 3 - 6 points), and the severely uncoordinated group SD (C - GAP score 7 - 12 points). The occurrence of mechanical complications (MC) at the last follow - up was recorded, including proximal/distal junction kyphosis (PJK/DJK), proximal/distal junction failure (PJF/DJF), and internal fixation failure. The predictive efficacy of the C - GAP score for the IS and DS groups was evaluated by the area under the receiver operating characteristic curve (ROC) (area under the curve, AUC). **Results:** Among the 98 ASD patients, a total of 25 cases (28.4%) developed postoperative mechanical complications, including 21 cases of PJK, 2 cases of PJF, and 2 cases of DJF. In the IS group with 47 patients, the P, MD, and SD subgroups included 27, 20, and 0 patients respectively, and the incidence rates of MC were 22.2% and 15.0% respectively ($p = 0.713$). The C - GAP score had no predictive ability for postoperative complications in the IS group (AUC = 0.443, $p = 0.598$). In the

DS group with 51 patients, the P, MD, and SD subgroups included 18, 24, and 9 patients respectively, and the incidence rates of MC were 11.1%, 37.5%, and 55.6% respectively ($p = 0.043$). The C - GAP score had good predictive ability for postoperative complications in the DS group (AUC = 0.701, $p = 0.022$). **Conclusion:** Compared with idiopathic adult spinal deformity, the C-GAP score is more applicable to the prediction of postoperative mechanical complications in degenerative adult spinal deformity. The prediction of postoperative MC in patients with idiopathic ASD using the C-GAP score needs further improvement.

ID: AGS26/1244
P0211: Paraspinal sarcopenia in patients with degenerative spinal deformity: implication in clinical outcomes

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Introduction: Recent studies suggest that paraspinal sarcopenia is distinct from systemic sarcopenia and influences the clinical manifestations of patients with degenerative lumbar stenosis (DLS). It was found that systemic sarcopenia is more prevalent and paraspinal muscle degeneration was more severe in patients with degenerative spinal deformity (DSD). However, the prevalence and clinical impact of paraspinal sarcopenia and its correlation with systemic sarcopenia remains unclear. **Material and Methods:** A total of 106 patients with DSD and 157 patients with degenerative lumbar stenosis were prospectively included in our intuition. Systemic sarcopenia was diagnosed according to diagnostic criteria recommended by the Asian Working Group for Sarcopenia (AWGS). hand grip strength, 6-meter walk test and 5-time chair stand test. Paraspinal muscle fat infiltration rate (FI%) and cross-sectional area were measured in MRI scans. The paraspinal muscle extensor endurance test (ET) was performed at baseline according to Ito test. The paraspinal muscle maximal exert (MVE) was measured using hand-held dynamometry. One-quarter of patients with significant multifidus muscle atrophy were defined as paraspinal sarcopenia in DSD patients. Degenerative characteristics of DSD including facet joint degeneration, Clinical measures of HRQoL included the SRS-22 and visual analog scale scores (VAS) for back pain and leg pain. The Spearman's correlation coefficient was used to examine the correlation between the paraspinal muscle measurements and sarcopenic values or clinical outcome scores. **Results:** A total of 263 patients enrolled in this study. The average age (61.8 ± 6.4 vs. 59.6 ± 5.3, $p > 0.05$) did not differ between the DSD group and the DLS group. A total of 21.7% of DLS and 51.9% of DSD were diagnosed as generalized sarcopenia. The correlation strength between sarcopenia measurements (Grip strength) and paraspinal muscle parameters including MF FI% and ET (rho = 0.31, $p < 0.05$), MVE (rho = 0.32, $p < 0.05$) low in DSD patients. The multifidus muscle fat infiltration rate (MF FI%) of DSD patients was $34.8 \pm 18.6\%$, while $22.6 \pm 12.2\%$ in DLS patients. One-quarter of DSD patients demonstrated approximately 40% fat infiltration in MF muscle. MF FI% showed a negative correlation with VAS-back and SRS-22 scores in DSD patients. DSD patients with paraspinal sarcopenia had lower endurance time (11.8 vs. 21.5s) and MVE (76.5 vs. 88.0N) and poor HRQoL (SRS-22, 2.4 ± 0.9 vs. 2.6 ± 0.8, $p = 0.035$) compared to non-paraspinal sarcopenia patients. **Conclusion:** Our findings offer substantial evidence for site-specific muscle loss of paraspinal muscle that is different from systemic sarcopenia in patients with DSD. DSD patients with paraspinal sarcopenia were characterized by loss of paraspinal function, impaired HRQoL. These findings provide new insights into the unique pathophysiology and screening DSD patients with poor HRQoL, as well as help to develop personalized muscle augmentation strategies.

ID: AGS26/1383
P0212: Endovascular management of pedicle screw-related aortic injuries: a case series and literature review

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Introduction: Aortic injuries in spine surgery are rare but potentially life-threatening complications. This study presents our experience managing aortic injuries caused by pedicle screw placement in spinal surgery. **Case Presentation:** Case 1: A 29-year-old woman underwent T3-L4 instrumentation for scoliosis at an external institution. Six months postoperatively, she presented to our institution with a lumbar surgical site infection, which was managed appropriately. One month after admission, she developed dyspnea, chest pain, and hypoxia. Imaging studies revealed pulmonary thromboembolism and, incidentally, a left T7 pedicle screw in contact with the descending aorta. Intravascular ultrasound confirmed a 5 mm deformation of the aortic wall without perforation. A multidisciplinary team decided to proceed with endovascular stent placement and pedicle screw removal. The procedure was successful, and the patient had an uneventful recovery. Case 2: A 37-year-old man sustained multiple vertebral fractures following a fall from a height of more than five meters. He underwent T7-T10 instrumentation at another institution. Four months later, he presented to our hospital with dyspnea and

progressive functional decline. Imaging studies revealed a T7 pedicle screw eroding the aortic wall, with no other findings related to his initial symptoms. Intravascular ultrasound confirmed the diagnosis. The patient underwent endovascular stent placement and pedicle screw removal, following the same protocol as the first case. **Results:** In both cases, the affected pedicle screws were successfully removed and repositioned, and endovascular stents were placed without complications. Both patients recovered without complications and continue under routine follow-up, with no reported symptoms to date. **Conclusions:** Although rare, postoperative vascular complications from pedicle screws can lead to significant morbidity and may present a wide range of symptoms. Endovascular treatment, combined with pedicle screw removal or repositioning, is the preferred management strategy. Based on our experience, intravascular ultrasound is a valuable tool for confirming diagnosis and guiding treatment.

ID: AGS26/1405
P0213: Risk factors for rod fracture in adult spinal deformity: emphasis on postoperative spinopelvic parameters

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Introduction: Adult spinal deformity (ASD) is associated with pain, disability, and diminished quality of life. Corrective surgery has improved outcomes, yet implant-related complications such as rod fracture remain a significant challenge, often necessitating revision surgery. While prior studies have identified risk factors including body mass index (BMI), osteotomy, and implant characteristics, the influence of postoperative spinopelvic alignment on rod durability remains unclear. This study aimed to identify demographic, surgical, and particularly postoperative radiographic predictors of rod fracture. **Material and Methods:** We conducted a retrospective cohort study of ASD patients undergoing posterior spinal fusion across ≥ 5 instrumented levels at a single academic center (2013-2023). Patients with tumor, infection, trauma, or pathologic fractures were excluded. Demographic, operative, and radiographic data were collected from a prospectively maintained database. Radiographs were analyzed preoperatively, postoperatively, and at 1 year. Rod fracture was defined as radiographic evidence of rod discontinuity. Patient-reported outcomes were assessed with the Oswestry Disability Index (ODI). Logistic regression was performed to identify independent predictors, with model calibration and discrimination evaluated using the Hosmer-Lemeshow test and area under the receiver operating characteristic curve (AUC). **Results:** A total of 138 patients were included, with 41 (29.7%) developing rod fracture during follow-up. Demographics, including age, sex, BMI, ASA class, and smoking status, were not independently associated with fracture. Preoperative radiographic measures showed no significant associations. Postoperative spinopelvic parameters, however, were predictive. Greater lumbar lordosis (OR 1.12, $p = 0.034$), increased pelvic tilt (OR 1.17, $p = 0.028$), and larger PI-LL mismatch (OR 1.09, $p = 0.050$) were significantly associated with increased fracture risk. Larger rod diameter was protective (OR 0.0093, $p = 0.014$). Reduction in modified pelvic femoral angle showed a trend toward decreased risk ($p = 0.069$). The model demonstrated good calibration (Hosmer-Lemeshow $p = 0.64$) and acceptable discrimination (AUC = 0.77). **Conclusion:** Rod fracture occurred in nearly one-third of ASD patients, a higher rate than previously reported. Unlike prior studies emphasizing demographic and operative factors, this analysis highlights the critical role of postoperative sagittal alignment in influencing rod durability. Increased lumbar lordosis, pelvic tilt, and PI-LL mismatch were independent predictors of fracture, while larger rod diameter conferred protection. These findings underscore the biomechanical contribution of sagittal balance to rod stress and suggest that optimizing postoperative alignment, alongside robust construct selection, may mitigate fracture risk.

ID: AGS26/1447
P0214: Evaluation of segmental lordosis following lumbar PSO and its impact on proximal junction failure

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Introduction: Proximal Junctional Failure (PJF) is a common long-term complication in patients undergoing ASD surgery. Various factors have been identified as potential risk factors for PJF such as obesity, inadequate postoperative sagittal balance, advanced age, and osteoporosis. This study aims to evaluate the impact of sagittal alignment parameters and segmental lordosis distribution on the risk of PJF in upper thoracic fusion

patients instrumented to the pelvis who underwent a PSO. **Material and Methods:** The cohort consisted of 67 ASD patients who underwent upper thoracic fusion (T1-T8) to the sacrum with PSO. Patients were grouped based on if they underwent revision surgery for PJK (PJF). Preoperative and postoperative sagittal parameters, including thoracic kyphosis (TK), pelvic tilt (PT), lumbar lordosis (LL), C7 sagittal vertical axis (SVA), C2 SVA, L1 pelvic angle (L1PA), alignment using L1PA and T4PA, segmental lordosis of each lumbar level, and Roussouly types, were analyzed. To determine segmental lordosis, we measured from the upper endplate of each vertebra. Statistical correlations were made to identify significant differences in these parameters between patients with and without PJF. **Results:** Of the 67 ASD patients, 30 had 2-year follow up. The percentage of patients who developed PJF within 2 years was 13.4%. Patients with L3 PSOs who had less change in LL from preoperative to postoperative (17.4 vs 39.8, $p = 0.006$), and had less postoperative LL (38.5° vs 59.2°, $p < 0.001$) were more likely to develop PJF. Increasing segmental lordosis at L2-L3 increased the risk of developing PJF after a PSO (PJF:7.25, No PJF 2.19, $p = 0.0395$). Assessment of other sagittal parameters, including TK, PT, C7 SVA, C2 SVA, L1PA, L1PA alignment (aligned vs malaligned), L1PA + T4PA alignment, Roussouly types, or segmental lordosis at other levels; these factors did not show any significant correlation with PJF occurrence. **Conclusion:** In patients undergoing ASD surgery extending to the upper thoracic region, inadequate correction of lumbar lordosis following a PSO increases the risk of revision surgery for PJK. However, restoring this lumbar lordosis more proximal to the PSO within the lumbar spine may also elevate the risk of PJF.

ID: AGS26/1475

P0215: Intensive care unit admission after three column osteotomy for adult spinal deformity is associated with inferior perioperative course and negates patient-reported outcome measure improvements

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Introduction: Three column osteotomies (3CO) are useful in correcting stiff deformities in adult spinal deformity (ASD). However, they increase surgical risk, and patients are often admitted to the ICU postoperatively. The effect of ICU admission after 3CO on perioperative course and patient-reported outcome measures (PROMs) remains unclear. We evaluate 1) perioperative outcomes and 2) changes in PROMs between patients admitted to ICU versus floor following 3CO. **Material and Methods:** ASD patients undergoing 3CO from 2016-2023 with 2-year follow-up were stratified by postoperative admission to ICU vs. Floor. 1) Multivariable logistic/linear regressions models assessed the impact of ICU admission on inpatient complications, length of stay (LOS), discharge disposition (facility vs home), and late ambulation (ambulation after postoperative day 2). 2) Mixed-effects models compared changes in PROMIS domain scores within and between ICU and floor groups across baseline, 1-year, and 2-years. Significance level was set at $p < 0.05$. **Results:** 196 patients met criteria and were grouped into postoperative ICU (N = 64) and Floor (N = 132). There were no significant differences in demographics and comorbidities between groups. 1) ICU patients had higher rates of any inpatient complication [86.4% vs. 51.5%, $p < 0.001$], including non-surgical site infection, cardiac/pulmonary event, respiratory failure, anemia, hypotension/tachycardia, and renal injury (all $p < 0.05$). LOS [9(6.3) vs. 6(4) days, $p < 0.001$], discharge to a facility [73.4% vs. 56.8%, $p = 0.04$], late ambulation [83.6% vs. 49.2%, $p < 0.001$], and transfusion rate [71.2% vs 50.8%, $p = 0.010$] were higher in ICU patients. Readmission and reoperation rates were not significantly different at 90-days and 2-years. On multivariable regression, ICU [β 3.2 (1.5-5.0), $p < 0.001$] and inpatient complication [β 1.7 (0.08-3.3), $p = 0.041$)] significantly predicted increased LOS. ICU [OR 5.05 (2.22-12.6), $p < 0.001$] and EBL [OR 2.32 (1.17-4.67), $p = 0.016$] significantly predicted inpatient complications. Finally, ICU [OR 3.55 (1.6-8.40), $p = 0.003$] was a significant predictor for late ambulation. 2) Baseline PROMIS were similar between groups. Global Physical score was higher in Floor at 1-year [37.9(9.3) vs. 33.4(6.8), $p = 0.01$]; Global Mental score [42.2(9.8) vs. 37.4(10.1), $p = 0.04$] and Physical Function score [34.8(9.1) vs. 30.1(7.2), $p = 0.01$] were higher in Floor at 2-years. Mixed effects modeling examined changes in PROMIS over time. Within ICU, PROMIS did not significantly improve across any time interval ($p > 0.05$). Within Floor, Global Physical scores improved from baseline to 1-year [4.14(1.83-6.46), $p < 0.001$] and baseline to 2-years [3.71(1.24-6.18), $p < 0.001$]. Global Mental improved from baseline to 1-year [2.86(0.38-5.35), $p = 0.015$]. Physical Function scores improved from baseline to 1-year [2.93(0.88-4.98), $p = 0.001$] and baseline to 2-years [2.81(0.060-5.01), $p = 0.005$]. When comparing ICU and Floor groups over these intervals, the Floor group demonstrated significantly greater improvements in Global Physical scores from baseline to 1-year. There were no significant differences in the amount of PROM improvement between the ICU and No ICU groups at other timepoints. **Conclusion:** 1) ICU admission after 3CO is associated with increased inpatient complication, longer hospitalization, and delayed mobilization. Routine ICU placement should be avoided if not medically necessary to optimize hospital course. 2) Patients without ICU admission experience significant PROM improvements for up to 2-years

while those with ICU admission fail to experience meaningful PROM improvements over time.

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P0216: Pelvic incidence determines spinal alignment in the sitting position

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Introduction: Current alignment guidelines are derived from standing radiographs, which may not accurately reflect daily activities such as sitting. The T4-L1-Hip axis has been established as a reliable tool for defining normative sagittal alignment in the standing position using vertebral pelvic angles (VPA). However, sitting alignment parameters are still not well understood. Understanding normal sitting alignment is clinically important, especially for non-ambulatory patients. This study aimed to establish normative spinal alignment in the sitting position by developing pelvic incidence (PI)-based formulas. The goal was to describe VPAs and vertebral tilts (VTs) among asymptomatic adults in the sitting position. **Material and Methods:** This retrospective study examined lateral standing and sitting radiographs from 1,428 adults being considered for hip replacement. Exclusion criteria included prior spinal surgery, disc degeneration visible on imaging (such as osteophytes, endplate sclerosis, disc space narrowing), spondylolisthesis, or a coronal Cobb angle (CA) greater than 10°. The measured spinal and pelvic parameters included PI, pelvic tilt (PT), L1-S1 CA, VPAs, and VTs from L5 to T10, which was the most proximal vertebra visible on sitting radiographs. Relationships between PI and other spinopelvic parameters were assessed using Spearman's correlation (ρ), and linear regression was used to model sitting alignment. **Results:** A total of 553 patients (278 females, 255 males) met the inclusion criteria, with a mean age of 56.91 ± 11.49 years, BMI of 28.44 ± 5.46 kg/m^2, and sitting PI of 55.45° ± 10.78. Sitting VTs were: L5VT -25.49° ± 10.76, L4VT -18.48° ± 9.61, L3VT -15.38° ± 8.67, L2VT -14.28° ± 7.85, L1VT -13.91° ± 7.16, T12VT -13.69° ± 6.54, T11VT -13.45° ± 6.13, and T10VT -13.36° ± 5.86. VT variability progressively decreased, and distributions became more symmetrical at proximal levels. Thoracic VTs (T10-T12) were weakly correlated with PI (ρ = -0.14, -0.19, -0.17; all $p < 0.001$), whereas lumbar VTs (L1-L5) had stronger correlations (ρ = -0.18 to -0.50, all $p < 0.001$). PT demonstrated a strong correlation with PI (ρ = 0.61, $p < 0.001$). Linear regression showed PI explained 4.6% (R^2, $p < 0.001$) of the variance in L1-S1. Established formulas for normal sitting VPAs included: T10PA = 0.57×PI-10.08 (R^2 = 0.36), L1PA = 0.55×PI-11.01 (R^2 = 0.52), and L4PA = 0.35×PI-4.15 (R^2 = 0.64) (all $p < 0.001$). T10PA and L1PA were nearly perfectly correlated (r = 0.94, R^2 = 0.88), with differences of ≤ 8.4° in 80% of cases; L1PA and L4PA also showed a strong correlation (r = 0.84). **Conclusion:** PI is a strong determinant of thoracolumbar alignment while sitting, similar to its role in standing. This study provides PI-based formulas for sitting spinal alignment that could serve as normative targets for non-ambulatory patients. The relationship between T10PA and L1PA suggests they can be used interchangeably for clinical assessment in the sitting position. High PI is associated with increased pelvic motion during sitting, emphasizing the need for personalized alignment goals.

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P0217: Do males and females have similar patient-reported outcomes in ASD surgery?

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Introduction: ASD cohorts are largely female (80-85%), but the outcome difference between males and females is

incompletely studied. Bumpass et al. (2017) suggested no outcome differences between sexes in an ASD cohort, and there are no other reports. There is much interest in sexual dimorphism in patient-reported outcomes in surgery. In total knee replacement, female patients generally report worse pain and function pre-op, and post-operative outcomes are worse in females. In 80% of reports involving sex differences in lumbar degenerative surgeries, female patients had at least one category of worse outcome scores. Therefore, we sought to examine sex differences in ASD surgery outcomes. **Material and Methods:** In this post-hoc analysis from prospectively collected data, elderly ASD (> 60 years) patients from the international, multicentre Prospective Evaluation of Elderly Deformity Surgery (PEEDS) study were divided into male and female cohorts. Radiographic and outcomes data were collected at 2- and 5-years post-operative. Multivariate linear regression adjusted for age, BMI, and Charlson Comorbidity Index, and unadjusted linear mixed-effects regression models were constructed for patient-reported outcomes (SRS, ODI, EQ5D) and radiologic parameters, with interaction terms for time and gender. Two-sided Wald tests were performed to test for significant differences ($\alpha = 0.05$). **Results:** Of 219 patients at inception of the cohort (176 females and 43 males), there were 144 females (81.2%) and 33 males (76.7%) with 2-year follow-up and 94 (53.4%) and 22 (51.2%) at 5-year follow-up. There were no differences in pre-operative demographics or comorbidities between sexes, except for a significantly increased rate of osteopenia (51% vs 17%) in females ($p = 0.006$); however, osteoporosis rates were not different (11% females vs 13% males). The only significant sex difference in pre-operative radiographic measurements was a higher SVA in males ($p = 0.024$). The only significant postoperative measurement was the PJK angle at the UIV+1, which was not different at 2-years, but significantly different at 5-years (15 deg female vs 20 deg male). There were no significant sex differences between pre- and postoperative SRS, ODI or EQ-5D at 2-years follow-up, but SRS-mental health subscore became different between groups at 5-years (4.1 male vs 3.7 female) ($p = 0.04$). With linear regression adjusted for age, BMI and comorbidity, there were no differences between sexes at 2-years postoperative. By 5-years postoperative, improvements for men were higher in SRS-total score ($p = 0.015$), mental health ($p = 0.005$) and self-image (0.022), and there was an increase in thoracic kyphosis in women at 5-years. In addition, depression rates were significantly higher in women at 5-years (OR 4.0 [95% CI 1.0-15.7]; $p = 0.049$), whereas there were no differences between groups at baseline and 2-years postoperatively. With mixed-effects linear regression adjusted for age, BMI and comorbidity, with the addition of an interaction term for time and gender, there were significant differences in favor of men for SRS-total score ($p = 0.038$), pain ($p = 0.026$), self-image ($p = 0.035$) and ODI ($p = 0.04$). **Conclusion:** While there are large differences in incidence of ASD between sexes, there are no apparent differences in pre- and post-operative radiographic measures or patient-reported outcomes at baseline (except for higher SVA in males) and at 2-years after ASD surgery. By 5-years postoperatively, women have significantly higher PJK angle than males and less thoracic kyphosis. Perhaps accordingly, there was no continued improvement in total SRS scores. In addition, women had 4X more significant depression by 5-years post op. These results are tempered by a low follow-up rate. Gender differences at 5-years postoperative in ASD surgery, particularly the association with higher PJK angles in women and evolving rates of depression, will deserve further exploration.

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P0218: Prone lateral anterior column realignment versus pedicle subtraction osteotomy for fracture-related adult spinal deformity: a matched cohort analysis

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Introduction: Prone lateral spinal surgery enables simultaneous lateral and posterior access, improving operative efficiency. With advances in minimally invasive techniques, anterior column realignment (ACR) has emerged as a less invasive alternative to pedicle subtraction osteotomy (PSO) for adult spinal deformity (ASD). This study compared the radiographic and clinical outcomes of prone lateral ACR versus PSO. **Materials and Methods:** We retrospectively analyzed ASD patients with vertebral fracture-related deformities who underwent prone lateral ACR between April 2019 and April 2023. Patients who underwent PSO for similar etiologies were matched by age, body mass index, and Charlson Comorbidity Index (CCI). A modified ACR classification was applied to stratify procedures by complexity, subdividing high-grade ACR into Grades 5A, 5B, 6A, and 6B based on single versus multilevel corpectomy and the use of posterior osteotomies. Demographics, perioperative variables, complications, radiographic parameters, and patient-reported outcome measures (PROMs) were evaluated with a minimum 2-year follow-up. **Results:** Forty patients were included (20 ACR, 20 PSO). Baseline characteristics were comparable between groups. Both techniques achieved significant improvements in lumbar lordosis, pelvic tilt, and global sagittal alignment, with no difference in local Cobb angle correction. Compared with PSO, ACR required fewer fusion levels (4.8 ± 2.0 vs. 6.9 ± 1.4, $p < 0.001$) and resulted in reduced blood loss (1411 ± 1023 vs. 2074 ± 1227 mL, $p = 0.045$). The modified ACR classification demonstrated a predictable gradient of segmental correction from 17° in low-grade cases to > 70° in multilevel corpectomy with posterior osteotomy. **Conclusion:** Prone lateral ACR achieves radiographic correction equivalent

to PSO with fewer fusion levels and lower blood loss, supporting its role as a less invasive alternative for ASD correction. The modified ACR classification provides a framework for estimating achievable correction and guiding surgical planning. Further prospective studies are warranted to confirm long-term outcomes.

ID: AGS26/1522
P0219: Prospective cohort comparison of long construct durability in adults between combined or single posterior approach

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Introduction: Adult spinal deformity (ASD) requiring long-segment thoracolumbar fusion with pelvic fixation represents a particularly high-risk population in which sustained radiographic correction and construct durability are paramount. Posterior-only fusion remains the most employed technique, whereas combined anterior-posterior fusion theoretically augments anterior column support but entails greater operative complexity and morbidity. Comparative evidence in large prospective cohorts with extensive constructs and long-term follow-up is scarce. This study prospectively investigates radiographic, clinical, and mechanical outcomes of posterior-only versus combined anterior-posterior fusion in patients undergoing long-segment ASD correction with pelvic fixation. **Methods:** This prospective cohort included consecutive ASD patients undergoing instrumented thoracolumbar fusion spanning ≥7 levels with pelvic fixation (2016-2023). Patients were treated with posterior-only or combined anterior-posterior fusion. Selection of the approach was determined by rigidity and need for a 3-column osteotomy. Outcomes included radiographic correction, patient-reported outcomes (ODI, SRS-22r), and mechanical complications, with Kaplan-Meier survival analysis for mechanical complications; rod fracture and proximal junctional kyphosis (PJK). **Results:** A total of 207 patients were analyzed (posterior-only, n = 114; combined anterior-posterior, n = 93). Baseline demographics and comorbidities were similar between groups, with no differences in age (62.7 vs. 61.3 years, p = 0.40), sex distribution (78% vs. 77% female, p = 1.0), or major comorbidities. Posterior-only patients more frequently underwent pedicle subtraction osteotomy (31% vs. 9%, p < 0.001). Operative characteristics differed: combined procedures had longer operative times (671 vs. 535 minutes, p < 0.001) and longer hospital stays (10.1 vs. 8.1 days, p < 0.001), but lower blood loss (1283 vs. 1651 mL, p = 0.012). Both approaches achieved durable correction. Lumbar lordosis increased by 20.7° in posterior-only and 17.7° in combined fusion (p = 0.23). Pelvic incidence-lumbar lordosis mismatch improved by 18.3° versus 12.5° (p = 0.012), and sagittal vertical axis decreased by 43.4 mm versus 30.4 mm (p = 0.08). Pelvic tilt improved in both groups (-5.5° vs. -3.0°), with a modest between-group difference (p = 0.046). GAP scores decreased significantly from baseline (posterior: 9.2 to 5.2; combined: 8.8 to 5.0), without between-group difference. T4-L1 pelvic angle mismatch also improved substantially (posterior: 10.4° to 2.4°; combined: 9.0° to 2.6°), again with no between-group difference. Patient-reported outcomes improved comparably across groups. ODI decreased by 19.8 points in posterior-only and 18.9 points in combined fusion (p = 0.73). All SRS-22r domains (pain, function, self-image, mental health, satisfaction) improved significantly within groups, with no between-group differences. MCID achievement rates were similar for ODI (65% vs. 64%) and all SRS-22r domains. Mechanical complications differed: rod fractures occurred in 14.9% of posterior-only versus 3.2% of combined cases (p = 0.01). Kaplan-Meier analysis confirmed superior rod fracture-free survival (log-rank p = 0.0099) and composite complication-free survival (p = 0.0199) in the combined cohort. Proximal junctional kyphosis was less frequent with combined fusion (10.8% vs. 19.3%), though not statistically significant (p = 0.17). **Conclusions:** Both posterior-only and combined anterior-posterior approaches provide durable radiographic correction and meaningful clinical improvement in ASD. However, combined fusion reduces rod fracture risk and enhances mechanical complication-free survival, supporting its role in long-segment ASD surgery improving the construct durability.

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P0220: Impact of GLP-1 agonist use on short-and long-term outcomes following adult spinal deformity surgery: a propensity score-matched analysis

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Introduction: Adult spinal deformity (ASD) is associated with a high risk of postoperative complications. Recently, there has been an increase in research evaluating the effects of Semaglutide and Glucagon-like peptide-1 (GLP-1) receptor agonists on postoperative outcomes due to its increasing popularity in treatment of diabetes and obesity. Prior research remains conflicted regarding GLP-1 agonist use on rates of postoperative complications, reoperation, and pseudarthrosis in spine surgery; however, the impact of GLP-1 agonist use on ASD surgery remained unknown. This study aims to evaluate short- and long-term outcomes in ASD surgery using a national database. **Material and Methods:** Adult patients who underwent spinal deformity surgery between 2010 and 2023 were identified using the PearlDiver Mariner database using multi-level spinal fusion procedure CPT codes along a diagnosis of ASD. Patients were grouped based on GLP-1 use within 1 year preoperatively. Exclusion criteria included patients under 18 years old, those with less than 2 years of postoperative follow-up, or those undergoing surgery for trauma, malignancy, or infection. A 1:1 nearest-neighbor propensity score matching for age, Elixhauser Comorbidity Index (ECI), gender, number of instrumented levels, insulin use, obesity, diabetes, and smoking status was performed. Primary outcomes included 30 day and 90 day complications and readmissions. Secondary outcomes included complications at 2 years, including pseudarthrosis, hardware removal, and secondary decompression or fusion. Continuous variables were compared using Welch's t-tests and discrete variables were compared using Chi-square tests. Univariate analysis was performed for associations between GLP-1 agonist use and rates of complications, readmissions, pseudarthrosis, and secondary surgery. **Results:** After propensity score matching, cohorts who underwent ASD surgery were identified with preoperative GLP-1 agonist use (N = 86) and without preoperative GLP-1 agonist use (N = 86). Cohorts were similar in age (64.2 vs 62.7 years), comorbidities (ECI: 7.94 vs 7.62), number of levels fused (7-12 levels: 28 vs 37, 13+ levels: 28 vs 28) ($p > 0.05$). Between cohorts, there was no difference in 30 day or 90 day complication rates of cerebrovascular accident, pneumonia, respiratory failure, myocardial infarction, acute kidney injury, deep vein thrombosis, pulmonary embolism, postoperative anemia, sepsis, aspiration pneumonitis, urinary tract infection, hematoma, wound dehiscence, surgical site infection, hardware infection, or mechanical complications (all $p > 0.05$). GLP-1 use was associated with increased 90 day readmission rates (OR: 2.303, $p = 0.048$). At 2 years, GLP-1 agonist use was associated with increased risk of hardware removal (OR: 0.042, $p = 0.042$). Rates of pseudarthrosis and secondary decompression or fusion were similar among cohorts at 2 years ($p > 0.05$). **Conclusion:** Preoperative GLP-1 agonist use was not associated with increased short-term complication rates after ASD surgery, but was linked to higher 90-day readmission rates and greater risk of hardware removal at 2 years. These findings suggest that while GLP-1 therapy may be safe in the immediate postoperative setting, it may influence long-term implant-related outcomes. Surgeons should be aware of these potential risks during patient counseling and preoperative management, and consider closer follow-up in patients receiving GLP-1 therapy.

ID: AGS26/1529
P0221: L1 slope and combined procedure as determinants of rod fracture in adult spinal deformity surgery

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Introduction: Rod fracture is one of the common mechanical complications after long instrumented spinal fusion for adult spinal deformity (ASD). Despite its prevalence, the independent risk factors remain debated. This study aimed to identify predictors of rod fracture using a prospective cohort of patients with long fusions to the pelvis and ≥ 2 years follow-up. **Methods:** A prospective cohort of 207 ASD patients who underwent thoracic-to-pelvis fusion with ≥ 7 instrumented levels and pelvic fixation, all with ≥ 2 years of follow-up was analyzed. The primary outcome was rod fracture, defined radiographically and clinically, occurring at any time after surgery. Baseline demographic and clinical variables included age, sex, body mass index (BMI), ASA class, comorbidity count, osteoporosis, and osteopenia. Operative variables included estimated blood loss, operative time, upper instrumented vertebra (UIV) level (≤ T6 vs ≥ T7), rod size (5.5 or 6.35), rod material (cobalt-chromium, titanium, stainless steel), multi-rod construct (accessory and satellite), combined anterior-posterior versus posterior-only approach, pedicle subtraction osteotomy (PSO), vertebral column resection (VCR), and bone graft characteristics (dose per level). Radiographic parameters were measured 6 weeks postoperatively and included lumbar lordosis (LL), pelvic incidence-LL mismatch (PI-LL), thoracic kyphosis (TK), pelvic tilt (PT), sacral slope (SS), L1 slope, L1 pelvic angle (L1PA), T9 and T4 pelvic angles, and regional mismatch angles (T4-L1PA, T1-T9PA, L1PA mismatches). GAP category was also recorded as proportioned and disproportioned. Univariate logistic regression was performed for each variable with rod fracture as the outcome. Predictors with $p < 0.25$ were entered into a multivariable logistic regression with forward stepwise selection based on the Bayesian Information Criterion (BIC). Multicollinearity was assessed with variance inflation factors (VIF). Model discrimination was assessed with receiver operating characteristic (ROC) analysis. **Results:** Among 207 patients, 20 (9.7%) experienced rod fracture during

follow-up, only 12 (5.8%) were revised. On univariate logistic regression, several variables were associated with rod fracture. Decreased risk: combined procedure (p = 0.010), BMP dose per level 3.2 mg (ave./level) (p = 0.065), and older age (p = 0.093). Increased risk: L1 slope (p = 0.002), multi-rod constructs (p = 0.043), T1-T9 pelvic angle mismatch (p = 0.139), sacral slope (p = 0.154), T4-L1 pelvic angle mismatch (p = 0.200), UIV category (p = 0.212). All other candidate predictors, including LL, PI-LL, and thoracic kyphosis, had p > 0.25. Stepwise forward regression identified two independent determinants of rod fracture: as a risk-increasing factor L1 slope (Estimate -0.12; OR 0.89 per degree, 95% CI 0.82-0.96; p = 0.002); and as a protective factor combined procedure (Estimate -1.74; OR 0.17, 95% CI 0.04-0.56; p = 0.008). The final model demonstrated fair discrimination (AUC = 0.77). **Conclusions:** Rod fracture occurred in 9.7% of patients with only 5.8% revision rate, lower than most reports of long fusions to the sacrum in adults. Independent predictor with increased risk was greater L1 slope, while combined anterior-posterior procedure was protective. These findings highlight the role of early sagittal alignment and construct strategy in mitigating rod fracture risk and may inform surgical planning and patient counseling in ASD surgery.

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P0222: Rod diameter provides greater protection against fracture than multi-rod augmentation in adult spinal deformity surgery

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Introduction: Rod fracture (RF) is a common late complication after long-segment fusion for adult spinal deformity (ASD). Multi-rod strategies, including accessory or satellite constructs, are often used to reduce fracture risk. The comparative effectiveness of these strategies versus upsizing to a larger-diameter rod remains uncertain. **Methods:** We analyzed a prospective cohort of 207 ASD patients who underwent thoracic-to-pelvis fusion with at least seven instrumented levels and ≥2 years of follow-up. Constructs were classified by rod size (5.5 vs 6.35 mm), configuration (2-rod, accessory 3-rod, satellite 4-rod), and material (cobalt-chrome, titanium, stainless steel). Patient variables included age, sex, body mass index (BMI), ASA class, osteoporosis or osteopenia, and revision status. Operative factors included posterior-only versus combined anterior-posterior approach, osteotomy type, and upper instrumented vertebra. Biologic support with bone morphogenetic protein (BMP) and allograft per level, as well as preoperative alignment and 6-week correction, were assessed. The primary outcome was RF. **Results:** RF occurred in 20 of 207 patients (9.7%), including 12 (5.7%) who required revision at a mean follow-up of 46 months. In 132 patients with 5.5mm cobalt-chrome rods, 15 fractures occurred (11.4%). In 75 patients with 6.35mm rods, all titanium or stainless steel, 5 fractures occurred (6.7%). Despite being implanted in heavier patients (BMI 31.8 ± 5.9 vs 28.3 ± 5.4, p < 0.001), 6.35 mm rods fractured less often. In 5.5mm cobalt-chrome constructs, the combined approach had less rod fractures than posterior-only constructs: RF was 1 of 24 with accessory rods (4.2%) and 1 of 30 with two rods (3.3%) in the combined group, compared with 9 of 30 (30.0%) and 1 of 25 (4.0%), respectively, in the posterior-only group. In 6.35 mm constructs, RF remained low regardless of 2-rod versus 4-rod configuration, and no accessory rods were used. By configuration, RF occurred in 6 of 108 2-rod constructs (5.6%), 10/54 accessory 3-rod constructs (18.5%), and 4/45 satellite 4-rod constructs (8.9%, p = 0.034). Satellite constructs were applied at osteotomy sites in 45 cases (43 PSO, 2 VCR), with all 4 rod fractures occurred at PSO levels. Rod material tracked with diameter: all 5.5 mm rods were cobalt-chrome (15 fractures, 11.3%), while 6.35 mm rods were titanium (4 fractures, 8.5%) or stainless steel (1 fracture, 3.7%), with no overall difference by material (p = 0.54). Preoperative PI-LL mismatch averaged 25°, lumbar lordosis 42°, thoracic kyphosis 33°, pelvic tilt 24°, GAP score 6.2, and T4-L1 pelvic angle mismatch 19°, with no group differences. Corrections at six weeks averaged -21° for PI-LL, +21° for lumbar lordosis, and +12° for thoracic kyphosis, again without differences. BMP averaged 3.2 ± 1.0 mg/level and allograft 16.6 ± 4.3 cc/level across groups, with no significant difference. **Conclusions:** 6.35 mm rods, all titanium or stainless steel and used in heavier patients, consistently demonstrated lower fracture rates without additional rods. Accessory 3-rod constructs with 5.5 mm cobalt-chrome rods did not reliably prevent fracture, and the apparent higher risk of accessory constructs reflected selective use in posterior-only cases. Rod diameter, rather than rod multiplicity or material, was the dominant determinant of construct durability.

ID: AGS26/1537
P0223: Upper thoracic fusion is protective against PJK: a survival analysis in 207 ASD patients

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Introduction: Proximal junctional kyphosis (PJK) is a common complication after adult spinal deformity (ASD) surgery, particularly in long thoracic-to-pelvis fusions. The choice of the upper instrumented vertebra (UIV) remains an area of debate. Stopping in the thoracolumbar region may preserve mobility and reduce operative morbidity but has been associated with higher rates of junctional complications. Extending to the upper thoracic spine may reduce mechanical failures but requires longer constructs and greater surgical exposure. Given this ongoing controversy, we evaluated whether upper thoracic UIVs provide longer PJK-free survival compared to lower thoracic UIVs. **Materials and Methods:** We prospectively analyzed 207 ASD patients who underwent long thoracic-to-pelvis fusion with pelvic fixation and ≥ 7 instrumented levels. All patients had a minimum 2-year follow-up. PJK was defined as a ≥ 20° increase in proximal junctional angle from baseline at any follow-up, or if the patient underwent revision surgery for a proximal junctional kyphosis complication. Patients were stratified by UIV location: upper thoracic (≤ T6) versus lower thoracic (≥ T7). Kaplan-Meier methods evaluated PJK-free survival, with log-rank testing for group comparisons. Cox proportional hazards models were used to adjust for age, sex, BMI, osteotomy use, and radiographic alignment parameters. **Results:** A total of 207 patients were included, of whom 32 (15.5%) developed PJK over a mean follow-up of 46 months. Baseline demographic and surgical characteristics are summarized in Table 1. The median estimated PJK-free survival for the entire cohort was 89.7 months (95% CI: 83.0-96.4). When stratified by UIV level, patients with upper thoracic UIVs (≤ T6) demonstrated a lower incidence of PJK (12.6%, 19/151) compared with those fused to the lower thoracic spine (≥ T7) (23.2%, 13/56), although this difference did not reach statistical significance on chi-square testing ($p = 0.10$). Kaplan-Meier analysis, however, confirmed significantly longer survival in the upper thoracic group, with 5-year PJK-free survival of 82% versus 68%, respectively (log-rank $\chi^2 = 3.98$, $p = 0.046$). On unadjusted survival estimates, the mean PJK-free survival time was 91.8 months (95% CI: 83.7-99.9) for the upper thoracic group and 70.7 months (95% CI: 61.1-80.4) for the lower thoracic group. Median survival was not reached within the follow-up window for either group due to censoring. In multivariate Cox regression adjusting for demographic variables (age, sex, BMI), osteotomy use, and radiographic alignment parameters, lower thoracic UIV location independently increased the risk of PJK (HR = 1.92, 95% CI: 1.04-3.56, $p = 0.038$). No other demographic or radiographic factors demonstrated independent association after accounting for UIV level. **Conclusion:** Upper thoracic long fusions demonstrate significantly longer PJK-free survival compared with lower thoracic long fusions. UIV location was an independent predictor of junctional durability, with lower thoracic constructs nearly doubling the hazard of PJK. These findings highlight the importance of UIV selection in ASD surgery, supporting the use of upper thoracic fixation to mitigate complications and extend construct longevity.

ID: AGS26/1545
P0224: Redefining reciprocal changes: postoperative T4-L1PA mismatch in lower thoracic fusions

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Introduction: The T4-L1 pelvic angle (T4-L1PA) mismatch has been validated as a personalized alignment target in upper thoracic (UT) to pelvis fusions for adult spinal deformity (ASD), while its role in lower thoracic (LT) to pelvis fusions is an active area of research. Thoracic flexibility (TF) may help predict postoperative mismatch in this setting. This study aimed to evaluate the relationship between TF and T4-L1PA mismatch in patients undergoing LT to pelvis fusions and to assess how postoperative alignment targets affect mechanical outcomes. **Material and Methods:** This retrospective cohort study included ASD patients undergoing fusion from T9-T12 to the pelvis, fused ≥ 5 levels, excluding those with prior thoracic fusions. All patients had preoperative standing and supine radiographs and discharge imaging. TF was defined as the ratio of the supine-to-standing T4-T12 Cobb angle (CA). The L1PA offset was calculated as the difference between the measured and PI-based expected L1PA value, which equals PI × 0.5 - (19° ± 2°). The ideal range for T4-L1PA mismatch was determined using published values by Hills et al. (2024) that have been shown to minimize mechanical complications after UT to pelvic fusions. Patients were then categorized as pre- and postoperative "matched" (T4-L1PA within range) [M] and "mismatched" (T4-L1PA out of range) [MM]. TF was defined as the preoperative supine-to-standing T4-T12 ratio (lower ratio indicates higher flexibility) and was analyzed for associations with T4-L1PA alignment between groups. Postoperative outcomes included mismatch status and proximal junctional complications: PJK (PJA ≥ 10° or ΔPJA ≥ 10°) and PJF (PJA ≥ 28° or ΔPJA ≥ 22°, or proximal fusion extension). Logistic regression was used to identify the relationship between radiographic parameters and postoperative

mismatch status. **Results:** 87 patients (61 females, 26 males) with a mean age of 65.61 (± 8.13) years, a BMI of 26.73 (± 5.47) kg/m^2, PI of 52.71°, and a follow-up period of 1.9 years were included. Baseline: 11.5% M, 88.5% MM; post-op: 14.9% M, 85.1% MM. Of the 10 patients who were preoperatively M, 8 (80%) became MM. Transitioned patients had lower BMI ($p = 0.04$), osteoporosis ($p = 0.04$), and lower preoperative PI-LL mismatch ($p = 0.02$). Univariate analysis linked TF ($p = 0.02$), preoperative T4-L1PA mismatch ($p = 0.03$), and postoperative thoracic kyphosis ($p = 0.02$) to mismatch status. In multivariate regression, only TF ($p < 0.05$) and osteoporosis ($p = 0.01$) were associated with postoperative mismatch status, while preoperative mismatch status and postoperative TK were not. Mechanical complications were predominantly observed in MM. PJF was seen exclusively in patients who were preoperatively mismatched and remained mismatched after surgery. **Conclusion:** Increased TF is associated with pre- and postoperative T4-L1PA mismatch, suggesting that UT-derived thresholds may not be valid for LT constructs. While baseline mismatch status was not predictive, persistent mismatch was associated with higher rates of proximal junctional complications, including PJF. These findings emphasize the need for LT-specific alignment targets and highlight the importance of including TF and systemic patient factors in preoperative planning and risk stratification.

ID: AGS26/1550
P0225: Was it just laminectomy? Drivers of clinical improvement after sagittal realignment in adult spinal deformity

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Introduction: Adult spinal deformity (ASD) frequently presents with coexisting lumbar spinal stenosis and global sagittal malalignment, both causing significant disability and reducing the quality of life. It remains unclear whether improvements in function and pain after ASD surgery are mainly due to laminectomy or realignment. This study aimed to assess whether ASD patients with lumbar stenosis gain more postoperative benefits than those without, and to identify the relative contributions of laminectomy and sagittal realignment in determining clinical outcomes. **Material and Methods:** We retrospectively reviewed ASD patients who underwent instrumented fusion of four or more spinal levels, with a minimum of two years of follow-up. Patients with previous spinal surgery or thoracic stenosis were excluded. Patients were then divided into groups based on whether they underwent lumbar laminectomy for stenosis concurrent with sagittal correction (Lam) or only underwent sagittal realignment (NoLam). The primary outcomes were PROMs: Oswestry Disability Index (ODI), Visual Analog Scale-back (VAS-Back), Visual Analog Scale-leg (VAS-Leg), the Short Form 12-item Health Survey (SF12), and the Patient-Reported Outcomes Measurement Information System (PROMIS). These surveys were collected preoperatively and at 6 weeks, 6 months, 1 year, and 2 years postoperatively. Preoperative and postoperative spinopelvic and coronal parameters-including pelvic incidence (PI), pelvic tilt (PT), PI-LL mismatch, L4-S1 lordosis, L1 pelvic angle (L1PA) offset, T4-L1 pelvic angle (T4L1PA) mismatch, C7 plumb line (C7PL), and the maximum Cobb angle (CA)-were compared between groups at the same time points. Variables were tested for normality with the Shapiro-Wilk test, and either parametric or nonparametric tests were applied accordingly. **Results:** A total of 143 patients (mean age 61.2 ± 13.6 years; 59 males, 84 females; mean BMI 27 ± 5.7 kg/m^2; mean PI 53.8° ± 12.9) were included in the study, with 73 (51%) undergoing lumbar laminectomy. Radiographic parameters and the extent of sagittal correction showed no significant differences between groups, either before or after surgery. The Lam group presented with worse preoperative disability (ODI 44.2 vs. 37.1, $p = 0.015$), higher leg pain (VAS-Leg 5.5 vs. 3.5, $p < 0.001$), and lower physical function (SF-12 PCS 23.4 vs. 31.3, $p = 0.004$) compared to the NoLam group. Both groups experienced significant improvements in all PROMs after surgery. Patients in the Lam group reported greater early relief of leg pain at 6 months (ΔVAS-Leg: 2.9 vs. 1.3, $p = 0.03$) and 1 year (3.4 vs. 1.4, $p = 0.02$). However, by two years, all PROMs converged, with no significant differences between groups. **Conclusion:** Patients undergoing ASD correction achieve similar long-term improvements in pain and function regardless of whether laminectomy is performed. The findings suggest that, while decompression may accelerate early symptom relief, it combines the benefits of neural decompression and comprehensive sagittal realignment.

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P0226: The sacral base as the key to coronal balance: clinical and geometric perspectives

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Introduction: Optimally there is no curvature of the spine in the coronal plane and this is maintained with a sacrum and pelvis parallel to the ground. Leg-length discrepancy, lumbosacral junctional deviations and sacral asymmetry may predispose sacral and pelvic obliquity, thus producing compensatory scoliotic curves to establish the coronal alignment. This study investigates the correlation between the asymmetric sacropelvic base and the compensatory scoliosis. **Material and Methods:** Patients in whom lumbar scoliosis was detected in the scoliosis X-rays were included in the study. Study population included 32 patients who were diagnosed with idiopathic scoliosis and had non-structural lumbar scoliosis with sacropelvic asymmetry and 36 patients who admitted with low back pain and diagnosed with lumbar scoliosis. Standing and supine AP/lateral scoliosis X-rays, lateral bending X-rays, orthorontgenograms, CT with scanograms, MRI were obtained to evaluate the sacropelvic obliquity and its underlying causes. The correlation between the lumbosacral angulation and compensatory spinal curve was assessed and formulized. Progressive deformity and persistent symptoms and/or degenerative pathologies secondary to asymmetric loading were treated with surgical intervention. **Results:** 78 patients were included in the study. 66 (84.6%) were female and 12 (15.4%) were male, the mean age was 28.6 ± 9.2 years (range: 12-48). 16 (%20.5) patients had pelvic obliquity secondary to leg-length discrepancy. 62 patients had pelvic asymmetry due to anatomical abnormalities including lumbosacral junction abnormalities (n:42; 53.8%), sacral asymmetry (n:17; 21.8%) and pelvic obliquity (n:3; 3.8%). The osseous anatomical anomalies were analyzed via three-dimensional CT reconstruction images. A geometric model was established to quantify coronal plane deviation, demonstrating that center deviation (D) equals patient height (L) multiplied by the tangent of the sacral obliquity angle (α) ($D = L \times \tan \alpha$). The minimum compensatory lumbar curvature required for balance was derived as Cobb = 2α. The cohort demonstrated a mean sacral obliquity of 8.2° ± 3.1 (range: 3°-15°), with corresponding mean lumbar Cobb angle of 19.4° ± 5.6 (Cobb/α ratio: 2.34). Surgical intervention was performed in 15 (19.2%) patients (6 with curve progression, 9 with symptomatic degeneration) using TLIF cages and short-segment stabilization. This achieved significant correction, reducing mean Cobb angles from 28.2° ± 6.8 preoperatively to 7.8° ± 2.4 postoperatively, with no perioperative complications or loss of correction at 1-year follow-up. **Conclusion:** Preserving coronal spinal alignment fundamentally requires the superior surface of S1 to remain parallel with the horizontal plane. Any tilt of this base inevitably induces compensatory scoliosis. Asymmetric mechanical loading accelerates early degeneration of the intervertebral discs and facet joints, leading to earlier onset of symptoms. With time, such curves evolve into structural deformities and progressive imbalance. In conclusion, when idiopathic scoliosis is suspected-especially in patients with non-structural lumbar curves-sacral base orientation must be carefully assessed. If leg-length discrepancy is present, it should be corrected. In patients with sacral obliquity and compensatory scoliosis but without limb-length inequality, early correction of the base and short-segment stabilization is advisable before the curve becomes structural. Such an approach can halt deformity progression and improve long-term clinical outcomes.

ID: AGS26/1583
P0227: The impact of rod insertion on intraoperative neuromonitoring alerts in spinal deformity surgery

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Introduction: Intraoperative neuromonitoring (IONM) plays a critical role in detecting potential neurological compromise during spinal deformity correction. The impact of rod placement as a preceding event remains incompletely understood. This study explores factors associated with rod placement as the preceding event of IONM alerts. **Material and Methods:** The study is a post hoc analysis of data from a prospective multicenter international observational study, where 20 international centers prospectively documented IONM (EMG, SSEP and MEP) alerts, demographics, radiographic findings, and surgical events of patients (10-80 years) undergoing spinal deformity surgery. Patients included had a major Cobb > 80° or underwent a Schwab type 2-6 osteotomy.

The data from alerts that occurred following rod placement were reviewed. The primary outcomes included the modality, and laterality of IONM alerts, as well as associated corrective measures and neurological outcomes. **Results:** Of the 543 patients analyzed, 17 (3.1%) experienced 25 IONM alerts directly following rod placement while 59 (10.9%) sustained non-rod related IONM alerts. Those with rod-related alerts had a median coronal Cobb angle of 84.5° (vs. 68°), coronal deformity angular ratio (DAR) of 13.5° (vs. 10°), sagittal DAR of 11.2 (vs. 7.4), and 35.3% had undergone intraoperative traction (vs. 9.5%). MEP changes were the most common alert modality (96% in rod related vs. 90.9% in non-rod), with bilateral alerts occurring in 66.7% of cases. SSEP changes occurred in 8% of rod related alerts vs. 20.8% in non-rod related alerts. There were 16 bilateral MEP alerts and 8 unilateral MEP.2 had associated SSEP changes. The most common surgical responses for bilateral MEP alerts included systemic responses (13/16, 81.3%), elevating BP (12/16, 75%), and rod removal (7/16, 43.8%). The most common surgical responses for unilateral MEP without SSEP included systemic responses (3/6 50%), elevating BP (2/6, 33%) and rod removal (2/6, 33%). For unilateral alerts with SSEP, all responses (2/2) were systemic, included rod removal and steroids. In bilateral MEP groups, all alerts recovered at least partially (13/16, 81.2% full recovery, 3/16, 18.8% partial), whereas in unilateral MEP group only 4/8 (50%) of alerts recovered fully, and 1 alert recovered partially, and all 2/2 alerts recovered in unilateral MEP with SSEP group. Overall, for alerts including rod placement, responses that included giving blood, removing rod or lessening correction resulted in higher full recovery of signal (14/17, 82.4% vs 4/8, 50%). Overall, 2/15 (13.3%) patients with rod placement as preceding event had de novo neurological deficits at discharge. **Conclusion:** Patients with rod placement had predominantly MEP alerts. Responses that included giving blood, removing rod or lessening correction resulted in high full recovery of signal. IONM alerts occurring following rod placement are a frequent occurrence and can be fully reversible in a large number of cases if the appropriate maneuvers are performed. The surgical team should be extra vigilant during this important and high risk step in the procedure.

ID: AGS26/1617
P0228: Evaluation of the effects of anesthetics and surgery on sleep quality in patients undergoing posterior spinal instrumentation surgery: a prospective randomised clinical trial

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Introduction: We aimed to evaluate the impact of the anesthesia method and surgical procedure on the sleep patterns and sleep quality of patients undergoing posterior spinal instrumentation using the Pittsburgh Insomnia Rating Scale-20 (PIRS-20). **Material and Methods:** A total of 40 patients ASA (American Society of Anesthesiology) I-III aged 18 and over who underwent elective spinal posterior instrumentation was included. The patients were divided into two groups randomly - those with sevoflurane and remifentanil anesthesia and those with total intravenous anesthesia (TIVA) - using the closed envelope method. Patients were evaluated before and after the surgery with the PIRS-20 (surgery one month previously and postoperative 7th day) for sleep quality, VAS (Visual Analogue Scale; recorded preoperative night and postoperative first hour), pain, and State-Trait Anxiety Inventory (STAI) for anxiety (recorded preoperative night and postoperative 7th day) scores. **Results:** When pre-operative and postoperative PIRS-20, VAS, and STAI scores were compared, no significant difference was observed between Group T and Group S ($p > 0.05$). The VAS values in Group S and Group T decreased significantly over time ($p < 0.001$, $p = 0.001$, respectively). The STAI scores decreased significantly over time ($p = 0.001$, $p = 0.001$, respectively). The PIRS-20 values remained unchanged in Groups S and T ($p = 0.132$, $p = 0.828$, respectively). **Conclusion:** The results of the study showed that, while the type of anesthesia did not affect the quality of sleep in the group of patients receiving posterior instrumentation, the surgical procedure did affect pain reduction in both anesthesia methods.

ID: AGS26/1684
P0229: The Hsu-Lace: a novel technique to prevent PJF

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Introduction: This retrospective study assesses the efficacy of Hsu-Lace technique in creating a "soft landing" for patients submitted to thoraco-lumbar-pelvic reconstruction intending to reduce proximal junction failure and reoperation rates. The present study aims to show a new technique in Adult Spine Deformity (ASD) surgery looking into the effects of the artificial interspinous Nylon and Tendon soft stabilization on proximal junction kyphosis/failure (PJK/PJF) and extension of fusion rates. **Material and Methods:** A retrospective review

was conducted on 53 patients who underwent thoraco-lumbar-pelvis fusion for ASD since 2019. Patients were categorized in two groups based on artificial interspinous stabilization in which the use was determined based on the instrumentation chose in each case - Nile-Life Health Care (LHC) (n = 27) or Tendon/Ausbio-APM (n = 26). Data collection included demographics, surgical details, follow-up, PJK, time of PJK, reoperation, and extension of fusion. **Results:** 8 patients developed PJK before 6 months and 5 were submitted to extension of fusion. 80% of these patients extended were from the Nile-LHC group. Despite this, we had 3 patients that developed PJK but had no proximal junction failure (PJF). **Conclusion:** We believe the Hsu-lace technique is valid and changed our practice reducing our PJF and extension of fusion rates.

ID: AGS26/1694
P0230: Anatomical iliac screw fixation: early outcomes and technical description of a sacroiliac-sparing, connector-free approach

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Background: Iliac fixation is fundamental for long lumbosacral constructs, yet conventional strategies such as S2-alar-iliac (S2AI) and classic iliac screws carry risks of wound complications, hardware prominence, and construct failure. S2AI fixation also traverses the sacroiliac joint and requires domino connectors, which may increase biomechanical stress and construct complexity. We describe a morphology-guided anatomic iliac fixation technique that spares the sacroiliac joint and avoids domino connectors, and report early outcomes in comparison with other fixation strategies. **Methods:** We retrospectively reviewed patients who underwent pelvic fixation at a tertiary center between 2018-2023. Patients were grouped as anatomic iliac fixation, classic iliac, or S2AI fixation. Data collected included demographics, operative time, blood loss, transfusion requirements, wound complications, and construct failure. The anatomic iliac fixation technique is detailed, highlighting consistent pelvic morphology landmarks that allow safe, reproducible placement while preserving sacroiliac integrity. **Results:** Thirty-two patients underwent pelvic fixation: 10 with anatomic iliac fixation, 10 with classic iliac, and 12 with S2AI screws. Mean age was 43.1 years, 78% female, with a mean BMI of 28.7. Operative time was shortest in anatomic iliac fixation (mean 5.5 h) compared with classic iliac (5.9 h) and S2AI (7.3 h). Mean blood loss was lower in anatomic iliac fixation (402 ml) compared with classic iliac (455 ml) and S2AI (1,208 ml). Transfusion was required in 66% of S2AI patients, 40% of anatomic iliac fixation, and none of the classic iliac cases. Wound complications were lowest in anatomic iliac fixation (20%) and classic iliac (20%) when compared to S2AI (33%). Construct failure with revision was observed in one classic iliac and one S2AI case, but none in anatomic iliac fixation. No anatomic iliac fixation patients experienced neurological, thromboembolic, or systemic complications. **Conclusion:** The morphology-guided anatomic iliac fixation technique provides a sacroiliac-sparing, connector-free alternative for pelvic fixation. Early outcomes suggest reduced wound morbidity, lower blood loss, and absence of construct failure compared with conventional iliac fixation methods. Importantly, anatomic iliac fixation demonstrates no inferiority to widely used techniques, positioning it as a practical and reproducible strategy that warrants further prospective validation.

ID: AGS26/1704
P0231: Why thoracolumbar junction matters: dynamic motion predicts mechanical complications in adult spinal deformity surgery

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Introduction: Mechanical complications and revision surgery after long instrumented fusion for adult spinal deformity (ASD) are well-recognized problems that adversely affect clinical outcomes. When the thoracolumbar junction (TLJ) is selected as the uppermost instrumented vertebra (UIV), these complications must be carefully considered due to the unique transitional biomechanics between the rigid thoracic and the mobile lumbar spine. Although several studies have analyzed proximal junctional problems related to TLJ as the UIV, little is known about the impact of dynamic motion at this segment. The purpose of this study was to investigate the risk factors for

mechanical complications and revision surgery in posterior fusion constructs stopping at the TLJ, with particular focus on the role of dynamic motion. **Material and Methods:** Between January 2012 and December 2019, we retrospectively reviewed patients with ASD who underwent long-segment posterior instrumented fusion terminating at the TLJ (UIV at L1 or T12). All patients achieved fusion to the sacrum and were followed for a minimum of 2 years. Demographic variables (age, sex, body mass index [BMI], bone mineral density [BMD], smoking status), surgical factors (fusion length, additional iliac fixation), and occurrence of mechanical complications were evaluated. Radiographic parameters, including pre- and postoperative alignment as well as flexion-extension segmental angle changes at the TLJ, were analyzed to assess the impact of dynamic motion on complication risk. **Results:** A total of 126 patients were included in the study (97 with UIV at L1 and 29 with UIV at T12). The mean age was 67.7 years (range, 49 to 83 years), and the mean duration of follow-up was 28.3 months (range, 24 to 90 months). Mechanical complications occurred in 42 of 97 patients at L1 (43.3%) and in 12 of 29 patients at T12 (41.4%), with no significant difference between the two groups. Multivariate regression analysis revealed that low bone mineral density (OR 0.206, p = 0.039), the use of iliac fixation (OR 6.069, p = 0.036), higher preoperative pelvic tilt (OR 1.121, p = 0.017), greater preoperative flexion-extension difference at the UIV-1/UIV segmental angle (OR 1.436, P = 0.039), and greater flexion-extension difference at the proximal junctional angle (OR 1.193, P = 0.044) were significant risk factors for mechanical complications. **Conclusion:** Low bone mineral density, the use of iliac fixation, higher preoperative pelvic tilt, and greater flexion-extension motion at both the UIV-1/UIV segmental angle and the proximal junctional angle were identified as significant risk factors for mechanical complications after long-segment fusion stopping at the thoracolumbar junction. These findings suggest that complication risk is determined not by whether the UIV is located at L1 or T12, but rather by whether the UIV involves a dynamic motion segment. Careful evaluation of preoperative motion dynamics at the thoracolumbar junction is therefore essential when selecting the UIV in adult spinal deformity surgery.

ID: AGS26/1748
P0232: Evaluation of reciprocal thoracic kyphosis changes after staged corrective surgery in adult spinal deformity

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Introduction: Reciprocal changes (RCs) in unfused spinal segments can significantly affect the global alignment after corrective surgery. Identifying radiographic thresholds for guiding surgical strategies is critical for optimizing the outcomes. **Material and Methods:** Ninety-eight ASD patients who underwent staged surgeries, including lateral lumbar interbody fusion (LLIF) and posterior spinal fusion (PSF), were analyzed. According to the final follow-up image, the patients were classified into balanced (BG) and imbalanced (IG) groups, with IG further stratified into proximal junctional kyphosis/failure (IG-PJK/PJF) and non-PJK/PJF (IG-NPJK/PJF). Radiographic and clinical data were collected preoperatively, postoperatively, and at 2-year follow-up. **Results:** The IG exhibited greater RCs in thoracic kyphosis (TK) and PI-LL mismatch from postoperative to follow-up than the BG (p = .030, p = .008). Significant predictors included Age > 65.5 y/o (AUC: .672) and Post-PT > 17.5° (AUC: .852) for imbalance and Post-TK > 34.5° (AUC: .755) for IG-PJK/PJF. IG-PJK/PJF showed poorer ODI scores than BG and IG-NPJK/PJF (p = .021 and p = .022, respectively). IG-PJK/PJF showed poorer total SRS-22 scores than IG-NPJK/PJF (p = .021). **Conclusion:** Increased RCs in TK was associated with adverse outcomes. Extending the upper instrumented vertebra (UIV) to the upper thoracic spine and addressing excessive TK (> 34.5°) may improve alignment and reduce complications. Radiographic thresholds can provide actionable guidance in surgical planning.

ID: AGS26/1751
P0233: A cost-effective irrigation technique in thoracolumbar spine fractures

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Introduction: To evaluate the effect of standardization of irrigation volume, a cost-effective intraoperative modification, on surgical site infection (SSI) rates in patients undergoing posterior spinal fusion for thoracolumbar (TL) vertebral fractures. **Material and Methods:** A retrospective review was conducted on 241 patients who underwent posterior spinal fusion for TL fractures by a single surgeon between 2001 and 2022. Patients were divided into two groups: Group 1 (2001-2011) underwent conventional syringe-based irrigation with non-standardized saline volumes, while Group 2 (2011-2022) received irrigation via an arthroscopic system using a standardized 3 L saline volume. Demographics, clinical characteristics, operative parameters, and SSI rates were compared between groups. **Results:** A total of 207 patients met the inclusion criteria (Group 1: n = 98; Group 2: n = 109). The average irrigation volume was 1,343 mL in Group 1 and 3,000 mL in Group 2 (p < 0.001). SSIs occurred in 5 patients (5.1%) in Group 1 and in 1 patient (0.92%) in Group 2 (p = 0.019). Pathogens isolated in Group 1 included Staphylococcus epidermidis (2), MRSA (1), MSSA (1), and

Escherichia coli (1). In Group 2, only MSSA was isolated. No significant differences were observed in age, sex, BMI, blood loss, hospital stay, smoking status, or diabetes. **Conclusion:** Irrigation with a standardized 3 L saline volume using an arthroscopic irrigation system was associated with a lower SSI rate compared with non-standardized syringe irrigation. Considering the morbidity, mortality, and healthcare costs related to SSIs, this simple and low-cost technique may be considered a useful adjunct in the surgical treatment of thoracolumbar fractures, although prospective multicenter studies are warranted.

ID: AGS26/2349

P0234: Types of pelvic fixation and their influence on pelvic incidence change after surgery for adult spinal deformity: a retrospective analysis

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Introduction: In Adult spinal deformity (ASD), restoring sagittal spinal alignment which is usually based on the measurement of pelvic incidence (PI) can positively modify the quality of life in patients post-operatively. While which was postulated to be a constant value specific to each person, recent literature reported that the latter can change with pelvic fixation after ASD surgery. This study will compare post-operative PI modification by types of pelvic fixation. **Material and Methods:** This is a retrospective multicenter study of 423 patients who have undergone ASD surgery between 2012 and 2022. These patients were divided into four groups, based on the type of pelvic fixation they received being either S2-Alar-Iliac screws (S2AI), Iliac screws (IS), Iliosacral screws (ISS), and no pelvic fixation. Post-operative PI change was defined by an absolute difference of $\geq 6°$ between pre- and post-operative values. Furthermore, patients were divided into 3 groups pre-operatively based on their PI: low ($< 40°$), medium (40°-60°), and high ($> 60°$). **Results:** Of the patients who had pelvic fixation, 45.9% had a change in PI compared to 12.8% in the group without pelvic fixation. Patients with S2AI had the higher rate of post-operative PI change (80%) followed by patients with ISS (39.6%) and patients with IS (15.3%).). In addition, patients with a low pre-operative PI tended to have an increase in post-operative PI (33.3° pre-operatively to 42.1° post-operatively) while patients with a high pre-operative PI tended to have a lower post-operative PI (69.9° pre-operatively to 66.5° post-operatively). Furthermore, a logistic regression model controlling for gender, pre-operative PI groups, the change in lumbar lordosis, pelvic tilt, sacral slope, and pelvic fixation showed that only the latter predicted the post-operative change in PI with an adjusted odd-ratio of 5.7. However, pelvic fixation was not a predictor of PI modification when we selected only patients with IS. **Conclusion:** Pelvic fixation was found to be an independent risk factor for PI change with an adjusted OR of 5.7. When stratifying by pelvic fixation type, S2AI screws had the greatest impact on post-operative PI change (ORa = 26.3) followed by ISS (ORa = 4.6) with IS having no impact on post-operative PI change.

ID: AGS26/2527

P0235: Impact of sarcopenia on surgical outcomes in adult spinal deformity: a systematic review and meta-analysis

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Introduction: Adult spinal deformity (ASD) is a complex condition frequently associated with high surgical risk and incidence of postoperative complications. Aging-related loss of skeletal muscle volume, strength, and quality defined as sarcopenia may have an adverse impact of ASD surgery. While reduced psoas and paraspinal muscle volume has been associated with complications in spine surgery, its specific impact in ASD remains unclear. This systematic review aimed to evaluate the association between sarcopenia and surgical outcomes in patients undergoing ASD surgery. **Materials and Methods:** A systematic search of PubMed and EMBASE was performed on May 5, 2025, to identify studies evaluating sarcopenia in ASD surgery. Eligible studies included adult patients ($\geq$ 18 years) undergoing thoracolumbar corrective surgery, with sarcopenia diagnosed using validated methods. Outcomes of interest were postoperative complications, re-operation, readmission, length of stay (LOS), and patient-reported outcome measures (PROMs). Data were extracted on study design, patient demographics, surgical characteristics, and follow-up. Meta-analysis was conducted using Review Manager 5.4, with odds ratios (ORs) for dichotomous outcomes and mean differences for continuous outcomes.

Results: Fifteen studies comprising 1567 patients met the eligibility criteria in this review. Meta-analysis showed no significant difference in reoperation rates (OR = 1.43 [95% CI 0.79- 2.59]) or readmission rates (OR = 1.51 [95% CI 0.88-2.59]). Patients with proximal junctional kyphosis had significantly lower muscle volume (MD = -174.83 [95% CI -258.92, -90.75]). Length of stay was significantly longer in sarcopenia patients (MD = 1.00 [95% CI 0.65, 1.36]). No statistically significant difference was observed in wound complications (OR = 2.00 [95% CI 0.58, 6.86]). Additionally, patients with higher CSA demonstrated smaller T4-L1PA mismatch after ASD surgery. **Conclusions:** This systematic review and meta-analysis clarified the impact of sarcopenia on surgical outcome in ASD patients. Our findings indicate that sarcopenia is a significant factor contributing to poorer surgical outcomes in ASD. Preoperative evaluation of trunk muscle volume may facilitate risk stratification, prevention of postoperative complications, and inform the development of appropriate perioperative interventions such as prehabilitation and nutritional support.

ID: AGS26/2673
P0236: A comparison of spinal radiographic parameters and 30-day complications with freehand or robotic-assisted dual S1AI and S2AI in adult spinal deformity

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Introduction: Both long and short segment fusions in ASD surgery mandate rigid spinopelvic fixation to prevent mechanical spinopelvic failure. Despite technical and hardware improvements, spinopelvic pseudoarthrosis and early hardware failure remain common following ASD. Recent literature suggests that the DSAI technique decreases these complications. Considering the growing role of robotics in ASD, we sought to evaluate the differences in spinopelvic parameters, complications, operative duration, and estimated blood loss between RA and FH for DSAI. We hypothesize spinal radiographic parameters following lumbosacral pelvic fixation using the dual S1 alar-iliac (AI) and S2AI (DSAI) technique in adult spinal deformity (ASD) would be similar between the robotic-assisted (RA) and freehand (RH) groups. **Material and Methods:** A multicenter retrospective chart review was conducted on clinical records at two institutions for patients who underwent primary DSAI for ASD. We collected clinical data including demographics, operative data, perioperative outcomes, and postoperative complications. **Results:** 38 patients were included (n = 24 RA, n = 14 FH). When comparing the RA and FH groups, preoperative demographic variables were comparable between groups age (67.3 vs 68.5, p = 0.65) and BMI (27.8 vs. 28.95, p = 0.67), etc. Preoperative radiographic values for L4-S1, Lumbar Lordosis (LL), Pelvic Incidence (PI), PI-LL, and pelvic tilt (PT) were not statistically different between cohorts. The only intraoperative complication was durotomy, which occurred in 16.6% RA vs 14.3% FH, p = 0.85. Operative duration was shorter in the RA group (392 mins RA vs. 542 mins FH, p < .01). EBL was less in the RA group (p = 0.03). LOS was comparable between groups (8.38 days RA vs. 9.64 days FH, p = 0.30). There was no difference in SSI (p = 0.28). **Conclusion:** Both RA and FH DSAI techniques confer similar changes to spinopelvic parameters in ASD. While there may be a trend of greater spinopelvic change with FH, further data is required to evaluate significance. We did not find a statistically significant difference in intraoperative or perioperative complications. We observed that RA DSAI may decrease blood loss and require shorter operative times.

ID: AGS26/2793
P0237: Study on adjacent vertebral fracture and degenerative scoliosis after percutaneous kyphoplasty in patients with osteoporotic vertebral compression fractures

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Introduction: To investigate the impact of degenerative scoliosis on the incidence of adjacent vertebral fractures after percutaneous kyphoplasty (PKP) in patients with osteoporotic vertebral compression fractures (OVCFs). **Methods:** A retrospective review was performed on 269 patients who underwent PVP for OVCFs between January 2014 and October 2022, all with ≥ 24 months of follow-up. Among them, 121 patients had degenerative scoliosis. Patients were grouped by the presence and severity of scoliosis, and adjacent vertebral fracture incidence was compared. Cox proportional hazards regression and Kaplan-Meier survival analysis were applied to identify risk factors and recurrence times. **Results:** Of the 121 patients with degenerative scoliosis, 28 (23.1%) experienced adjacent vertebral fractures during follow-up, significantly higher than the rate in patients without scoliosis. Independent predictors of refracture included a T-score < -3.0 and the presence of degenerative scoliosis (both p <

0.001). When the scoliotic curve and index fracture were localized within T10-L4, a postoperative Cobb angle ≥ 20° (p = 0.002) and progressive angle increase (p = 0.001) markedly increased refracture risk. The mean recurrence interval was 17 months. **Conclusion:** Degenerative scoliosis is a significant risk factor for adjacent vertebral fractures after PKP in OVCF patients. Curve severity within the thoracolumbar region, particularly Cobb angle ≥ 20° or progressive deformity, further predisposes to refracture. Close postoperative surveillance and preventive measures are strongly recommended in this high-risk group.

ID: AGS26/2837
P0238: C2PA alone is insufficient: prediction of pelvic tilt correction requires consideration of lower-limb compensation

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Introduction: Pelvic tilt (PT) correction is vital in adult spinal deformity surgery. The C2-pelvic angle (C2PA) is a proposed geometric predictor of PT change, yet its accuracy may be altered by compensatory lower-limb (bent-knee) posture. Whether ΔC2PA maintains predictive efficiency when such compensation is present remains unclear. **Methods:** We analyzed a prospectively collected cohort of adults undergoing long spinal fusion (≥ 7 levels) for deformity correction. Among 207 eligible patients, 184 had complete preoperative and 6-week postoperative standing radiographs including knee flexion angle (KFA) measurements. Patients were stratified based on preoperative knee flexion angle into Low (≤ 5°, n = 63), Mid (5-12.7°, n = 60), and High (> 12.7°, n = 61) groups. Demographic and radiographic variables were analyzed, focusing on PT, PI-LL mismatch, lumbar lordosis (LL), thoracic kyphosis (TK), thoracolumbar alignment (TL), T4-L1 pelvic angle (T4L1PA), and Global Alignment and Proportion (GAP) score. Preoperative to 6-week changes were compared between groups using ANOVA with Tukey post-hoc tests. Multivariable regression tested the contributions of ΔC2PA and preoperative C2 tilt to PT change (ΔPT = ΔC2PA+Preoperative C2 Tilt), with simple slope analysis quantifying the modifying effect of knee flexion. **Results:** Overall, ΔC2PA and preoperative C2 tilt explained PT change with high accuracy (adjusted R^2 = 0.81). Stratified analysis showed the strongest fit in the Low flexion group (R^2 = 0.86), intermediate in Mid (R^2 = 0.79), and lowest in High (R^2 = 0.75). Simple slope analysis revealed that the efficiency of ΔC2PA in translating to PT correction decreased progressively with knee flexion: from 0.82 PT/°C2PA at 0° flexion to 0.74 PT/°C2PA at 15°. This equates to roughly a 10% greater C2PA correction required in the presence of 15° knee flexion to achieve the same PT change. Prediction error of the geometric model also increased linearly (+0.063 per-degree of flexion, p = 0.003). At 6-week, patients with greater preoperative knee flexion achieved larger absolute corrections across several spinopelvic parameters. PT decreased by -3.0° in the Low, -5.0° in the Mid, and -8.2° in the High group (High vs Low: -5.2°, p = 0.002). PI-LL mismatch improved by -14.3° (Low), -19.1° (Mid), and -30.9° (High), with significantly greater correction in the High group compared with both Low (-16.6°, p < 0.001) and Mid (-9.8°, p = 0.005). Lumbar lordosis increased by +15.1° (Low), +22.0° (Mid), and +32.4° (High), with the High group showing the largest gain (+17.3° vs Low, p < 0.001). GAP score improved by -3.6 (Low), -4.1 (Mid), and -5.8 (High), with greater improvement in the High group compared with Low (-2.2, p = 0.004). For TK, TL, T4L1PA, preoperative values were worse in patients with greater knee flexion, but the magnitude of change from baseline to 6-week did not differ significantly between groups. **Conclusions:** C2PA alone is insufficient for predicting pelvic tilt correction without accounting for compensatory knee flexion. Patients with bent-knee posture have worse baseline spinopelvic parameters and achieve larger absolute corrections in PT, PI-LL mismatch, LL, and GAP score after surgery. Our study shows reduced efficiency of ΔC2PA in driving PT correction, with ∼10% more correction required at 15° of flexion. Surgical planning should explicitly incorporate knee compensation to optimize sagittal balance.

ID: AGS26/2841
P0239: C2 pelvic angle as a surrogate for global alignment and proportion: comparative validation against GAP and T4L1PA in long-fusion ASD surgery

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Introduction: The Global Alignment and Proportion (GAP) score is widely used for preoperative planning and mechanical complication risk assessment in adult spinal deformity (ASD) surgery, but its intraoperative application is limited by reliance on Cobb angles. Vertebral-pelvic angles (VPAs) are reliable intraoperative metrics, though they lack segmental planning utility and their preoperative applicability remains restricted. C2 Pelvic Angle (C2PA) has been proposed as a parameter to guide pelvic tilt (PT) correction, yet its relationship to global alignment is not fully established. To examine the relationship between GAP score and C2PA in long-fusion ASD surgery, thereby assessing the validity of C2PA as a preoperative planning parameter and comparing its predictive value with T4L1PA. **Methods:** A prospective cohort of 207 surgical patients undergoing long-

segment fusion (≥ 7 levels), all with pelvic fixation, was analyzed. Normative C2PA values were derived using the formula PI × 0.4 - 13. The primary outcome was C2PA mismatch > 13°, as proposed in prior literature derived from community-dwelling adults. Predictors included GAP score (continuous, categorical, binary (< 7 vs ≥ 7)) and T4L1PA (continuous, categorical, binary). For T4L1PA categorical analysis, values < -1° were classified as overcorrection, -1° to +3° as in target, and > +3° as under correction, consistent with published thresholds. For the binary analysis, a 4° cutoff was applied, with > 4° defined as high risk and ≤ 4° as low risk. Discrimination was assessed using receiver operating characteristic (ROC) analysis with DeLong comparisons. Logistic regression estimated odds ratios for C2PA mismatch per unit increase in GAP. Patient-reported outcomes (PROs), including SRS-22 subscores/total and Oswestry Disability Index (ODI), were evaluated at 1-year follow-up, the point at which improvements typically plateau. **Results:** GAP showed excellent discrimination for C2PA mismatch > 13° (AUC 0.93, 95% CI 0.89-0.96). Each 1-point increase in GAP doubled the odds of mismatch (OR 2.07, 95% CI 1.73-2.57), while a 5-point increase conferred OR 37.7 (95% CI 14.1-100.5). GAP continuous significantly outperformed T4L1PA continuous (AUC 0.93 vs. 0.86, p = 0.032). T4L1PA continuous demonstrated an AUC of 0.78 when tested against GAP severity. For categorical analyses, GAP performed strongly (AUC 0.87) and significantly outperformed T4L1PA categories (AUC 0.79, p = 0.023). Agreement between GAP and T4L1PA categorical groupings was negligible (κ ≈ 0). For binary analyses, GAP and T4L1PA demonstrated similar discrimination (AUC 0.76 vs. 0.77, p = 0.80), with GAP favoring specificity and T4L1PA favoring sensitivity. Patient-reported outcomes were consistently more favorable in patients with C2PA mismatch ≤ 13°, though none reached statistical significance. ODI showed a nonsignificant trend toward improvement in the ≤ 13° group. **Conclusion:** C2PA demonstrates strong potential as a practical surrogate for the GAP score in preoperative planning, offering proportional targets linked to global alignment. In contrast, T4L1PA is valuable intraoperatively but does not adequately capture overall alignment. Used together, C2PA and T4L1PA provide complementary guidance: C2PA for preoperative planning of proportional correction and T4L1PA for intraoperative verification.

ID: AGS26/2868

P0241: Perioperative recovery kinetics and narcotic use following CMIS surgery for adult spinal deformity correction of 6 or more levels

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Introduction: Circumferential minimal invasive surgery (cMIS) for adult spinal deformity (ASD) avoids extensive muscle dissections and osteotomies to achieve optimal alignment. Therefore, it is conceivable that patients would ambulate early after surgery and would need fewer narcotic medications. It is important to objectively quantify these parameters to better understand cMIS outcomes. We conducted this study to evaluate patient mobility after 2 stage cMIS and use of narcotic pain medications in early postoperative period and follow-up up to 3 months. **Methods:** We analyzed retrospectively a prospectively maintained registry of patients undergoing 6 or more levels thoracolumbar 2 staged cMIS for ASD from Jan 2011 to Dec 2023. Total number of steps ambulated in postop period and the morphine equivalent (MME) of narcotics administered were calculated in postoperative period and up to 3 months after surgery. **Results:** A total of 133 patients were identified. No patient went to the ICU126 patients (95%) were able to stand sometime between the 2 stages of cMIS. On postop day 1 {(POD 1), days denoted after second stage} 71 patients (53.3 %) were able to stand upright, and 22 patients (16 %) walked at least 25 feet. By POD 4,102 patients (77%) had walked at least 25 feet, of which 43 patients (32%) walked 100 feet or more. 52 patients were taking narcotic pain meds preoperatively. The patients needing narcotics decreased from 124 (93%) (average MME 89.7) on POD 1 to 36 patients (27%) on POD 7 (average 47.3 MME). At 2 week follow up, 57 patients (43 %) were completely off narcotic medications and the rest 76 patients had narcotics use decreased to 13.6 MME on average. At the 3 month follow up 94 patients (71%) were completely off narcotics, and the rest of 39 patients (29%) had a decreased use to an average of 4.8 MME (95 % decrease from POD 1). **Conclusion:** Utilizing cMIS for ASD probably helps in early mobility and use of significantly less narcotic pain medications post-surgery. These advantages of cMIS could minimize complications associated with hospital stay and could improve functional outcomes in the early postoperative phase. This possibly makes cMIS a more favorable option for elderly population and patients with comorbidities. Further studies directly comparing data from open surgical techniques may be warranted to delineate the differences with cMIS.



ID: AGS26/2872
P0242: Translating research to clinical practice: understanding the research needs and learning methods of surgeons to help guide future spine deformity research: a survey of AO Spine members

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Introduction: Outcomes research through prospective and retrospective studies have helped provide guidance in the management of patients. How this research is disseminated to reach the target audience is an evolving process especially with the rapid advances in technology and social media. Projects that we have undertaken to date have had variable uptake by the spine surgery community. Controversy exists whether the incorporation of our work was influenced by the relevance of the research or the method of dissemination. Before investing in future studies, a survey was carried out to determine the needs of our target spine surgeons, assess the impact of our past work, and understand the modalities used to acquire new knowledge. **Material and Methods:** An anonymous English language survey was developed on Survey Monkey and consisted of 40 questions, including knowledge gaps and knowledge translation. The survey was distributed to members of AO Spine via email with a link to the questionnaire between March 20th and April 14th, 2025. Data analysis was performed with Excel. **Results:** A total of 399 responses were received from AO Spine members practicing across 60 countries. 28% of responses were from Asia Pacific region, 27% from Europe South Africa, 18% from Latin America, 16% from North America, and 11% from the Middle East and Northern Africa. 80% of responders were orthopedic surgeons. 279 respondents reported a focus on deformity surgery. 75%vof responders who performed deformity surgery indicated they use classification tools when evaluating patients and 80% routinely apply clinical guidelines in treatment planning, while 91% stated that findings from multicenter studies influence their clinical decision-making. 52-62% of responders were not aware of our previously published tools, revealing significant gaps in dissemination and adoption across clinical settings. The most cited sources of exposure included publications, conferences, and AO Spine educational courses, while key barriers to implementation were difficulties incorporating additional resources into existing workflows and administrative limitations. About 50% of responders were familiar with ScoliRISK study, while 45% reported being unaware of our other cited studies. The most common channels through which respondents became aware of these studies included conferences and meetings, peer-reviewed journals, and AO Spine courses. The highest-rated research priorities identified by the respondents included the development of diagnostic and treatment guidelines (71%) and prediction tools or decision algorithms (69%). The most critical knowledge gaps in the field of spinal deformity identified by 259 participants were proximal junctional kyphosis (PJK) prevention and treatment (69%), spinal alignment guidelines (54%), guidance for treatment of osteoporotic patients (52%), better tools for risk stratification for patients undergoing surgery (46%), and pseudarthrosis and rod fracture/instrumentation failure (41%). **Conclusion:** PJK, spinal alignment and osteoporosis were the leading knowledge gaps identified by the spinal deformity surgeons responding to the survey. The highest-rated research priorities were development of diagnostic and treatment guidelines and prediction tools/ decision algorithms. The dissemination of research outcomes should be improved to aid the adoption in clinical settings. The results of this survey will help in our planning future research projects and knowledge translation activities.

ID: AGS26/2887
P0243: High pelvic incidence and limited PI-LL correction increase risk of rod fracture

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Introduction: Rod fracture (RF) is a frequent mechanical complication of adult spinal deformity (ASD) surgery. Spinopelvic alignment is central to sagittal balance and inadequate alignment may predispose to construct failure. This study evaluated the impact of preoperative parameters, postoperative correction, and ROC-derived thresholds on RF occurrence. **Material and Methods:** We retrospectively reviewed the charts of 140 ASD patients who underwent long-segment posterior fusion (≥ 7 levels) between 2015 and 2023. Radiographic analysis included pelvic incidence (PI), pelvic tilt (PT), lumbar lordosis (LL), and PI-LL mismatch (PILL). Preoperative values, postoperative outcomes, and correction (ΔLL, ΔPT, ΔPILL) were compared between patients with and without RF. ROC analysis was performed to identify optimal predictive thresholds. **Results:** RF occurred in 35.7% of patients at a median of 761 days postoperatively. Patients with RF had higher preoperative PI (60.5° vs. 56.5°, $p = 0.037$) and PT (28.7° vs. 25.8°, $p = 0.042$). Preoperative LL ($p = 0.183$) and PILL ($p = 0.573$) were not predictive. Postoperative PT (21.6° vs. 19.8°, $p = 0.229$), LL (50.4° vs. 48.3°, $p = 0.273$), and PILL (11.9° vs. 9.7°, $p = 0.264$) did not significantly differ between groups. However, ΔPILL was smaller in the RF group (-15.3° vs.

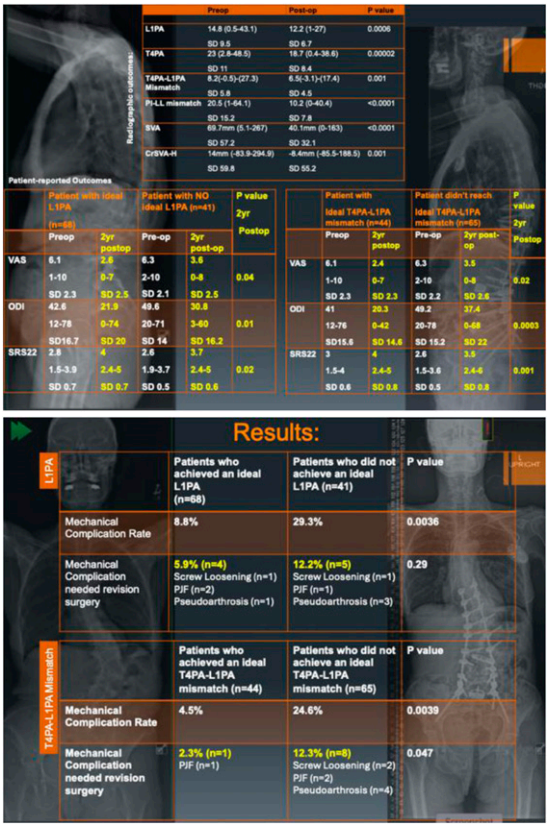
-19.9°, p = 0.042), indicating that insufficient mismatch correction increased fracture rates. ΔLL (p = 0.696) and ΔPT (p = 0.453) were not associated. ROC analysis demonstrated modest discriminative ability. PI ≥ 52.5° predicted RF with sensitivity 0.84 and specificity 0.37 (AUC = 0.60). PT ≥ 25.5° showed sensitivity 0.74 and specificity 0.47 (AUC = 0.61). ΔPILL ≥ -26.3° yielded sensitivity 0.88 and specificity 0.31 (AUC = 0.59). **Conclusion:** Elevated preoperative PI and PT, together with insufficient PILL correction, were associated with higher RF rates. ROC analysis identified sensitive thresholds for PI and ΔPILL, though overall predictive accuracy was limited. These findings highlight the importance of careful preoperative alignment assessment and optimization of sagittal correction to reduce mechanical failure risk in ASD surgery.

ID: AGS26/2986
P0244: Can ideal L1PA and T4PA-L1PA mismatch predict mechanical failure in circumferential minimally invasive adult spine deformity correction?

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Introduction: Role of sagittal balance in improving patient clinical outcomes has been well established in adult spine deformity (ASD) correction. More recently, L1 pelvic angle (L1PA) and L1PA-T4 pelvic angle (T4PA) mismatch have been shown as predictors of post-operative mechanical failures in long construct deformity correction. We conducted this study to evaluate if realignment of ideal L1PA and T4PA-L1PA mismatch in ASD patients undergoing circumferential minimally invasive spine fusion decreases postoperative mechanical complications. **Method:** Single surgeon adult spinal deformity (ASD) database of patients who underwent circumferential minimally invasive spine surgery (cMISS) was retrospectively examined from 2011 to 2022. Inclusion criteria were ASD (Cobb > 20°, SVA > 50mm, PI-LL > 10°), fusion ≥6 levels, minimum 2-year follow-up, upper instrumented level (UIV) T10-T12 and lowest instrumented vertebrae (LIV) of L5 or below, with having pre-operative and post-operative long standing X-rays. Pre-operative and post-operative long standing X-rays were measured for L1PA, T4PA, sacral vertical axis (SVA), pelvic incidence (PI), lumbar lordosis (LL), PI-LL mismatch for each patient. Ideal L1PA was defined as (0.5 x PI) - 21 ± 5°. The ideal T4PA-L1PA mismatch was defined as -4° to 4°. Patient charts were reviewed for any mechanical complications. A mechanical complication was defined as proximal junctional kyphosis, proximal junctional failure, rod fracture, re-operation due to hardware failure, pseudoarthrosis, screw loosening. Mechanical complications rates and revisions rates were compared between patients who attained an ideal L1PA and L1PA-T4PA mismatch versus those did not. **Results:** 109 patients met the inclusion criteria with an average age of 66.8 years (22-84, SD 9.6). The average pre-operative L1PA, T4PA-L1PA mismatch, SVA, PI-LL mismatch was 14.8°, 8.2°, 69.7mm, and 20.5° respectively. The average post-operative L1PA, T4PA- L1PA mismatch, SVA, PI-LL mismatch was 12.2°, 6.5°, 40.1mm, and 10.2°, respectively (p < 0.01). 68 (62.4%) patients achieved an ideal L1PA post-operatively. 44 (40.4%) patients achieved an ideal T4PA-L1PA mismatch. Mechanical complication rate between patients who achieved an ideal L1PA versus those who did not was 29.3% and 8.8%, respectively (p < 0.01). Mechanical complication requiring revisions surgery in patients who achieved an ideal L1PA versus those who did not was 12.2% and 5.9%, respectively (p = 0.29). Mechanical complication rate between patients who had an ideal post-operative T4PA- L1PA mismatch versus those who did not was 4.5% and 24.6%, respectively (p < 0.05). Mechanical complication requiring revisions surgery in patients who achieved an ideal T4PA- L1PA mismatch versus those who did not was 2.3% and 12.3%, respectively (p < 0.05). Proximal junctional failure requiring revision surgery was seen in only 1 patient who did not achieve an ideal L1PA and in 2 patients who had an ideal L1PA post-operatively. **Conclusion:** L1PA and T4PA- L1PA mismatch may be predictive of mechanical failure in patients undergoing circumferential minimally invasive spine fusion for spinal deformity. T4PA- L1PA mismatch may be predictive of need for revision surgery. However, L1PA and T4PA- L1PA mismatch were not predictive of proximal junctional kyphosis or proximal junctional failure.



ID: AGS26/2993
P0245: Long segment 6 Plus levels circumferential minimal invasive surgery (cMIS) for adult spinal deformity: 2-year outcomes analysis

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Introduction: Deformity correction with circumferential minimal invasive surgery (cMIS) involving longer segments (6+ levels) spanning the thoracolumbar spine is technically more challenging than fusions limited to lumbar spine. Rod fixation and reduction of deformity over more vertebral levels in a minimally invasive subfascial manner contributes to the technical difficulty. Radiological and clinical outcomes specific to fusions involving these long segments for adult spinal deformity (ASD) have not been delineated previously. We conducted this study to evaluate radiological spinal parameters and clinical outcomes at 2 years postoperatively in the 6+ levels of cMIS deformity correction patient group. **Methods:** A prospectively collected database of all patients who underwent CMIS correction of ASD from Jan 2011 to December 2021 was studied. Inclusion criteria was instrumentation of 6 + levels with upper instrumented vertebra (UIV): T12 and above, lower instrumented vertebra (LIV):S1 and below in patients with ASD [Cobb > 20, SVA > 50 mm, pelvic incidence PI- lumbar lordosis LL > 10, or pelvic tilt (PT) > 20], and at least 2year follow-up. Pre-operative, post-operative, and ≥ 2 years radiographic parameters (Cobb, CVA, SVA, LL, PI, PT, SS, PI-LL mismatch), clinical outcomes (VAS, ODI, SRS-22), complications and readmissions were analyzed. **Results:** A total of 105 patients were identified of which four patients had passed away from natural causes and seven were lost to follow-up. Thirty patients had a follow up between 1-2 years and 64 patients had ≥ 2 year complete radiological and clinical data and were included for this study (Mean = 59 month (24-130, SD 26.6). The clinical outcomes scores VAS ($p < 0.001$), TIS ($p < 0.001$), ODI ($p = 0.01$), SRS22 ($p = 0.01$) were all significantly improved both at 3-month and 2-year follow ups. The sagittal radiological measure of alignment including SVA, PI-LL mismatch, lumbar lordosis and thoracic kyphosis improved significantly compared to preop, whereas correction in coronal alignment/CVA was not statistically significant ($p = 0.06$). Three patients had proximal junctional failure, and underwent hardware revision (2 weeks, 15 and 21 months postop). Pseudoarthrosis with hardware failure were noted in three patients at thoracolumbar junctions and underwent reinstrumentation. Two patients had hardware prominence with associated localized pain posteriorly and underwent hardware removal. Four patients had asymptomatic hardware failure noted past 13 months that did not need any intervention. Two patients had superficial wound dehiscence and underwent debridement and closure. **Conclusion:** In the treatment of ASD, cMIS involving long segment fusions is a safe and effective option both for deformity correction and improving patient outcomes significantly. There were no catastrophic complications. The complication profile and the rates of hardware failure and proximal junctional failure are noted to be lower compared to reported outcomes with open deformity correction techniques.

ID: AGS26/2994
P0246: Rod fracture after adult spinal deformity surgery: a surgical rather than patient-driven complication

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Introduction: Adult spinal deformity (ASD) correction is a complex surgical undertaking that often requires extensive instrumentation and carries a risk of mechanical failure, including rod fracture (RF). While technical factors have been linked to RF, ambiguous evidence regarding patient-derived variables such as age, sex, BMI, or baseline frailty and disability has contributed to hesitancy in offering surgical treatment to vulnerable populations. This study investigates the relationship between patient characteristics and the incidence of RF to evaluate whether certain populations are indeed more susceptible to this complication. **Material and Methods:** We retrospectively analyzed the charts of ASD patients who underwent posterior spinal fusion with ≥ 7 instrumented levels between 2015 and 2023 at a single academic center. Follow-up was a minimum of 1 year. RF was confirmed by radiographic imaging. Patient variables included age, sex, BMI, sarcopenia (measured via MRI-based psoas index), preoperative opioid use, frailty score, and baseline Oswestry Disability Index (ODI). Statistical associations between these variables and RF were assessed using Spearman's correlation and chi-square testing. **Results:** Among 140 patients, RF occurred in 35.7%. RF rates were not influenced by baseline patient characteristics such as age (rho = -0.016, $p = 0.851$), sex ($\chi^2 = 0.001$, $p = 0.980$), or BMI (rho = -0.046, $p = 0.592$). Similarly, patient health indicators including sarcopenia (rho = 0.072, $p = 0.502$), frailty score (rho = 0.078, $p = 0.361$), and ODI (rho = -0.151, $p = 0.089$) showed no association with RF. Preoperative opioid use, often a surrogate for complex chronic conditions, also did not differ between groups ($p = 0.390$). **Conclusion:** In our cohort, RF rates were not influenced by baseline patient factors including age, BMI, sex, frailty,

sarcopenia, or preoperative disability. These findings suggest that the risk of RF is shaped primarily by surgical and biomechanical factors rather than by variations in patient health or baseline characteristics. They also reveal that it may be safe to implement standard reinforcement strategies across a broad and diverse ASD population, regardless of preoperative health status.

ID: AGS26/3002

P0247: Precision computer-assisted surgical planning for double-level modified PSO in the thoracolumbar region for severe kyphotic deformity in ankylosing spondylitis

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Objective: This study aimed to evaluate the accuracy of a computer-assisted surgical planning approach integrating automated image stitching, apical vertebra identification, and a machine learning algorithm for double-level modified pedicle subtraction osteotomy (mPSO) in severe kyphotic deformity secondary to ankylosing spondylitis (AS). We hypothesized that this solution would overcome the limitations of traditional radiographic assessment and improve the precision of osteotomy planning. **Material and Methods:** A retrospective cohort study was conducted on 26 AS patients with severe kyphosis who underwent double-level mPSO (including both single- and double-level osteotomy cases in a 2:1 ratio). A custom-developed module within the 3D Slicer platform was employed, utilizing a three-feature-point matching algorithm for full-spine image stitching. Spinal curvature analysis was used for apical vertebra identification and osteotomy simulation. A machine learning model was trained on preoperative parameters (Sagittal Vertical Axis - SVA, Global Kyphosis - GK, Chin-Brow Vertical Angle - CBVA) to predict the osteotomy strategy (1-level or 2-level). **Results:** The planning platform achieved an 80% success rate in full-spine image stitching and 85% accuracy in apical vertebra identification. The machine learning model demonstrated 85% agreement with the actual surgical decisions regarding the number of osteotomy levels. Postoperative assessment revealed significant improvement in sagittal alignment: SVA decreased by 20.79 ± 1.60 cm, the kyphotic angle decreased by 47.23 ± 4.14°, and the pelvic incidence minus lumbar lordosis (PI-LL) mismatch improved from 79.65 ± 4.25° to 30.52 ± 4.20°. T12 and L3 were the most frequently selected osteotomy levels. The mean operative time was 511.1 minutes with an average blood loss of 2159 mL. **Conclusion:** Computer-assisted planning incorporating advanced image analysis and machine learning effectively supports surgical decision-making for severe AS-related kyphotic deformity. This approach enables accurate spinal assessment, precise osteotomy planning, and contributes to personalized surgical outcomes.

ID: AGS26/3009

P0248: Efficacy and safety of modified pedicle subtraction osteotomy for kyphotic deformity in ankylosing spondylitis

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To summarize our experience with modified pedicle subtraction osteotomy (mPSO) for kyphotic deformity in ankylosing spondylitis (AS), focusing on its efficacy and safety. **Material and Methods:** We retrospectively reviewed 149 patients who underwent mPSO between January 2018 and September 2025, all performed by a single surgeon. Single-level osteotomy: 121 patients; double-level osteotomy: 26 patients. Patient demographics, radiographic correction, clinical outcomes, and perioperative complications were analyzed. **Results:** The mean follow-up duration was 35.17 ± 9.98 months. Both single- and double-level osteotomy groups achieved significant improvement in sagittal alignment. SVA improved from 766.5 ± 176.4 mm to 101.4 ± 65.03 mm (single-level) and from 1044.0 ± 198.6 mm to 139.1 ± 75.3 mm (double-level). Maximum thoracic kyphosis decreased from 42.00 ± 12.71° to 22.02 ± 14.92° (single-level) and from 104.40 ± 19.86° to 47.23 ± 20.69° (double-level). PT improved from 37.02 ± 13.30° to 28.56 ± 11.25 (single-level) and from 32.56 ± 18.33° to 28.77 ± 13.10° (double-level). PI-LL decreased from 13.56 ± 8.32° to 7.85 ± 8.95° (single-level) and from 79.65 ± 21.26° to 30.52 ± 21.02° (double-level). LL increased from -3.33 ± 2.62 to 29.80 ± 2.25 (single-level) and from -24.42 ± 17.73° to 21.50 ± 17.58° in the single- and double-level groups, respectively. The overall complication rate was 20.0% for single-level osteotomy and 26.9% for double-level osteotomy, with the most common events being dural tears/CSF leakage, neurological deficits, and systemic or wound-related complications. Severe complications, such as intraoperative neurophysiological signal loss and postoperative motor deficits, were rare, occurring in 2.7% of cases. **Conclusion:** mPSO provides effective radiographic correction of kyphotic deformity in AS, with overall satisfactory safety. However, 2 cases of severe intraoperative complications occurred, highlighting the need for careful surgical planning and meticulous intraoperative technique.

ID: AGS26/3093

P0249: Preoperative radiographic and CT evaluation imprinted on plain paper: a cost-effective, accurate alternative to navigation and robot-assisted correction of severe, rigid, and neglected spinal deformities in resource-limited settings

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Introduction: Navigation and robotic systems enhance precision in spinal deformity correction but remain inaccessible in many resource-limited settings due to cost and infrastructure demands. This study evaluates a low-cost, paper-based preoperative planning method using serial radiographs and CT scans to reconstruct pedicle anatomy, curvature patterns, screw trajectories, and osteotomy strategies-imprinted on plain paper-for severe, rigid, and neglected spinal deformities. **Material and Methods:** Thirty-two patients (mean age: 18.9 ± 5.4 years) underwent corrective surgery planned with the imprinted paper-based technique. Preoperative imaging was manually analyzed to reconstruct spinal anatomy and simulate instrumentation. Surgical and radiographic outcomes were compared with published navigation-assisted benchmarks. **Results:** Preoperative Cobb angles ranged from 81.6° to 110.2° (mean 94.8° ± 7.3°) and improved postoperatively to 23.8°-40.6° (mean 31.2° ± 4.6°), yielding correction rates of 61.9%-76.5% (mean 68.4% ± 4.1%). Screw placement accuracy was 89.8%-97.0% (mean 93.9% ± 2.2%), with malposition rates of 2.0%-6.1% (mean 3.7% ± 1.1%). Operative times ranged from 6.1 to 7.8 hours (mean 6.9 ± 0.5 hours), comparable to complex navigation-assisted surgeries. Neurological complications occurred in four patients (12.5%), all transient and resolved without permanent deficit. Estimated cost savings were 82%-88% compared to navigation-equipped procedures. At 15-26 months follow-up (mean 20.4 ± 2.6 months), all patients maintained stable correction and solid fusion. **Conclusion:** Preoperative radiographic and CT evaluation imprinted on plain paper is a scientifically robust, cost-effective, and accurate alternative to navigation- or robot-assisted techniques for severe spinal deformity correction. Comparable correction rates, screw accuracy, and operative times, coupled with manageable complication rates, make this method a practical solution for delivering high-quality spine care in resource-limited environments.

ID: AGS26/3102
P0250: Single-stage posterior vertebral column resection (PVCR) for the correction of severe and rigid spinal deformities: a prospective analysis of 31 cases

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Introduction: The management of severe and rigid spinal deformities remains one of the greatest challenges in spine surgery. Posterior vertebral column resection (PVCR) has evolved into a powerful technique that allows three-column correction through a single posterior approach. Despite its technical demands and potential complications, PVCR offers the possibility of meaningful correction and functional improvement in carefully selected patients. **Material and Method:** This prospective case series included 31 patients with severe (Cobb angle > 60°) or rigid kyphotic deformities who underwent single-stage PVCR between July 2016 and June 2023. Demographic data, operative parameters, radiological correction, functional outcomes, and complications were analyzed. Clinical outcomes were assessed using the Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS) for pain. **Results:** The mean age of patients was 30.7 ± 9.8 years (range 15-52), with a mean follow-up of 27.6 ± 8.4 months. The average operative time was 422 ± 95 minutes (range 320-760), and mean intraoperative blood loss was 760 ± 210 mL (range 560-1380). Postoperative kyphotic Cobb angle correction ranged from 31.2° to 56.4°, representing substantial deformity reduction. Functional outcomes improved significantly: mean ODI decreased from 58.6 ± 6.5 preoperatively to 11.2 ± 3.5 at final follow-up, and mean VAS improved from 6.7 ± 0.5 to 1.8 ± 0.7. Complications included dural tears in 3 patients (9.6%), transient thoracic root pain in 1 patient (3.2%), and neurological deterioration in 4 patients (12.9%)-three of which were transient with full recovery within 3 months, and one late-onset deficit with partial recovery. Surgical site infection occurred in 1 patient (3.2%). No mortality was observed. **Conclusion:** Single-stage PVCR is a safe and effective option for the correction of severe and rigid spinal deformities when performed in experienced hands. Despite its complexity and potential complications, PVCR can achieve substantial radiological correction, significant pain reduction, and marked functional improvement, making it a valuable tool in the armamentarium of deformity surgery.

ID: AGS26/3347
P0251: Clinical and radiological results for dual anchorage (SI-S2AI) system using patient specific templates in long construc instrumentations

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Introduction: In the context of long-segment instrumentations, extension of fixation to the sacroiliac joint (SIJ) is often required to ensure mechanical stability. At the same time, the SIJ is increasingly recognized as a potential source of chronic pain after long-segment instrumentations. Therefore, simultaneous posterior sacroiliac fusion could be a critical, yet technically demanding step during these compex surgeries. This study aims to evaluate sacroiliac joint fusion and screw placement accuracy while also documenting complication and revision rates in a cohort of patients treated with this novel patient-matched technology. **Material and Methods:** A dual-anchorage system with both an SI- as well as an S2AI screw was used bilaterally in 20 patients. Each patient underwent a preoperative CT scan,

which is used to perform surgical planning for the customization of the patient-specific guide. All surgeries are performed by a single surgeon via a posterior only approach. Follow-up evaluations are conducted at 3 and 6 months postoperatively including collection of sarco-iliac pain through VAS score and provocative tests. Subjects underwent high-resolution CT at 6 months after SI joint fusion. An independent radiologist analysed CT scans for the following endpoints: 1) Degree of apposition of bone to the implant within the sacrum (rated as 0-30%, 30-50%, 50-90%, > 90%). 2) Bridging bone within the treated joint (and, if present, location of bridging [adjacent, distant, both] and extent of bridging (< 5%, 5-15%, 15-30%, 30-100% of SI joint volume). 3) evidence of positive bone remodeling, defined as presence of increased bone density/sclerosis adjacent to the implant that appears to be due to new bone formation and/or an increase in mechanical demand at or distant from the bone-implant interface. A superimposition analysis was performed comparing the planned and actual screw trajectories. **Results:** 20 patients were operated by one single surgeon. 40 SI and 40 S2AI screws were placed. 3/40 (7.5 %) S2AI screws and 1/40 2.5 %) SI screw were placed in a direction that was significantly deviated from the preoperative planning. One complication related to malplacement of the screws was noted (Sacral fracture). None of the screws were revised. 40 SIJ's were instrumented. In 2/20 (10 %) patients, we could not confirm fusion of the SI joint. In a third patient an infection led to removal of the implanted screws. Postoperatively 60 % of patients were satisfied with their overall clinical result. 1 out of 20 (10 %) patients had pain related to the SI joint. **Conclusion:** Using a patient specific guide for both SI and S2AI screw placement is suggestive to be accurate and safe. SI fusion can be achieved using this dual anchorage system in the vast majority of cases. Additional clinical benefit of less postoperative SI joint pain after long segment fusion was noted. Further research with larger cohorts is necessary to confirm these findings.

A ID: AGS26/3349
P0251.1: Association between sagittal malalignment and proximal junctional compression in lumbar fusion patients

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Introduction: Sagittal malalignment is a well-established risk factor for mechanical complications following adult spine deformity correction surgery. In particular, increased biomechanical loading at the proximal junction has been linked to proximal junctional kyphosis and failure. The Global Alignment and Proportion (GAP) score was developed to assess the adequacy of spinopelvic realignment, yet its relationship with proximal junctional loading remains insufficiently defined. This study aims to investigate the association between GAP score and compressive force at the proximal junction in patients with lumbar fusion to the pelvis. **Methods:** For 41 patients who underwent lumbar fusion to the pelvis, 246 sagittal alignments were simulated using each patient's preoperative alignment and five suggested realignment strategies: Age-adjusted, GAP, Segmental, Roussouly, and T4–L1-axis. Musculoskeletal (MSK) models were generated by adjusting sex-matched generic templates to various spinal alignments. The models were fused from L2 to the pelvis. MSK analysis was performed under standing posture and spinal compression at the proximal junction (UIV/UIV+1) were calculated. The association between proximal junctional compression and GAP score was analyzed. Because the data were not normally distributed, Spearman's rank correlation was used to assess associations, and GAP categories (proportioned, moderately disproportioned, severely disproportioned) were compared using the Kruskal–Wallis test and Post-hoc Dunn's test. **Results:** Spearman's correlation demonstrated a significant positive association between GAP score and proximal junctional compression ($\rho = 0.63$, $p < 0.001$). Kruskal–Wallis testing confirmed significant differences in compression across GAP categories ($H = 77.8$, $p < 0.001$). Post-hoc Dunn's test revealed stepwise increases, with compression forces significantly higher in moderately and severely disproportioned patients compared with proportioned alignment, and highest in the severely disproportioned group (all $p < 0.001$). **Conclusion:** Proximal junctional compression is strongly associated with GAP score in patients undergoing lumbar fusion to the pelvis. Higher GAP scores, indicating greater sagittal malalignment, correspond to significantly increased biomechanical load at the proximal junction. These findings suggest that restoring proportional spinopelvic alignment may reduce mechanical stress and potentially lower the risk of proximal junctional complications.

ID: AGS26/3394
P0252: Should we try to classify the etiology of adult spinal deformity? An analysis of images from the PEEDS study

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Introduction: Adult spinal deformity (ASD) is a broad term, encompassing patients with a variety of disorders which lead to radiographic spinal deformity. Babu et al. reported a consensus Delphi-based study to categorize ASD patients, which resulted in a classification system encompassing 4 broad metrics to classify

the General Health Status, Spine-Specific Status encompassing many common HRQOL sets, Radiographic Measurements and Type of Deformity. Type of Deformity is derived from the Aebi classification, which classifies ASD into three categories: *de novo* degenerative lumbar scoliosis (DNDLS), progressive idiopathic scoliosis in adulthood (Adult Idiopathic Scoliosis (AdIS)) and Secondary Scoliosis (e.g. pelvic obliquity due to leg-length inequality, neuromuscular or congenital disorders). The Delphi panel felt with almost unanimity that the classification should be included. In theory, the Aebi classification represents different disease processes which may have effect on outcomes. It was felt that patients with DNDLS may have different curve patterns and worse sagittal plane parameters which may lead to different surgical patterns than in AdIS. However, the discriminant ability and reliability of the Aebi classification have not been well-tested. Guler et al. tested the classification reliability of 179 x-rays (103 AdIS and 76 DNDLS) amongst 5 surgeons and found modest interrater reliability. Unanimity of classification was achieved in 42/103 AdIS patients and in only 17/76 DNDLS patients and Kappa coefficients ranged from 0.04 to 0.6. In this study, we sought to measure reliability of the Aebi classification in a set of images from the PEEDS study. **Material and Methods:** In this post-hoc analysis from prospectively collected data, elderly ASD (> 60 years) images patients from the international, multicenter Prospective Evaluation of Elderly Deformity Surgery (PEEDS) study were anonymized and 4 experienced spine surgeons (GS, RR, SK and SL) classified the images, with 3 surgeons classifying them twice. Images were examined in person in the first round, and then again in person 6 months later. We used Microsoft Forms for data collection, with separate terms for Classification (Likely DNDLS, Likely AdIS, Congenital and Other). There were a maximum 7 classifications per image. 50 images were examined, with AP and lateral 36" images being reviewed. Frequencies of case classifications over 80%, between 60-80% and below 60% were measured. For each case, surgeons were asked a descriptive field leading to their decision, including Cobb angle, lateral rotatory olisthesis, sagittal plane imbalance, Schwab classification (D, N or L) and were able to enter free text. Frequencies of these descriptors were tallied. **Results:** There were 21 cases with 7 classifications, 28 cases with 6 classifications, and one case with only 4 classifications. Of 50 cases, only 5 (10%) received unanimous classification as DNDLS. A further 11 cases had only 1 instance of misclassification (22%) and were mostly classified as DNDLS. Therefore, 16/50 or 32% of cases had high levels of agreement. In 11 (or 22%), there was 60-80% agreement. In 23 cases (or 46%), there was less than 60% agreement. Some descriptors were strongly associated with classification. When there was sagittal plane imbalance, 96% of the cases were classified as DNDLS. Similarly, a thoracolumbar Cobb apex resulted in a AdIS classification 90% of the time. Lateral rotatory olisthesis was alternately classified as DNDLS (63%) or AdIS (37%). **Conclusion:** While the Aebi classification is deemed important by spine surgeons in a Delphi process, the accuracy of classification is poor. Only 32% of cases had high concordance of agreement, and these were highly more likely to be DNDLS cases. As such, without further development of classification systems, based on a single visualized image, surgeons cannot achieve concordance on the underlying diagnosis of ASD. The only other investigation on classification reliability for etiology of ASD was by Guler et al., who also found only fair agreement between observers. In both studies, sagittal plane imbalance was rated to be highly associated with DNDLS. While AdIS and DNDLS may be distinct diagnostic groups and may respond to treatment differently, it is impossible to accurately classify at this time. Future investigations could investigate serial images over a long time-range (> 20 years) to understand the evolution of ASD cases.

ID: AGS26/3429
P0253: Social determinants of health predict patient-reported pain outcomes 60 months following surgery for grade 2 lumbar spondylolisthesis: a QOD study

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Introduction: We aim to investigate whether social determinants of health (SDOH) affect patient-reported outcomes (PROs) 2 years after surgery for Meyerding grade 2 lumbar spondylolisthesis. **Methods:** Patients with grade 2 spondylolisthesis prospectively enrolled at the 14 SpineCORe study group sites of the Quality Outcomes Database (QOD) were identified. Separate multivariate linear regression models were trained to identify

predictors of 60-month postoperative PROs, including numerical rating scale (NRS) leg pain (NRS-LP), back pain (NRS-BP). Each model was trained using the following SDOH: insurance payor, education level (at least college degree vs none), and preoperative employment status. The models also controlled for age, gender, ASA grade, BMI, and preoperative value of each PRO. **Results:** In total, 328 patients who underwent surgery for grade 2 lumbar spondylolisthesis were identified. Twenty-five patients expired prior to the 60-month follow-up point, yielding a cohort of 303 patients. The 60-month follow-up rate for this cohort of 303 patients was 81%. Usage of Medicaid versus private insurance was an independent predictor of worse NRS-LP (β-coefficient: 2.564, p = 0.007) and NRS-BP (β-coefficient: 2.2, p = 0.027) at 60-month follow-up. Medicaid insurance status was associated with a worse baseline NRS-BP compared to private insurance (Medicaid: 8.8 ± 1.5 vs. Private: 6.9 ± 2.2). Patients with Medicaid insurance compared to private insurance had worse absolute NRS leg (Medicaid: 4.9 ± 2.2 vs. Private: 2.3 ± 2.8, p = 0.004) and back (Medicaid: 5.4 ± 3.2 vs. Private: 2.5 ± 2.7, p = 0.026) pain scores at 60-month follow-up; however, they experienced similar degrees of preoperative to postoperative (delta) leg (Medicaid: -1.8 ± 3.0 vs. Private: -4.0 ± 3.8, p = 0.052) and back (Medicaid: -3.4 ± 2.8 vs. Private: -4.3 ± 3.3, p = 0.387) pain improvements. **Conclusion:** In patients with grade II spondylolisthesis, Medicaid insurance status was associated with worse baseline low back pain. After surgery for grade II spondylolisthesis, Medicaid insurance status was an independent predictor of worse leg pain and significantly associated with worse absolute leg and back pain, Patients with grade II spondylolisthesis experienced similar improvements in back and leg pain following surgery regardless of insurance status.

ID: AGS26/3437

P0254: What factors predict return to work after surgery for grade 1 lumbar spondylolisthesis? A 5-year spine CORe QOD analysis

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Introduction: Unemployment following surgery incurs significant societal costs. We aim to identify predictors of return to work following surgery for grade 1 lumbar spondylolisthesis. **Methods:** Patients in the prospective Quality Outcomes Database Spine CORe Grade 1 Lumbar Spondylolisthesis module were divided into two groups: employed preoperatively and unemployed preoperatively. Univariate and multivariate instruments were used to identify predictors of return to work/employment within 5 years postoperatively. **Results:** Across the 12 highest enrolling QOD sites (Spine CORe Group), 608 patients were enrolled. Of these 608 patients, 604 patients had baseline employment status recorded. 275 were employed preoperatively, of which 249 had return to work follow-up data. Of the 329 patients unemployed preoperatively, 218 had return-to-work follow-up data. By 5 years postoperatively, 87.1% (n = 217) of those employed preoperatively and 22.0% (n = 48) of those unemployed preoperatively returned to work. In each cohort, there were no differences in age, gender, BMI, ASA grade, or ethnicity between those who did and those who did not return to work. On multivariate analysis for the preoperatively employed cohort, college degree (OR: 5.1, CI: 1.6-20.3) and active employment (OR: 6.4, CI: 1.8-23.7) remained independent predictors of returning to work. For those preoperatively unemployed, a college degree (OR: 2.6, CI: 1.2-5.9) independently predicted return to work. **Conclusions:** Approximately 87% of patients employed preoperatively return to work, and 22% of patients unemployed preoperatively return to the workforce within 60 months after surgery for grade 1 spondylolisthesis. College-level education independently predicted return to work for both preoperatively employed and preoperatively unemployed patients.

Degenerative cervical

ID: AGS26/87

P0255: Anterior cervical trapezoid corpectomy and fusion (ACTCF): a novel technique for cervical spondylotic myelopathy

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Introduction: To describe a novel technique, namely, anterior cervical trapezoid corpectomy and fusion (ACTCF), and to research its initial clinical efficacy in the treatment of cervical spondylotic myelopathy (CSM). **Material and Methods:** A total of 30 patients with CSM who were treated with the ACTCF between May and December 2021 were retrospectively reviewed. The main surgical procedures include discectomy, trapezoidal osteotomy, pruning and replanting of autogenous bone, and implantation of cage. Relevant data, including patient sex, age, follow-up time, operative duration, postoperative complications, operative level, and osteotomy segment, were collected. Visual analog scale (VAS), Japanese Orthopaedic Association (JOA) scores and Neck Disability Index (NDI) before surgery, immediately, 1 month, 3 months, 6 months and 12 months after surgery were collected. The decompression and fusion outcomes were evaluated by X-ray and CT. Disc height of involved segment, C2-C7 cervical lordosis (C2-C7 CL) and sagittal segmental alignment (SSA) before surgery, immediately, 1 month, 3 months, 6 months and 12 months after surgery were measured. The correlated data were analyzed using t test, with significance defined as $p < 0.05$. **Results:** All patients in this study had favorable outcomes and experienced no postoperative complications. The limbs and neurological symptoms of 30 patients improved significantly after the operation. The mean follow-up was 13.4 months. The VAS, JOA scores and NDI significantly improved at immediately, 1 month, 3 months, 6 months and 12 months after surgery ($p < 0.05$). Disc height of involved segment, C2-C7 CL and SSA improved at immediately, 1 month, 3 months, 6 months and 12 months after surgery ($p < 0.05$). Radiographic review revealed no significant back plant settlement, and good fusion was observed at an early stage. **Conclusion:** For the treatment of CSM with cervical spinal stenosis, ACTCF may be a good alternative to traditional ACCF which can reduce complications, maintain intervertebral height, and accelerate fusion time.

ID: AGS26/88
P0256: Novel lever-up laminoplasty for treating multilevel cervical spondylotic myelopathy: a prospective study of clinical and radiologic outcomes

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Introduction: To assess the clinical and radiological outcomes of lever-up laminoplasty (LLP) using innovative hinged titanium plates for treating multilevel cervical spondylotic myelopathy (CSM). **Material and Methods:** In this prospective study, 25 patients with multilevel CSM underwent LLP from June to October 2022. Intraoperative metrics (operative time, blood loss, transfusion volume, and complications) were recorded. Postoperative imaging evaluated spinal cord decompression by measuring the midsagittal diameter, transverse area, and osseous canal volume. Clinical outcomes were evaluated using the Japanese Orthopaedic Association (JOA) scores preoperatively, and axial symptoms (AS) were quantified using the Visual Analogue Scale (VAS). **Results:** All procedures were successfully performed, with follow-up periods of 24 months. Postoperative imaging confirmed complete neural decompression in the treated segments, without any signs of cervical instability. Significant increases in the midsagittal diameter (C3-C7) and cross-sectional area of the spinal canal were observed compared to preoperative values ($p < 0.01$). The osseous spinal canal volume increased by an average of 61.82% ± 18.50%. Both the JOA and VAS scores demonstrated significant improvements postoperatively ($p < 0.01$). One patient experienced transient C5 nerve root palsy, which was resolved with conservative treatment. No other complications or significant AS were reported. **Conclusion:** LLP using hinged titanium plates is a safe and effective surgical approach for the treatment of multilevel CSM. This technique results in significant expansion of the spinal canal, thorough neural decompression, and a reduced incidence of postoperative AS, thereby presenting a promising alternative to traditional laminoplasty methods.

ID: AGS26/167
P0257: Cervical paraspinal muscle atrophy is associated with internal carotid artery stenosis

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Introduction: Paraspinal muscle degeneration, characterized by fatty infiltration (FI) and reduced functional cross-sectional area (fCSA), contributes to spine instability, chronic pain, and disc degeneration. The association between abdominal aortic calcification (AAC) and lumbar muscle atrophy is well-established, highlighting the interplay between vascular health and muscle degeneration. However, similar vascular-muscle associations in the cervical spine are unexplored. Carotid stenosis, primarily recognized as a biomarker of cardiovascular risk, may also reflect vascular impairment to cervical paraspinal muscles. The objective of our study is to assess the relationship between carotid artery stenosis (CAS) and muscle morphology and understand the association between vascular health and musculoskeletal degeneration. **Material and Methods:** A retrospective cross-sectional study. Muscle measurements were conducted on T2-weighted axial MRIs at the C3 mid-vertebral level, categorized and segmented into five bilateral functional groups: 1) the

sternocleidomastoid group (SCM), 2) the anterior group (AG), 3) the posteromedial group (PM) , 4) the posterolateral group (PL), and 5) the trapezius group (TP). The fCSA and FI for each muscle group were calculated. Carotid analysis was performed on CTA images using specialized software, which semi-automatically calculated mean and maximum stenosis. Correlations between muscle parameters and mean and maximum stenosis were analyzed using Spearman's correlation coefficient. Multivariable linear regression analysis was conducted to further examine the relationship between stenosis measurements and muscle measurements with adjustments for age, BMI, and sex. **Results:** Sixty-five patients undergoing primary cervical spine surgery between 2009 and 2018 with preoperative cervical MRI and CTA exams (≤ 12 months apart) were included. After adjusting for age, sex, and BMI, regression analyses showed that more severe stenosis was associated with higher FI. Mean stenosis was significantly associated with FI in all muscle groups, including SCM ($p = 0.001$), anterior ($p = 0.022$), PL ($p = 0.031$), PM ($p = 0.003$), and TP ($p = 0.001$). Maximum stenosis was associated with reduced fCSA in SCM ($p = 0.032$) and anterior (= 0.032), as well as FI in SCM ($p = 0.005$), TP ($p = 0.006$), and PM ($p = 0.001$). **Conclusion:** This study is the first to demonstrate a significant association between CAS and cervical paraspinal muscle atrophy. These findings suggest that vascular health, particularly carotid stenosis, may contribute to muscle degeneration through impaired perfusion and metabolic changes. Future research should investigate the causal relationship between vascular health and muscle degeneration to enhance clinical management, given the link between muscle atrophy and spinal instability, chronic pain, and poor postoperative outcomes.

ID: AGS26/196

P0258: Thoracic inlet angle as a predictor of recovery in cervical spine surgery: a cluster analysis of demographic interactions on radiographic and functional outcomes

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Introduction: Thoracic Inlet Angle (TIA) is a critical factor in understanding cervical alignment and predicting recovery outcomes following cervical spine surgery. We analyzed the correlations between TIA and T1Slope, CL, and cSVA at multiple time points, perform cluster analysis based on PreopΔ, and assess how demographic interactions impact outcomes within each cluster. **Material and Methods:** In this multi-center study of 157 cervical spine surgery patients, correlations between TIA and T1Slope, CL, and cSVA were evaluated preoperatively and at 1 month, 1 year, and 2 years postop. Clusters based on PreopΔ divided patients into Cluster 0 (high PreopΔ), Cluster 1 (moderate PreopΔ), and Cluster 2 (low PreopΔ). **Results:** TIA showed strong correlations with T1Slope ($r = 0.76$, $p < 0.001$) and CL ($r = 0.63$, $p < 0.001$), confirming TIA's alignment impact. While Cluster 0, with the highest PreopΔ, experienced persistent alignment challenges, Cluster 2 - despite lower PreopΔ - exhibited delayed functional recovery and significantly higher ODI scores at 2 years, particularly among smokers ($p < 0.001$). This finding diverges from expectations, suggesting that lower preoperative misalignment alone does not ensure better outcomes. Cluster 1 outcomes were heavily influenced by BMI and age, with older and high-BMI patients showing worse TIA and CL recovery. The interaction effects reveal that demographic factors like smoking, age, and BMI may sometimes outweigh alignment severity in determining functional recovery. **Conclusion:** High PreopΔ was linked to alignment difficulties, as expected, but functional recovery was notably poorer in Cluster 2 smokers, showing that demographic risks can heavily influence outcomes. Cluster 1 patients with high BMI and age showed exacerbated alignment and pain, suggesting these patients require weight management and targeted postoperative alignment support.

ID: AGS26/244

P0259: Cervical spinal canal stenosis: a rare cause of syringomyelia

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Introduction: Syringomyelia is commonly associated with Chiari malformations, spinal trauma, arachnoiditis or tumors. Cervical canal stenosis is rarely implicated in this intramedullary cavitation. **Material and Methods:** We report the case of a 60 year-old man with disabling paresthesia and impaired pain in upper limbs. Physical examination revealed spastic tetraparesis and syringomyelic syndrome. X-ray of the cervical spine demonstrated stenosis of the cervical canal and degenerative changes from C3 to C6 levels. Magnetic resonance imaging showed also a syrinx located in the cervical and thoracic regions from C1 to T3. There were no contrast enhancement or cranio-vertebral junction abnormalities. After cervical laminectomy, symptoms improved and the syrinx has almost disappeared. **Results:** Magnetic resonance imaging showed also a syrinx located in the cervical and thoracic regions from C1 to T3. There were no contrast enhancement or cranio-vertebral junction abnormalities. After cervical laminectomy, symptoms improved and the syrinx has almost disappeared. **Conclusion:** Syringomyelic cavity may be developed due to craniospinal pressure dissociation caused by spinal cord compression. Laminectomy could be sufficient to induce regression of the syringomyelia.

ID: AGS26/439
P0260: Diagnostics and surgical correction of spondylogenic dysphagia in cervical spondylosis

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Introduction: Spondylogenic dysphagia occurs in patients over 60 years of age, according to various authors, with a frequency of up to 10.6% and often remains undiagnosed. Cervical deforming spondylosis and Forestier's disease occupy a leading place among the causes of this syndrome. **Material and Methods:** The results of diagnostics and surgical treatment of five patients with spondylogenic dysphagia are presented. All patients underwent CT of the cervical spine and barium esophagography before surgery. All patients were assessed before and after surgery (after 2 weeks and 6 months) using the following scales: 10-point numerical rating scale (NRS) for pain syndrome and the functional outcome of swallowing scale for the degree of dysphagia (FOSS scale). **Results:** Before surgery, 2 patients had FOSS III dysphagia, and 3 patients had FOSS IV dysphagia. The average pain level according to the NRS was 7.8. All patients underwent osteophytectomy via anterior transcervical access. In the early and late postoperative period, gradual regression of swallowing disorders to FOSS I was noted, as well as regression of pain syndrome to 2 according to the NRS. The follow-up period was 2 years. **Conclusion:** Microsurgical transcervical osteophytectomy provides stable regression of dysphagia and pain syndrome in the absence of relapses.

ID: AGS26/464
P0261: Handgrip strength reflects frailty, gait, and dexterity in patients with degenerative cervical myelopathy

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Introduction: Degenerative cervical myelopathy (DCM) is a progressive neurological disorder caused by compression of the spinal cord within the cervical canal, leading to neurological deficits such as gait and hand dexterity impairments. Handgrip strength is not merely an indicator of muscle weakness; it is also used as a predictor for various outcomes, including length of hospital stay and prognosis. This study aimed to evaluate whether handgrip strength affects frailty, gait status, and dexterity in patients with DCM. **Material and Methods:** This cross-sectional observational study included 94 patients (29 females, 65 males; mean age 66.9 years) who underwent surgery for DCM. Preoperatively, we measured handgrip strength, lower extremity extension power (LEP), pinch strength, 10-meter walk test, counter test, height, weight, body mass index (BMI), the Japanese Orthopaedic Association (JOA) score, the geriatric nutritional risk index (GNRI), and the 5-item modified frailty index (mFI-5). The mFI-5 was used to classify patients into a healthy group (0 points), a prefrail group (1 point), and a frail group (≥ 2 points). **Results:** Handgrip strength was significantly correlated with age ($r = -0.468$, $p < 0.001$), height ($r = 0.601$, $p < 0.001$), weight ($r = 0.459$, $p < 0.001$), LEP ($r = 0.675$, $p < 0.001$), walking speed ($r = 0.617$, $p < 0.001$), counter test ($r = 0.659$, $p < 0.001$), pinch strength ($r = 0.723$, $p < 0.001$), total JOA score ($r = 0.468$, $p = 0.001$), upper extremity motor function ($r = 0.616$, $p < 0.001$), lower extremity motor function ($r = 0.658$, $p < 0.001$), mFI-5 ($r = -0.369$, $p = 0.001$), and GNRI ($r = 0.207$, $p = 0.046$). No significant correlation was found with BMI, upper extremity sensory function, lower extremity sensory function, trunk sensory function, or bladder function. The mean handgrip strength was 19.5 ± 9.7 kg in the frail group, 25.2 ± 7.1 kg in the prefrail group, and 30.0 ± 7.5 kg in the healthy group. Handgrip strength in the frail group was significantly lower than in both the prefrail and healthy groups. **Conclusion:** In preoperative DCM patients, handgrip strength was positively correlated with height, weight, lower extremity extension power, walking speed, pinch strength, and counter test, and negatively correlated with age. Our findings suggest that handgrip strength can serve as an indicator of walking ability, manual dexterity, and frailty status in preoperative DCM patients. This highlights the potential utility of handgrip strength in the preoperative assessment of patients with DCM.

ID: AGS26/526
P0262: Understanding the role of vascular health in cervical muscle atrophy and disc degeneration

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Introduction: Degeneration of paraspinal muscles and intervertebral discs has been associated with spinal instability, chronic pain, and suboptimal surgical outcomes. While the

impact of aortic calcification on lumbar spine structures has been previously explored, similar vascular-degenerative associations in the cervical spine remain poorly understood. The objective of this study is to evaluate the relationship between carotid artery stenosis (CAS) and cervical paraspinal muscle morphology as well as its potential association with intervertebral disc integrity. **Material and Methods:** A retrospective cross-sectional study of patients undergoing primary cervical spine surgery between 2009 and 2018 with preoperative cervical MRI and CTA exams (≤ 12 months apart) was performed. T2-weighted axial MRIs from C3 to C7 were used to measure fat infiltration (FI) and functional cross-sectional area (fCSA) in six bilateral muscle groups: sternocleidomastoid (SCM), anterior group (AG), scalenus (SN), posteromedial (PM), posterolateral (PL), and trapezius (TP). Disc degeneration was evaluated using a validated Disc Signal Intensity (DSI2) index across the same cervical levels. CAS was measured on CTA using semi-automated software, yielding both maximum stenosis (single most narrowed point) and mean stenosis (average narrowing throughout the vessel). Correlations between muscle and disc parameters and carotid artery stenosis were analyzed using Spearman's correlation and multivariable regression adjusted for age, sex, and BMI. **Results:** Sixty-five patients (58% female, median age of 67 years and BMI of 26.5 kg/m^2) were included. Spearman analyses demonstrated that higher mean and maximum CAS were significantly correlated with increased FI and reduced fCSA across multiple muscle groups, particularly at the C3 and C4 levels (all $p < 0.05$). In multivariable linear regression models, higher mean stenosis was significantly associated with increased FI in the SCM ($p = 0.008$), PL ($p = 0.024$), PM ($p = 0.001$), TP ($p = 0.003$), and AG ($p = 0.026$) at C3, as well as the PM ($p = 0.023$) at C4 and SCM ($p = 0.032$) at C5. Higher mean stenosis was also associated with reduced fCSA in the PM ($p = 0.049$) and SCM ($p = 0.034$) at C4. Similarly, increased maximum stenosis was significantly associated with increased FI in the SCM ($p = 0.008$) and TP ($p = 0.012$) at C3, and the PL ($p = 0.019$) at C4, along with reduced fCSA in the SCM ($p = 0.035$) at C4. No significant associations were observed between CAS and disc degeneration, as assessed by the DSI2 index. **Conclusion:** CAS was linked to cervical muscle atrophy, particularly at the C3 level, pointing toward a potential role of vascular health in muscle degeneration. In contrast, disc degeneration as measured by the DSI2 index showed no association with CAS, suggesting that muscle atrophy and disc degeneration may follow distinct degenerative or metabolic pathways.

ID: AGS26/551
P0263: Postoperative surgical site infections (SSI) in cervical spine surgery from preceding epidural steroid injection: a systematic review and metanalysis

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Introduction: When elective spine surgery is planned on the background of recent epidural steroid injections (ESI), the risk of infection is of foremost relevance. This is more so of concern when these treatment episodes are in proximity. The immunosuppressive effects of corticosteroids coupled with the long half-life of these medications is of clinical significance. Though evidence exists for lumbar spine surgery on this topic, there is paucity of evidence of cervical spine surgery (CSS). This systematic review assesses risk of post operative infections following cervical spine surgery within 3 months of an ESI for a degenerative spinal pathology. The three month interval duration was deemed to be clinically relevant for patient-care and also practical period for analyses, based on existing literature in lumbar spine surgery. **Method:** A systematic review in accordance with Preferred Reporting Items for Systematic review and Meta-Analyses (PRISMA) guidelines was conducted for English literature assessing infection as an outcome in cervical spine surgery following cervical ESI. Studies with interval greater than 3 months between ESI and cervical spine surgery, case reports, review articles were excluded. From a cumulative 271 studies identified from the PubMed database, three retrospective cohort studies were included for the systematic review and meta-analysis. **Results:** One study assessed outcomes of anterior and posterior CSS separately while the remaining two included both anterior and posterior CSS. All three papers analysed outcomes from retrospective American health insurance-based clinical databases. A total of 22,445 patients received an ESI within the preceding 3 months of CSS as against 355,002 patients in the control group undergoing CSS without preceding ESI. Post-operative infection was found in 155 patients (0.69%) receiving preceding ESI as against 2950 patients (0.83%) in the control group. Analysis performed using random effects model with Mantel-Haenszel method found no statistical difference between the two cohorts with risk ratio of 1.21 (95% confidence interval 0.92-1.6). **Conclusion:** Our meta-analysis confirms no increased risk of SSI in patients who have had steroid injections within three months preceding their cervical spine surgery compared to the group that did not. This information is clinically relevant for shared decision making for patients with degenerative cervical spinal pathology. Larger prospective trials to may shed stronger evidence for clinical practise to overcome the limitations of the retrospective insurance-based database studies used for this analysis.

ID: AGS26/593
P0264: Transient skeletal muscle loss after cervical decompression for myelopathy

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Introduction: Degenerative cervical myelopathy (DCM) is a prevalent spinal cord disorder in older adults that causes neurologic symptoms such as gait instability and disruption of fine motor control. The goal of surgical decompression for DCM is to halt or reverse neurologic symptoms as measured by the modified Japanese Orthopaedic Association (mJOA) scale, but factors influencing postoperative recovery remain incompletely understood. Sarcopenia, defined as abnormally low skeletal muscle mass and/or strength, is common in older adults and is associated with accelerated functional decline, increased mortality, and may negatively affect outcomes in cervical spine procedures. Bioelectrical impedance analysis (BIA) is a guideline-accepted, noninvasive method for quantifying skeletal muscle mass, and can be used to calculate the appendicular skeletal muscle index (ASMI, kg/m^2) and detect sarcopenia at presurgical baseline and postoperative changes over time. This study was designed to determine the preoperative prevalence of sarcopenia and characterize postoperative longitudinal changes in ASMI in patients undergoing surgical decompression for DCM. **Material and Methods:** In this prospective study, patients between 18 to 100 years of age scheduled to undergo non-emergent cervical decompression for DCM were enrolled after providing written informed consent. Exclusion criteria were cardiac electronic devices and inability to stand unsupported for 60 seconds. ASMI was measured using BIA preoperatively and at 3, 6, 13, and 26 weeks postoperatively. Functional status was assessed at the same time points using mJOA scores calculated from questionnaires. Repeated measures generalized linear models were used to model longitudinal change in ASMI following surgical decompression using follow-up week as the independent variable. Estimated marginal means for each follow-up time-point were compared with baseline and simulation adjustment was used to account for multiple comparisons. Analyses were repeated using sex, mJOA score, and surgical invasiveness as model covariates. Surgical invasiveness was defined as the number of vertebral levels fused (1, 2-3, or $\geq$ 4 levels). **Results:** Data were analyzed from 31 patients. Preoperative characteristics included age, body mass index (BMI), BMI group, obesity status, sex, ASMI, mJOA score, sarcopenia status (yes/no), osteoporosis status, and the number of vertebral levels fused. Preoperatively, 6.5% (n = 2) of patients met the criteria for sarcopenia. Postoperatively, ASMI was significantly different (less) from baseline at weeks 3, 6, and 13 ($p = 0.002$, 0.001, and 0.008, respectively) but did not differ from preoperative values by week 26 ($p = 0.71$). Males had a significantly greater ASMI than females ($p = 0.001$), but the interaction between sex and postoperative week was not statistically significant ($p = 0.78$), indicating post-operative change in ASMI did not differ by sex. mJOA score was not associated with ASMI ($p = 0.66$). **Conclusion:** ASMI decreased significantly during the first 13 weeks after cervical decompression but appeared to recover to presurgical baseline levels by week 26. The early ASMI decrease is consistent with expected decreases in postoperative activity and lifting restrictions and suggests transient, rather than persistent, postoperative muscle loss. Continued postoperative follow-up to one and two years may reveal any long-term changes in ASMI or sarcopenia prevalence as a result of decompression.

ID: AGS26/684
P0265: Post-operative Horner's syndrome (HS): a case report on a rare complication after anterior cervical dissectomy and fusion (ACDF) surgery

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Introduction: Cervical degenerative disc disease (CDDD) is common in older individuals, typically presenting with pain and neurological symptoms. The gold standard for correction is Anterior Cervical Discectomy and Fusion (ACDF), a safe, effective procedure. Horner's Syndrome (HS) is an extremely rare complication immediately post-ACDF with approximately 0.06% incidence, due to impairment of the sympathetic trunk. We aim to present, to our knowledge, the first case of delayed-onset HS post-ACDF. **Material and Methods:** The patient, a 48-year-old woman, with CDDD-related pain and radiculopathy, was counselled and consented for C5/6 and C6/7 ACDF. ACDF was performed by standard anterior left-sided incision at appropriate levels identified with II and Kasper pins. Contrasting with our usual practice, deeper-toothed retractors were employed for better exposure. Two cages were inserted at C5/6 and C6/7. Standard ACDF procedural time

was taken at 180 minutes without intra-operative complications. **Results:** The patient experienced significant relief from CDDD symptoms immediately post-ACDF, however, developed sudden onset left-sided HS, with ptosis and anhidrosis approximately 48-hours post-ACDF. A prednisolone course was initiated, and she was followed-up at 2, 6, 12, and 16 weeks postoperatively. By 2-weeks, she exhibited clinical improvement, and by 12-weeks, her HS had completely resolved, with no residual effects. **Conclusion:** This case study is the first documented instance of delayed-onset HS post-ACDF to our knowledge. It may possibly be associated with the type of retractors used, resulting in neuropraxia or strain on the sympathetic chain ganglia. We recommend adequate exposure while minimizing excessive retraction of the longus colli muscle to reduce irritation to the sympathetic trunk.

ID: AGS26/747
P0266: Short and long-term outcomes in multiple sclerosis patients undergoing cervical spine surgery: a retrospective database review

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Introduction: Cervical spinal myelopathy (CSM) in patients with multiple sclerosis (MS) presents a unique clinical challenge due to the interplay of demyelination and spinal degeneration, which exacerbates neurological deficits and complicates surgical outcomes. While cervical decompression and stabilization procedures are standard for symptom relief, current data is limited by small sample size leading to unclear short-term medical complications and long-term mechanical outcomes in MS patients. **Methods:** Using the TriNetX database, a retrospective cohort study was conducted across 104 healthcare organizations. Patients undergoing cervical decompression or stabilization procedures were categorized into two cohorts: MS patients diagnosed $\geq$ 1 year before surgery and non-MS patients were propensity score matched (1:1) with balanced demographic and comorbidities. Outcomes included 30-day medical complications (e.g., hospital readmissions) and 2-year mechanical complications (e.g., hardware failure, adjacent segment disease, revision surgeries). Statistical analyses included risk differences, risk ratios, and p-values. **Results:** 840 patients were included in each cohort. The matched cohorts were predominantly female (67.4% MS vs 64.9% non-MS), white (74.6% MS vs 75.4% non-MS), and non-Hispanic (74.3% MS vs 74.5% non-MS), with mean ages of 57.4 $\pm$ 10.6 and 58.1 $\pm$ 11.1 years respectively. MS patients had significantly higher rates of hospital readmissions within 30 days compared to non-MS patients (18.2% vs. 13.6%; risk difference = 0.046; 95% CI: 0.012-0.081; p = 0.009). No significant differences were observed in 2-year mechanical complications, including hardware failure, adjacent segment disease, or revision surgeries, between the two cohorts. **Discussion:** This study highlights an increased risk of 30-day hospital readmissions in MS patients undergoing cervical spine procedures, emphasizing the need for tailored perioperative care in this population. However, comparable 2-year mechanical outcomes suggest that MS alone should not contraindicate cervical spine surgery. These findings provide clinicians with valuable insights to guide surgical decision-making and optimize postoperative outcomes for MS patients.

ID: AGS26/851
P0268: Timing of subsidence in segmental plate fixation for anterior cervical discectomy and fusion

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Introduction: Anterior cervical discectomy and fusion (ACDF) has become a gold standard in treatment of degenerative cervical myelopathy and radiculopathy. While this is an effective treatment strategy when successful, complications such as pseudoarthrosis and cage subsidence can affect outcomes. Anterior plate fixation can decrease these complications but can be difficult to apply, particularly in multi-level procedures. Segmental anterior plate application has been proposed to decrease difficulty in plate application and enhance biomechanical stability which can decrease operative time and potential patient complications. While subsidence rates are still being elucidated, the time from surgery to subsidence is equally important for the surgeon's knowledge. This study aims to determine the time from surgery to subsidence for ACDF with segmental anterior plate fixation as well as identify risk factors that may lead to subsidence. **Material and Methods:** This is a retrospective review of 86 patients who underwent ACDF with segmental anterior plate fixation from January 2020 to January 2022. Patient demographics and clinical data were collected. Radiographs were taken during the time of surgery and at subsequent patient follow-up visits. Subsidence was defined as > 3 mm of height loss across the fusion level on subsequent radiographs. Average time from surgery to subsidence was calculated and the Welch t-test was used to determine what patient characteristics were associated with subsidence. **Results:** 86 patients were included in the study. 11 patients had subsidence of the cage-plate construct. The average time from surgery to subsidence was 130 days (SD 102.6 days). There were no

statistically significant differences for categorical or continuous variables in those who subsided and those who did not. However, there was a large positive effect for body mass index (BMI) (Cohen's d = 0.95) and weight (Cohens' d = 0.85) for those with higher BMI trending towards higher rates of subsidence. Smoking showed a non-significant increase in odds of subsidence, Odds ratio [95% confidence interval] (3.686 [0.747, 18.193]). **Conclusion:** The average time from surgery to subsidence was 130 days. Subsidence can cause issues such as an increase in patient's pain and potential need for revision surgery. Knowing when these implants subside can help surgeons understand at what time points follow-up is important and when to get post-operative radiographs. Understanding risk factors for subsidence can also help surgeons to optimize patients pre-operatively to decrease these complications.

ID: AGS26/868
P0269: What factors on initial patient presentation are associated with patient satisfaction following cervical spine surgery? Insights from a prospectively collected outcomes database

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Introduction: Patient satisfaction following cervical spine surgery is multifactorial, but the precise contributors remain incompletely understood. Prior research suggests that demographic characteristics, medical comorbidities, and psychosocial factors can influence postoperative outcomes. Identifying which factors are important provides avenues for improving patient selection and intervening to improve outcomes. This study examined which patient factors at initial presentation were associated with satisfaction at 90 days, 1 year, and 2 years after cervical spine surgery. **Material and Methods:** A prospective multicenter database was queried for patients undergoing cervical spine surgery at a tertiary care institution from 2013-2023. Patients presenting emergently or lacking two-year follow-up satisfaction data were excluded. Satisfaction, assessed at 90 days, 1 year, and 2 years postoperatively, was dichotomized into "satisfied" (met expectations and improved, would repeat) and "not satisfied" (improved, but would not repeat and did not meet expectations). Baseline symptoms, prior interventions, medical history, education and employment plans were evaluated as predictors of satisfaction. T-tests and Chi-square tests were used for continuous and categorical variables respectively. Multivariable logistic regression was employed to identify predictors. **Results:** A total of 515 patients (53% male, 47% female; 89% White, 11% non-White) were included. Overall satisfaction (categorized as "Met expectations was 85% at 90 days, 82% at 1 year, and 78% at 2 years. Race was a consistent predictor of satisfaction ($p < 0.001$ at 90 days and 1 year, $p = 0.024$ at 2 years), with White patients reporting higher satisfaction. Higher education level was significantly associated with greater satisfaction at 90 days ($p = 0.018$) and at 2 years ($p = 0.023$). Patients who planned to return to work reported significantly higher satisfaction at 1 year ($p = 0.009$) and 2 years ($p = 0.002$). Early satisfaction at 90 days was lower among patients with prior cervical surgery ($p < 0.001$), atrial fibrillation ($p = 0.037$), congestive heart failure ($p < 0.001$), anxiety ($p = 0.001$), or adjacent segment disease ($p = 0.028$). At 2 years, a longer interval since previous spine surgery ($p = 0.003$) and the absence of chiropractic treatment ($p = 0.034$) were associated with higher satisfaction. Logistic regression was limited due to number of patients with complete data. **Conclusion:** Patient satisfaction following cervical spine surgery is influenced by multiple factors, with race, education level, and return-to-work plans showing the most consistent associations across time points. Medical comorbidities including atrial fibrillation, congestive heart failure, and anxiety significantly impact early satisfaction while previous treatments influence long-term outcomes. These findings may inform patient selection, pre-operative counseling, and targeted interventions to optimize satisfaction outcomes.

ID: AGS26/871
P0270: Impact of perioperative anticoagulation on outcomes following cervical spine fusion surgery: a propensityscore-matched analysis

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Introduction: Anticoagulation therapy in spine surgery is an often-debated topic due to the competing risks of deep vein thrombosis and epidural hematoma. These risks are further compounded by differing patient comorbidities and surgical complexity. Recent literature has begun to better shed light on the necessity of anticoagulation with some studies showing benefits and others with detrimental effects. However, a broader look at specific postoperative complications and long term satisfaction following cervical fusion surgery has not been undertaken. This study takes advantage of dichotomous prescribing habits between two services and rigorous propensity score matching to analyze the influence of anticoagulation therapy on clinical outcomes. **Material and Methods:** A multicenter, prospectively collected database was retrospectively reviewed to identify all patients who underwent cervical fusion at a tertiary healthcare system between 2014 and 2024. A comprehensive review of patient charts was conducted to ensure adherence to the prescribing patterns of both orthopedics and neurosurgery services. Patients with documented

histories of deep vein thrombosis (DVT) or hypercoagulable conditions were excluded. Patients were stratified based on anticoagulation status (anticoagulated: n = 581; control: n = 675). Propensity score matching was performed using age, gender, BMI, race, smoking status, diabetes, and ASA classification, resulting in 374 matched pairs (n = 748). Composite outcomes for all complications and neurologic complications. T-tests and Chi-square tests were used for continuous and categorical variables respectively. Binary logistic regression was employed with Firth correction used for rare events. **Results:** Pre-matching analysis revealed the anticoagulation group was significantly older (61.6 vs. 56.0 years, $p < 0.001$), had higher prevalence of CAD ($p = 0.007$), hypertension ($p < 0.001$), and differences in racial composition ($p = 0.006$). Post-matching, all baseline characteristics were balanced ($p > 0.05$), with matched groups having a mean age of approximately 59.7 years, BMI around 31.0, and similar distribution of gender, race, smoking status, diabetes, ASA class and other cardiovascular comorbidities. Postoperatively, the anticoagulation group experienced significantly higher rates of lower extremity weakness (20.1% vs. 11.8%, $p = 0.002$). Although myelopathy (1.1% vs. 0%) and bowel/bladder dysfunction (1.1% vs. 0%) were more common in the anticoagulated group, these differences were not statistically significant ($p = 0.124$ for both). Rates of DVT (0.8% vs. 0.5%, $p = 1.000$), pulmonary embolism, CSF leak, wound dehiscence, and hematoma (0% vs. 1.1%, $p = 0.124$) were also not statistically significant. The anticoagulated group had significantly longer hospital stays (mean LOS: 3.87 vs. 1.83 days, $p < 0.001$) and were more frequently discharged to non-home facilities such as skilled nursing, rehabilitation, or acute care settings (15.0% vs. 4.5%, $p < 0.001$). Readmission and reoperation rates within 90 days were not significantly different. Patient satisfaction at 90 days, 1 year, and 2 years were not significantly different between groups (all $p > 0.05$). Across cervical fusion regression models, longer hospital stay consistently predicted worse outcomes-new weakness (OR 1.14/day, $p < .001$), any complication (OR 1.22/day, $p < .001$), neurologic complications (OR 1.17/day, $p < .001$), and hematoma (OR 1.20/day, $p < .001$). Anticoagulant use was not protective for DVT (removed from model; $p = .871$), PE (OR 3.76, $p = .347$), or hematoma (removed; $p = .612$), but it predicted neurologic complications (OR 1.61, $p = .042$) and new weakness (OR 1.70, $p = .024$). Diabetes predicted wound dehiscence (OR 12.82, $p = .021$); osteoporosis increased risk of any complication (OR 2.00, $p < .001$), neurologic complications (OR 1.71, $p = .031$), and hematoma (OR 7.24, $p = .009$) but was inversely associated with new weakness (OR 0.57, $p = .022$). Race effects were notable: Asian patients had higher odds of any complication (OR 4.63, $p = .014$) and neurologic complications (OR 6.25, $p = .002$); Black (OR 6.11, $p = .002$) and Asian (OR 3.40, $p = .033$) patients had higher odds of new weakness; Hispanic patients showed elevated odds for neurologic complications (OR 3.47, $p = .032$). **Conclusion:** This propensity-matched analysis demonstrates that anticoagulation therapy following cervical fusion surgery is associated with increased postoperative morbidity without providing demonstrable clinical benefits. Anticoagulation was associated with significantly higher rates of lower extremity weakness, neurological complications, along with substantially longer hospital stays and increased discharge to institutional care facilities. In regression modeling, anticoagulation use also predicted neurologic outcomes. Despite these interventions aimed at preventing thromboembolic events, anticoagulation provided no protective effect against DVT or pulmonary embolism. The substantial increase in healthcare resource utilization, combined with the lack of protective benefits and increased risk of neurological complications, challenges the routine use of anticoagulation in cervical fusion patients. These findings support a more selective, individualized approach to anticoagulation decisions and suggest that routine prophylaxis may not be warranted in the majority of cervical fusion cases.

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P0271: Single-level ACDF outcomes in hypertensive patients: a propensity score-matched comparison of ARBs and ACE inhibitors

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Introduction: Activation of Renin-angiotensin system (RAS) receptors in bone has been shown to promote osteoclastic activity, whereas RAS blockers (commonly prescribed for hypertension) decreases osteoclastic and increases osteoblastic activity. Clinical data suggest potential associations between RAS blocker use and reduced fracture risk, yet evidence on their role in spinal fusion outcomes remains limited. Importantly, angiotensin receptor blockers (ARBs) and angiotensin-converting enzyme inhibitors (ACEIs) act through distinct mechanisms, which may translate into differential effects on fusion and perioperative outcomes. This study aimed to compare perioperative complications, revision rates, and healthcare utilization in hypertensive patients undergoing single-level (SL) ACDF treated with ARBs versus ACEIs. **Material and Methods:** The TriNetX Global Collaborative Network was queried to identify hypertensive patients undergoing SL ACDF using CPT and ICD-10 codes. Two cohorts were defined: ARB users with hypertension and ACEI users with hypertension. ARB and ACEI users respectively had prescriptions within 6 months before and 6 months after surgery. Propensity score matching (1:1) was performed for age, sex, BMI, Charlson Comorbidity Index, smoking status,

osteoporosis. Outcomes assessed included medical complications at 90 days, as well as surgical complications, revision rates, and resource utilization at 90 days, 6 months, and 1 year. **Results:** After matching, 4,551 patients were included in both the ACEi and ARB cohorts. ARB use was associated with a significantly lower risk of deep infection after ACDF at 90 days (OR 0.453, p = 0.034). Pseudarthrosis rates were reduced in the ARB group at 90 days (OR 0.844, p = 0.008), 6 months (OR 0.838, p = 0.004), and 1 year (OR 0.837, p = 0.003). Conversely, myocardial infarction (MI) risk was significantly increased in ARB patients at 90 days (OR 1.531, p = 0.028). Resource utilization was lower in the ARB group, with decreased readmissions at 90 days (OR 0.880, p = 0.048), 6 months (OR 0.871, p = 0.023), and 1 year (OR 0.883, p = 0.025). **Conclusion:** ARB use was associated with lower risks of pseudarthrosis, deep infection, and hospital readmission compared to ACEI use. These findings suggest a potential protective effect of ARBs on fusion integrity and perioperative outcomes. ARB use was associated with higher MI rates at 90 days follow-up, which has been reported in other trials. Larger prospective studies are needed to validate these associations, but in the meantime, our study suggests avoiding ACEi, if possible, in the early post-operative period following ACDF.

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P0272: Multicenter analysis of clinical results of the algorithmic approach to the choice of anterior decompressive-stabilizing intervention in two-segment degenerative diseases of the cervical spine

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Introduction: Currently, there are no substantiated clinical and radiological indications in the specialized literature for the differentiated use of discectomy with a two-level ACDF and one-level ACCF in the treatment of patients with two-segment cervical degenerative diseases. Purpose of the study was prospective evaluation of the long-term clinical results of the algorithmic approach to the choice of ACDF and ACCF for two-segment degenerative diseases of the cervical spine. **Material and Methods:** A comparative analysis of the treatment of patients with two-segment cervical degenerative diseases was performed among a prospective cohort of patients (n = 95) operated on according to the preoperative clinical and morphological algorithm in three neurosurgical departments of Irkutsk and Krasnoyarsk (Russia) and Almaty (Kazakhstan) in the period 2021-2023 and a retrospective control group (n = 186) operated on at the Irkutsk from 2009 to 2020 using the same surgical techniques depending on the surgeon's preference. The results were compared between the subgroups of ACDF and ACCF according to preoperative and remote clinical data (neurological symptoms, level of pain syndrome in the cervical spine and upper extremities, functional status according to ODI and mJOA, quality of life according to the SF-36 scale, the result of the operation according to the Macnab scale) and the presence of complications according to the Dindo-Clavien classification. **Results:** After ACCF, the prospective group demonstrated better dynamics: recovery of neurological functions ($p < 0.05$), regression of pseudoradicular symptoms ($p < 0.05$), improvement of NDI ($p = 0.032$) and mJOA ($p = 0.041$), physical ($p = 0.015$) and psychological ($p = 0.013$) health components according to SF-36, and better indicators according to the Macnab scale ($p = 0.006$). The incidence of complications in prospective subgroups was significantly lower compared to retrospective ones: after ACDF ($p = 0.025$) and ACCF ($p = 0.032$). **Conclusion:** An algorithmic anterior approach to differentiated choice of ACDF and ACCF in two-segment cervical degenerative diseases led to significant improvement of clinical outcomes and reduction of postoperative complications with a minimum 2-year postoperative follow-up period.

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P0273: Cervical anterior osteophytes: case series, management, and clinical results

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Cervical anterior osteophytes and Diffuse Idiopathic Skeletal Hyperostosis (DISH) are non-inflammatory conditions frequently observed in the elderly. While often asymptomatic, they can rarely lead to serious clinical manifestations, including dysphagia, dysphonia, respiratory distress, and increased vulnerability to spinal cord injury following mild trauma due to altered spinal biomechanics. This study aims to retrospectively review cases diagnosed at Bursa City Hospital Neurosurgery Clinic between November 2023 and August 2025 and share findings regarding their management. Six male

patients (mean age 69.3 ± 8.7 years) were evaluated. The primary presenting complaints included neck and arm pain (66.6%), gait disturbance and weakness (50%), and dysphagia/dysphonia (33.3%). Preoperative neurological examinations varied from normal motor strength with severe movement limitation to spastic tetraparesis and tetraplegia. Radiological findings identified anterior osteophyte involvement predominantly at C4-7 and massive involvement from C2-T1. One patient was followed conservatively after declining surgery. Another patient with massive DISH achieved complete resolution of symptoms three months after an anterior osteophytectomy. The remaining cases required combined anterior and posterior surgical approaches due to concomitant cervical degenerative disease and spinal cord lesions. Notably, histopathological examination in two patients revealed osteochondromas, a rare finding in the anterior column that carries risks of recurrence and malignant transformation. Surgical management of these conditions is challenging as they often coexist with other degenerative pathologies. Technical nuances are critical, including the use of a rigid nasogastric catheter for esophageal identification, the potential use of a chisel for excision, and intraoperative neuromonitoring to protect the recurrent laryngeal nerve. In conclusion, while many cases of DISH and cervical osteophytes can be managed conservatively, symptomatic and progressive cases require surgical intervention. Clinicians should remain vigilant regarding the potential for underlying malignancies or rare tumors like osteochondromas, making histopathological evaluation recommended whenever possible.

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P0274: Impact of frailty on surgical outcomes in degenerative cervical myelopathy: a systematic review and meta-analysis

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Introduction: Frailty is increasingly recognized as a key predictor of surgical risk, yet its impact on outcomes in degenerative cervical myelopathy (DCM) remains poorly defined. Although frail patients often present with worse baseline function, it is unclear whether they achieve similar postoperative gains or experience disproportionate perioperative risk. **Objective:** To systematically evaluate the effect of frailty-measured by the modified Frailty Index (mFI) or Hospital Frailty Risk Score (HFRS)-on functional recovery and complication rates after surgical intervention for DCM. **Material and Methods:** A systematic search of PubMed, Embase, Scopus, and Web of Science was performed through July 2025. Studies were included if they reported frailty status and at least one clinical outcome in adults undergoing surgery for DCM. Meta-analyses were conducted using standardized mean differences (SMD) and odds ratios (OR) with 95% confidence intervals (CI). Risk of bias was assessed using the Newcastle-Ottawa Scale, and publication bias was evaluated with Egger's test. **Results:** Eleven retrospective cohort studies comprising 105,166 patients met inclusion criteria. High-frailty patients demonstrated worse preoperative status, including lower mJOA scores (10.83 vs. 12.31), higher Nurick grades (3.97 vs. 3.05), and poorer SF-36 PCS and NDI scores (all $p < 0.05$). Despite these baseline differences, postoperative functional improvements were comparable between high- and low-frailty groups across all metrics (e.g., ΔmJOA: $p = 0.466$; ΔNDI: $p = 0.794$). Frailty was, however, strongly associated with increased perioperative risk, including prolonged hospital stay (SMD 2.25), readmission (OR 2.09), reoperation (OR 4.00), and mortality (OR 11.95). Intraoperative parameters, such as blood loss and operative time, did not differ significantly between groups. **Conclusion:** Frailty is a strong predictor of perioperative complications in DCM surgery but does not reduce the potential for meaningful functional recovery. Incorporating frailty assessments into preoperative evaluation can improve risk stratification, guide patient counseling, and support perioperative optimization-without excluding appropriately selected frail patients from surgical treatment.

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P0275: Comparing complication profiles and patient factors for C2 versus C3 as the upper instrumented vertebra in cervical fusion

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Introduction: Extending a cervical fusion construct to the C2 vertebra is a more complex procedure than stopping at C3. This study aims to identify the patient demographics and complication rates associated with choosing C2 versus C3 as the upper instrumented vertebra (UIV). **Material and Methods:** A retrospective cohort study of 200 patients undergoing multi-level posterior cervical fusion was conducted. Patients were grouped by UIV: C2 (n = 103) or C3 (n = 77). Demographics, comorbidities, and complication rates were compared using chi-square and t-tests. **Results:** The two cohorts were well-matched for age, sex, BMI, smoking status,

and prevalence of diabetes or inflammatory arthritis. However, the revision surgery rate was significantly higher in the C3 cohort (17.1% vs. 4.2%, p = 0.005). Furthermore, the C3 cohort had a significantly higher rate of wound complications (9.2% vs. 0.0%, p = 0.002). There was a non-significant trend towards a higher number of laminectomy levels in the C3 group (4.55 vs. 4.09, p = 0.034) and a higher rate of other neurologic deficits (23.7% vs. 13.5%, p = 0.086). Rates of C5 palsy, SSI, PJK, PJF, DJK, and DJF were not significantly. **Conclusion:** While baseline patient factors are similar, choosing C3 as the UIV is associated with a significantly higher risk of revision surgery and wound healing complications compared to constructs incorporating C2. This may be due to the increased mechanical strain on a construct that ends at the more mobile C3 segment versus the inherently stable C2. Surgeons must weigh the potential radiographic advantages of stopping at C3 against its significantly higher complication profile.

ID: AGS26/995
P0276: Clinical signs and symptoms for degenerative cervical myelopathy: a scoping review of case-control studies to facilitate early diagnosis among healthcare professionals with stakeholder engagement

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Introduction: Degenerative cervical myelopathy (DCM) is a leading cause of chronic spinal cord dysfunction, with diverse clinical presentations that complicate diagnosis. Therefore, it is important to identify the signs and symptoms of DCM that demonstrate high diagnostic accuracy. This review aims to evaluate the sensitivity and specificity of signs and symptoms in diagnosing DCM. **Material and Methods:** Articles up to June 2024 were retrieved from PubMed, EMBASE, and Cochrane databases using search terms like "degenerative cervical myelopathy", "cervical spondylotic myelopathy", "sensitivity", "specificity", and related signs and symptoms. Studies were screened based on selection criteria assessing the sensitivity and specificity of signs or symptoms using an appropriate control group. **Results:** Sixteen studies were included. The most sensitive signs were Tromner sign (93-97%) and hyperreflexia (15-85%). Specific signs included the Babinski sign (93-100%), Tromner sign (79-100%), clonus (96-99%), and inverted supinator sign (78-99%). Neck pain had a sensitivity of 76-94% and specificity of 11-73%. Hand incoordination showed 52% sensitivity and 92% specificity. Altered hand sensation had 76% sensitivity and 90% specificity. Upper extremity weakness had 51-75% sensitivity and 18-95% specificity. Gait imbalance exhibited 56-63% sensitivity and 52-95% specificity. **Conclusion:** Sensitive signs like the Tromner sign and hyperreflexia are useful for screening, while specific signs such as Babinski, clonus, and the inverted supinator sign aid in confirmation of DCM. Symptoms like neck pain, hand incoordination, and altered hand sensation should heighten suspicion and guide differential diagnosis. Early and accurate diagnosis using these indicators can improve patient outcomes and reduce diagnostic delays.

ID: AGS26/1000
P0277: The effect of body mass index and metabolic syndrome on postoperative outcomes after cervical laminoplasty

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Introduction: Obesity and metabolic syndrome have become common comorbidities among patients undergoing spine surgery. While previous studies have explored the effects of body mass index (BMI) and metabolic syndrome on various spine procedures, large-scale database analyses specifically focused on cervical laminoplasty remain lacking. This study aimed to evaluate 30-day postoperative outcomes following cervical laminoplasty, stratified by BMI categories and the presence of metabolic syndrome. **Material and Methods:** This study utilized data from the American College of Surgeons National Surgical Quality Improvement Program database from 2007 to 2022. Patients who underwent cervical laminoplasty were identified and categorized into underweight, normal weight, pre-obese, and class I-III obese groups according to the World Health Organization guidelines, as well as according to the presence or absence of metabolic syndrome. The primary outcome was the 30-day occurrence of at least one complication (excluding blood transfusions). Secondary outcomes included rates of major and minor complications, readmissions, reoperations, hospital length of stay (LOS), and total operative time. **Results:** A total of 2,261 patients were analyzed, including 21 underweight, 510 normal-weight, 782 pre-obese, 565 class I obese, 249 class II obese, and 134 class III obese individuals. The cohort consisted of 244 individuals with metabolic syndrome and 2,017 without. There were no significant differences in the 30-day rates of overall complications (excluding blood transfusions), major or minor complications, readmissions, reoperations, or hospital LOS across non-normal-weight BMI groups compared to normal-weight patients. However, after adjusting for baseline variables, class II obesity (coefficient 23.585, 95% confidence interval [CI] 10.815-36.355; p < 0.001) and class III obesity (coefficient 20.096, 95% CI 4.712-35.479; p = 0.011) were independently associated with longer operative

time. Patients with metabolic syndrome had a significantly higher likelihood of experiencing at least one postoperative complication, excluding blood transfusion (11.1% versus 5.9%, p = 0.003), and at least one major complication (7% versus 3%, p = 0.003). Specifically, they exhibited significantly increased rates of deep incisional surgical site infection (SSI; 2% versus 0.5%, p = 0.017), postoperative pneumonia (2.9% versus 0.7%, p = 0.005), and postoperative dialysis (0.4% versus < 0.1%, p = 0.032). Additionally, patients with metabolic syndrome had significantly longer hospital stays (4.6 ± 4.4 days versus 3.7 ± 4.0 days, p = 0.003) and were significantly more likely to experience prolonged hospitalization (27% versus 14.7%, p < 0.001). After adjusting for confounding variables, metabolic syndrome remained an independent risk factor for deep incisional SSI (odds ratio [OR] 3.25, 95% CI 1.07-9.80, p = 0.037), postoperative pneumonia (OR 4.17, 95% CI 1.63-10.63, P = 0.003), and prolonged hospitalization (OR 1.68, 95% CI 1.17-2.41, p = 0.005). **Conclusion:** Patients with metabolic syndrome face a significantly increased risk of adverse perioperative outcomes after cervical laminoplasty. Implementing preoperative interventions such as rigorous serum glucose control and effective hypertension management may help mitigate surgical complications and reduce associated costs in these patients. Furthermore, preoperative weight loss in class II-III obese patients may help decrease operative time, potentially minimizing surgical risks and associated costs.

ID: AGS26/1008
P0278: Racial and ethnic disparities in posterior cervical spine surgery: an analysis of 19,994 cases

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Introduction: Although racial disparities have been studied in the context of anterior cervical spine surgery, limited literature exists on outcomes following posterior cervical spine procedures, which differ in surgical techniques, indications, and recovery. This study aimed to evaluate the extent of racial and ethnic disparities in perioperative outcomes after posterior cervical spine surgeries. **Material and Methods:** Using data from the 2006-2023 American College of Surgeons National Surgical Quality Improvement Program database, we conducted a retrospective cohort study of patients who underwent posterior cervical fusion or cervical laminoplasty, identified through Current Procedural Terminology codes 63050, 63051, 22590, 22595, and 22600. Patients were stratified by race (White, Black or African American, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native) and Hispanic ethnicity. Individuals of the White race served as the reference group in all analyses. The primary outcome was the incidence of any postoperative complication (excluding blood transfusion) within 30 days. Secondary outcomes included major, minor, medical, and surgical complications, total operative time, hospital length of stay, and discharge disposition. **Results:** A total of 19,994 patients were included in the study. The majority were White (n = 14,276, 71.3%), followed by Black or African American (n = 3,473, 17.4%), Asian (n = 822, 4.1%), American Indian or Alaska Native (n = 218, 1.1%), Native Hawaiian or Pacific Islander (n = 114, 0.6%), and Hispanic (n = 1,091, 5.5%). After adjusting for covariates, Black or African American race was independently correlated with higher risk of experiencing at least one major complication (odds ratio [OR] 1.264, 95% confidence interval [CI] 1.07-1.488; p = 0.005), a medical complication (OR 1.234, 95% CI 1.057-1.436; p = 0.007), cardiac arrest requiring cardiopulmonary resuscitation (OR 2.631, 95% CI 1.427-4.718; p = 0.001), pulmonary embolism (OR 1.88, 95% CI 1.262-2.755; p = 0.001), extended hospital stay (OR 1.921, 95% CI 1.742-2.117; p < 0.001), and non-home discharge (OR 1.801, 95% CI 1.645-1.972; p < 0.001), in addition to longer total hospital stay (coefficient 1.114, 95% CI 0.969-1.258; p < 0.001). Asian race was independently correlated with longer operative times (coefficient 17.621, 95% CI 12.249-22.994; p < 0.001) and longer hospital stay (coefficient 0.77, 95% CI 0.498-1.042; p < 0.001). Native Hawaiian or Pacific Islander race was independently correlated with longer hospital stays (coefficient 1.938, 95% CI 1.253-2.623; p < 0.001) and higher odds of prolonged hospitalization (OR 2.396, 95% CI 1.535-3.668; p < 0.001). Similarly, Hispanic ethnicity was independently associated with increased hospital stay duration (coefficient 0.597, 95% CI 0.36-0.833; p < 0.001) and higher risk of extended hospitalization (OR 1.309, 95% CI 1.109-1.54; p = 0.001). **Conclusion:** Racial and ethnic minority patients were significantly more likely to experience unfavorable outcomes within 30 days following posterior cervical spine surgery in comparison to White patients. These disparities underscore the need for comprehensive, interdisciplinary approaches to address inequities in surgical care. Future research should incorporate social determinants of health to further explore the root causes of these racial and ethnic outcome differences.

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P0279: Prevalence of congenital cervical spinal stenosis in the Brazilian population

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Introduction: Cervical spinal canal stenosis is a multifactorial condition characterized by narrowing of the canal, most commonly affecting individuals over 50 years of age. Although more

frequent in the lumbar region, about 25% of cases involve the cervical spine, where it may cause nerve root and spinal cord compression, leading to cervical spondylotic myelopathy. Etiology includes degenerative changes and congenital factors, with congenital narrowing representing a relevant risk in younger individuals. Surgical treatment may be required depending on symptoms. Knowledge of physiological parameters of the cervical canal is essential for evaluating inflammatory, traumatic, and degenerative conditions; however, normative values and prevalence of congenital stenosis remain poorly described in the Brazilian population. This study aimed to establish the prevalence of congenital cervical spinal canal stenosis in a Brazilian cohort using magnetic resonance imaging. **Material and Methods:** A total of 600 cervical spine MRIs were analyzed retrospectively, equally distributed by sex and age group (20-80 years). Sagittal canal diameter and canal area were measured from C3 to C7. Interobserver reliability was assessed using the intraclass correlation coefficient (ICC). **Results:** A total of 600 cervical spine MRIs were analyzed. Mean sagittal canal diameter ranged from 11.3 to 13.5 mm, and canal area ranged from 210 to 264 mm^2. Men had larger canals than women. Overall, 86% of individuals had sagittal diameters below 14 mm, and 52% below 12 mm, suggesting a high prevalence of potential congenital stenosis. Interobserver reliability was generally good to excellent for diameter and moderate to excellent for canal area. **Conclusion:** The Brazilian population exhibits smaller cervical canal dimensions, suggesting a potential predisposition to congenital stenosis and an increased risk for myelopathy.

ID: AGS26/1248
P0280: Standalone cage for the treatment of symptomatic adjacent segment stenosis in the degenerative cervical spine

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Introduction: ACDF with cage is considered to be the standard technique in the treatment of degenerative cervical stenosis. Cervical adjacent segment disease (ASD) is not a common pathology like in the lumbar spine. In case of ASD treated with interbody fusion, the stresses expected on the implant make the use of standalone cages debatable. Data dealing with this subject is few in the literature. **Material and Methods:** A retrospective study of prospectively collected patients undergoing ACDF for ASD using standalone cage (1/2013 and 1/2022). Total of 101 levels in 87 patients (48 m. and 39 f., mean age: 57.3 years). The data were analysed with emphasis on the sagittal profile, cage subsidence and fusion rate at the final follow-up (FU). **Results:** ASD occurred after monosegmental fusion in 30 cases, bisegmental fusion in 42, and trisegmental fusion in 15 patients. ASD was cranial to the fusion in the majority of cases (71%) and affected mostly a single disc. Mean FU period of two years with minimum one year. The analysis revealed an improvement of the mean SL of adjacent disc from 4.2° preop. to 7.5° postop. At the final FU, the mean SL remained more or less unaffected with a value of 7.2°. Cage subsidence occurred in 12 patients (13.8%). A patient was re-operated due to postoperative hematoma. Temporary unilateral recurrent laryngeal palsy occurred in 3 patients (recovered). CL improved from 15.1° to 21.2° at the final FU. Fusion rate in one-year postop, full radiologic fusion was achieved in 85 patients with a pseudoarthrosis rate of 3.4% (three patients). These 3 patients were asymptomatic. Neither the number of fused segments at the index surgery nor the location of the ASD did have a significant effect on the final results. **Conclusion:** Standalone cage for ACDF in case of ASD is a safe procedure yielding good results in terms of cervical sagittal profile and fusion rate, regardless the number of fused segments at the index surgery.

ID: AGS26/1263
P0281: Is cervicothoracic OPLL a distinct clinico-radiological variant? A critical analysis of neurological recovery predictors

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Introduction: Ossification of the posterior longitudinal ligament (OPLL) involving the cervicothoracic junction (CTJ) represents a distinct and under-characterised variant of spinal pathology. While sub-axial cervical OPLL has been extensively studied, CT-OPLL poses unique biomechanical and neurological challenges, with limited literature addressing its clinico-radiological features and prognostic indicators. The aim of the study is to evaluate the clinical and radiological predictors of neurological recovery in patients with CT-OPLL undergoing posterior instrumented decompression and fusion. **Material and Methods:** This retrospective study analysed 53 patients with CT-OPLL treated surgically between 2017 and 2023. Preoperative imaging included CT-based axial morphology classification (hill, mushroom, plateau), canal occupancy ratio measurement, and MRI evaluation of cord signal changes and morphology. Clinical parameters such as mJOA score, Nurick grade, hand myelopathy signs, and bladder dysfunction were recorded. Recovery rate (RR) was calculated using Hirabayashi's formula, with RR $\geq$ 50% considered good recovery. Univariate and multivariate logistic regression analyses were performed to identify independent predictors of poor recovery. **Results:** Hill-type axial morphology and a canal occupancy ratio (COR) greater than 65% were significantly associated with poor neurological recovery ($p < 0.006$). ROC analysis yielded an AUC of 0.777 for the occupancy ratio, with 68% specificity and 60.7% sensitivity. Patients with plateau and mushroom morphologies showed better

postoperative outcomes. Notably, signs of hand myelopathy were absent in 30% of patients, particularly those with maximum stenosis below C5, and 31.4% experienced bladder dysfunction, with limited postoperative improvement. MRI cord signal changes and sagittal alignment parameters did not significantly correlate with recovery. **Conclusion:** CT-OPLL is a distinct clinico-radiological entity with poorer neurological outcomes compared to sub-axial OPLL. COR and axial morphology are strong predictors of recovery in patients with CT-OPLL. These findings highlight the importance of detailed preoperative imaging and morphology-based risk stratification to guide surgical planning and patient counselling.

ID: AGS26/1446
P0282: Use of tranexamic acid in posterior cervical decompression and fusion: safety and efficacy

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Introduction: The purpose of this study was to investigate the safety and efficacy of intravenous tranexamic acid in posterior cervical spine surgeries at a single academic institution. Various measures of blood loss, such as transfusion rate, are recognized to be critical in influencing patient outcomes in surgical procedures. The role of tranexamic acid, an antifibrinolytic agent, has not been investigated in cervical spine surgeries, specifically in posterior cervical spine fusions. This study aims to investigate the safety and efficacy of tranexamic acid use in posterior cervical instrumented fusion operations at a single center, through a retrospective chart review. **Material and Methods:** A retrospective cohort analysis of 555 patients undergoing posterior cervical fusion was conducted, examining whether tranexamic acid administration reduced intraoperative blood loss, the need for transfusions, and postoperative complications. Patients were divided into two cohorts: those who received and those who did not receive tranexamic acid. Statistical analyses were performed to compare estimated blood loss, transfusion rates, postoperative hemoglobin and hematocrit levels, complication rates, and 90-day readmission rates. **Results:** The results did not find an association between tranexamic acid and a reduced need for blood transfusions, or a lower estimated blood loss. Tranexamic acid administration was associated with a higher incidence of 90-day complications and readmission rates. There was no significant difference in venous thromboembolic events between the cohorts. **Conclusion:** Tranexamic acid was not associated with a reduction in clinically significant outcomes of blood loss or transfusion rates in posterior cervical fusions. The increased complication and readmission seen in patients administered with tranexamic acid warrants further investigation through prospective studies, and a tempering of expectations by spine surgeons as to the efficacy and safety of the drug in posterior cervical spine surgery.

ID: AGS26/1459
P0283: Pain relief outperforms functional improvement for patient satisfaction two years after cervical spine surgery

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Introduction: Patient satisfaction is an important metric for evaluating outcomes in value-based cervical spine care. PROMIS scores in particular have become widespread and broadly accepted as a tool to track patient progress and measure surgical success. Yet, neck pain and arm pain remain vital patient reported symptoms during clinical visits. Although both functional and symptomatic outcomes are routinely collected, their relative impact on long-term satisfaction remains uncertain. This study investigated whether improvements in physical function (PROMIS-PF) or reductions in pain more strongly predict satisfaction two years after cervical spine surgery. **Material and Methods:** A multicenter, prospective database was used to identify of all patients who underwent cervical spine surgery between 2013 and 2023 at a tertiary care institution. Inclusion criteria was the presence of 2 year satisfaction data. Satisfaction at two years was dichotomized as "satisfied" (met expectations or would repeat surgery) versus "unsatisfied" (did not meet expectations or would not repeat). PROMIS-PF, neck pain, and arm pain scores were collected at baseline, 90days, 1 year and two years. MCID per the registry was defined as a $\geq$ 4.5-point increase for PROMIS-PF and a $\geq$ 2-point reduction for pain scores. Statistical analysis included univariate testing and multivariate logistic regression with backward stepwise elimination. **Results:** The study cohort contained 515 patients with a mean age of 58.4 ± 11.7 years, BMI of 30.9 ± 6.4, and was 54.8% male. The majority were White (89%). Overall satisfaction rate at two years was 76.4%. In univariate analysis, all outcome measures at 2 years were significantly associated with satisfaction ($p < 0.001$), including PROMIS-PF scores, PROMIS-PF change from baseline, and MCID achievement. Similar associations were found for both neck and arm pain scores and their respective MCID status. The largest effect sizes were observed for meeting MCID at 2 years in neck pain ($\chi^2 = 61.3$), followed by arm pain ($\chi^2 = 39.7$). PROMIS-PF change scores remained consistently significant across all timepoints. The final logistic regression model (Nagelkerke $R^2 = 0.323$) identified four independent predictors of satisfaction: lower arm pain at two years (OR 0.786, 95% CI 0.692-0.893, $p < 0.001$), achievement of neck pain MCID at two years (OR 3.011, 95% CI 1.414-6.413, $p = 0.004$),

higher PROMIS-PF score at two years (OR 1.048, 95% CI 0.996-1.102, p = 0.070), and older age (OR 1.037 per year, 95% CI 1.006-1.069, p = 0.021). **Conclusion:** Contrary to our hypothesis, pain-related outcomes-specifically persistent arm pain and clinically meaningful improvement in neck pain-were stronger predictors of two-year satisfaction than physical function. Although PROMIS-PF trended toward significance, pain relief emerged as the dominant factor. These findings suggest that long-term satisfaction after cervical spine surgery is more tightly linked to symptom resolution than to functional gains, underscoring the importance of targeted pain management strategies in surgical planning and follow-up.

ID: AGS26/1468
P0284: Fusion, function, and risk factors after ACDF: A > 1,000 case consecutive single-surgeon cohort from Tasmania

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Introduction: Anterior cervical discectomy and fusion (ACDF) is one of the most frequently performed procedures in spine surgery. While outcomes for single- and two-level constructs are well established, the role of multilevel ACDF remains controversial due to concerns regarding pseudarthrosis, subsidence, and dysphagia. Most published series are small, heterogeneous, or derived from specialist referral centers, leaving uncertainty about real-world performance in broader health systems. We report one of the largest consecutive single-surgeon ACDF cohorts worldwide, spanning both public and private practice across Tasmania. This study directly compares single/2-level procedures with extended constructs (3-5 levels), with specific analysis of smoking status, providing a unique benchmark for contemporary practice. **Materials and Methods:** This was a retrospective consecutive cohort study including all patients undergoing ACDF by a single neurosurgeon between January 2017 and January 2025. Patients were stratified as single/2-level or multilevel (3-5). Baseline variables collected included demographics, comorbidities, smoking status (current, former, never), surgical indication, and preoperative Neck Disability Index (NDI). The primary outcome was radiographic fusion at 6 and 12 months, assessed by plain radiographs or CT. Secondary outcomes were functional improvement (absolute NDI, change in NDI, and achievement of the minimal clinically important difference [MCID, ≥ 10 points]) and perioperative complications. Sensitivity analyses excluded early imaging (< 20 weeks for the 6-month window; < 10 months for the 12-month window). Subgroup analyses were performed by construct length (1-2 vs 3-5 levels), age group, and smoking status. **Results:** Over 1,000 patients were included: > 500 single/2-level and > 500 multilevel ACDFs, with constructs up to 5 levels. Indications were predominantly neck pain with radiculopathy (80-90%), with myelopathy in 5-10%. Fusion rates exceeded 98% for single/2-level constructs, 91% for 3-level, 89% for 4-level, and > 85% for 5-level constructs. Smoking was associated with a modestly reduced fusion rate at 12 months, but the majority of smokers (> 85%) still achieved union. Functional recovery was substantial across all groups, with mean NDI improvement of 18-22 points and > 70% achieving MCID. Complications were infrequent: 9 postoperative hematomas requiring evacuation, 4 recurrent laryngeal nerve palsies requiring injection, 6 posterior fixations for symptomatic subsidence, 3 infections requiring drainage, and 1 Horner's syndrome. Transient dysphagia (~8%) and dysphonia (~1%) resolved without intervention. Importantly, complication rates did not significantly differ between smokers and non-smokers, although delayed fusion was more common in smokers. **Conclusion:** This > 1,000 case Tasmanian cohort represents one of the largest single-surgeon ACDF experiences worldwide. Across both public and private systems, ACDF achieved high fusion rates, substantial and durable functional recovery, and a low incidence of major complications. Extended constructs up to 5 levels performed comparably to single- and two-level procedures, directly challenging the perception that multilevel ACDF carries prohibitive risk. Smoking was identified as a potential but not prohibitive risk factor for delayed fusion. These findings provide robust, real-world evidence that long-segment ACDF can be performed safely and effectively, setting new international benchmarks and informing surgical decision-making. Further detailed comorbidity analysis, including postoperative smoking impact, will be presented in the full manuscript.

ID: AGS26/1628
P0285: Does implant choice matter? Clinical and radiological outcomes of three-level ACDF with standalone anchored cage versus plate-cage system

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Introduction: Anterior cervical discectomy and fusion (ACDF) is a well-established procedure for cervical degenerative disc disease (DDD). While the efficacy of stand-alone anchored cage (SAAC) systems has been demonstrated in single- and two-level fusions, evidence remains sparse regarding their use in three-level disease. This study compared clinical and radiological outcomes of three-level contiguous ACDF using SAAC versus traditional plate-cage (PC) constructs. **Material and Methods:** We retrospectively reviewed patients undergoing three-level contiguous

ACDF (C3-C7) between January 2017 and December 2022 with a minimum follow-up of 24 months. Clinical outcomes recorded include Visual Analogue Scale (VAS) for pain, Neck Disability Index (NDI), and modified Japanese Orthopaedic Association (mJOA) scores. Radiological outcomes assessed segmental height, local alignment, radiological fusion and C2-C7 Cobb angle at multiple time-points. Perioperative variables (operative duration, blood loss, and drain output) and complications were documented. Statistical significance was set at $p < 0.05$. **Results:** Forty-five patients were included (PC: 25; SAAC: 20) in this study. Patients in the SAAC group were significantly older (68.7 ± 7.8 vs. 55.8 ± 9.8 years, $p < 0.001$). Mean blood loss (108.8 vs. 167.2 ml, $p < 0.001$) and operative duration (281.0 vs. 310.0 minutes, $p = 0.014$) were lower in the SAAC cohort. Both groups demonstrated significant improvement in VAS, NDI, and mJOA scores at two years, without intergroup differences. Radiologically, both constructs improved segmental height and lordosis; the SAAC group showed greater immediate segmental correction (15.7° vs. 10.8°, $p = 0.020$). Both groups had demonstrated radiological fusion by 24 months. Complication rates were low and comparable, though transient hoarseness was more common in SAAC. One SAAC patient required re-exploration for hematoma. **Conclusion:** Three-level ACDF using SAAC provides comparable clinical and radiological outcomes to PC constructs, with the advantages of reduced operative time and blood loss. SAAC may represent a safe and effective alternative, performing well even in older cohort.

ID: AGS26/1683

P0286: Can large language models translate spine surgery guidelines for patients? A validation study using AO spine recommendations for degenerative cervical myelopathy

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Introduction: The AO Spine guidelines provide internationally validated, evidence-based recommendations for the management and treatment of degenerative cervical myelopathy (DCM), the leading cause of spinal cord dysfunction. Most medical guidelines are written in a formal academic language that is not always tailored for patients' consumption. The American Medical Association (AMA) recommends that patient education materials be written at or below a 6th-grade reading level to ensure accessibility. Large language models such as ChatGPT offer free guideline-informed answers tailored to both clinicians and patients. The purpose of this study is to evaluate whether the free ChatGPT-5 version could generate accurate responses to guideline-based clinical scenarios when adapted for 1- primary care clinicians (inquiring on behalf of their patients), and 2- patients themselves. **Material and Methods:** Five clinical scenarios were extracted directly from the AO Spine DCM guidelines (severe, moderate, and mild myelopathy; non-myelopathic cord compression with and without radiculopathy). Each scenario was entered into ChatGPT-5 (August 2025, free web version) using a base instruction to act as a spine surgeon. The questions were then phrased in two formats: one aimed at general medical doctors (concise, precise answers for non-specialist physicians such as family doctors or primary care providers) and one aimed at patients with health literacy at or below a 6th-grade level. Ten outputs were generated in total. Three fellowship-trained spine surgeons independently graded each output response on a Likert scale (3 = accurate, 2 = partially accurate, 1 = inaccurate). Accuracy was summarized with means, ranges, and proportions of exact agreement across raters. **Results:** Clinician-facing responses generated by ChatGPT were rated near perfectly accurate, with an average score of 2.93 (±0.26) and perfect agreement in 4 of 5 scenarios by the three graders. Additionally, none of the clinician-facing responses were graded as completely inaccurate. The generated patient-facing responses were less consistent, with an average of 2.33 (±0.72) and a range from 1 to 3, with no complete agreement between the three graders. Graders gave lower ratings when ChatGPT skipped important points, such as mJOA cut-offs, when to recommend surgery as opposed to conservative treatment, and depending on how strong the supporting evidence was. **Conclusion:** In this validation study, ChatGPT-5 reliably reflected AO Spine guideline recommendations for DCM when producing responses for general medical doctors. Patient-facing answers (≤ 6th-grade level) were generally aligned with the guidelines, but important details were sometimes lost. These findings suggest that ChatGPT, a free tool that can be widely used by patients, can potentially extend guidelines for spine surgery to wider audiences. However, spine expert review and input remain invaluable to ensure key nuances in patient education are not missed and decisions about DCM management follow the guideline accurately.

ID: AGS26/1707

P0287: Posterior C1-C2 facet distraction versus anterior odontoidectomy with posterior craniocervical fusion: a comparison of two surgical approaches

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Introduction: Basilar invagination is a craniocervical pathology associated with significant morbidity. Traditional surgical treatments relied on direct decompression via either transoral or transnasal approaches, which carry significant morbidity and require a second stage posterior fusion. Direct posterior distraction between the C1-2 facets using interbody cages has emerged a powerful alternative treatment. However, direct comparisons between the techniques are lacking. Herein we describe a case series of patients that underwent direct anterior decompression to patients undergoing posterior intrafacet spacer placement for basilar invagination, with attention paid to surgical variables, outcomes and complications with regards to each technique. **Material and Methods:** Eleven patients that underwent either transoral decompression or posterior cervical distraction for basilar invagination were retrospectively reviewed at our single institution. Patient demographics, surgical variables and post-operative radiographic, length of stay and complication data were collected. Statistical comparisons were made between posterior cervical and transoral approaches using appropriate statistical tests for the sample size. **Results:** 7 patients underwent posterior cervical C1-2 spacer placement, while 4 underwent transoral decompression with posterior fusion. Total surgical time was significantly lower in patients undergoing posterior cervical distraction. There was trend toward differences in need for critical care or total length of stay but these did not reach significance. **Conclusion:** Although both anterior decompression and posterior C1-2 distraction represent viable methods for treating basilar invagination, direct C1-2 distraction may provide equivalent long term outcomes with reduced operative time while avoiding the need for staged surgery.

ID: AGS26/1789
P0288: Three-month clinical and radiological evaluation in patients undergoing anterior cervical surgery involving more than three levels

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Introduction: The anterior cervical spine approach, first described by Smith and Robinson, is currently one of the most widely used surgical techniques for treating degenerative cervical spine conditions. Its popularity has increased due to the rising prevalence of such conditions, largely attributed to changes in population demographics and aging trends. However, anterior cervical fusion involving more than three levels has been associated with a higher risk of pseudoarthrosis, which may lead to poor clinical outcomes, including persistent symptoms or even worsening neurological function. Existing studies on the subject are heterogeneous, prompting this research to focus on a more uniform sample. Specifically, the study includes patients with degenerative cervical spine pathology, treated using an anterior approach and implants from a single provider, to minimize variability and better assess the risk of pseudoarthrosis and other clinical complications. **Material and Methods:** The objective of the study was to describe the clinical and radiological characteristics three months after surgery in patients who underwent anterior cervical surgery involving more than three levels. This was an observational, cross-sectional, and retrospective study conducted at the spine service of the "Dr. Victorio de la Fuente Narváez" Orthopedic Hospital. Data was collected from patients who had undergone multi-level cervical spine surgery and were evaluated three months postoperatively. Clinical and radiological variables were analyzed to detect complications such as pseudoarthrosis, loosening or fatigue of implants, persistent pain, or neurological damage. All data were obtained from electronic clinical records. For the statistical analysis, descriptive methods were used. Quantitative variables such as age and number of levels fused were reported as means with standard deviations (SD), while qualitative clinical and radiological variables were expressed as absolute (n) and relative (%) frequencies. All data were presented in tables and/or charts using IBM SPSS version 26.0. **Results:** A total of 100 patients who underwent anterior cervical fusion were analyzed. The average age was 66.09 years, with a male predominance (57%). The most common comorbidities were hypertension and type 2 diabetes mellitus. Notably, 81% of the patients were smokers. The most frequently affected cervical levels were C4 and C5 (100% of cases), followed by C6 (99%) and C3 (70%). Importantly, no cases of implant loosening, fatigue, or migration were reported. Clinically, 57% of the patients experienced decreased sensitivity, and 43% reported paresthesias postoperatively. **Conclusion:** In conclusion, patients who underwent multi-level anterior cervical surgery were primarily males in their sixth decade of life. On average, four levels were operated on, with C4 and C5 being the most commonly involved segments. The most frequent postoperative clinical findings were sensory disturbances and paresthesias. Despite the complexity of multi-level fusion, no mechanical complications related to the surgical hardware were observed, suggesting a potentially favorable short-term outcome under standardized conditions.

ID: AGS26/1915
P0289: Postural balance and patient-reported outcomes in patients with degenerative cervical spinal stenosis: 1-year follow-up comparison between surgical and nonsurgical treatment

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Introduction: Degenerative cervical spinal stenosis (CSS) can lead to spinal cord compression, resulting in gait and balance impairments. In patients with cervical myelopathy, previous studies showed that surgical decompression improves postural control. However, data on balance outcomes in patients who do not undergo surgery remain limited. This study aimed to compare balance parameters and patient-reported outcomes between baseline and 1 year follow-up, as well as changes in parameters over time between CSS patients treated with and without surgery. **Material and Methods:** Twenty patients with CSS were followed up for an average of 14.0 ± 2.8 months after baseline assessment. Eight patients underwent surgical decompression, and twelve were managed conservatively. All participants performed a 30-second balance test with eyes open (EO) and eyes closed (EC), standing upright with feet shoulder-width apart on a balance platform (Biodex Balance System, Shirley, USA; sampling rate 20Hz). The test was conducted on both hard and foam surface. The system calculated a stability index for all four conditions defined as the root mean squared distance of the x and y coordinates. The Neck Disability Index (NDI), the modified Japanese Orthopaedic Association score (mJOA) and the Falls Efficacy Scale-International (FES-I) were collected as PROMs. Differences between baseline and follow-up were investigated for each group using paired t-test ($p < 0.05$), while differences in baseline-to-follow-up changes between groups were tested using Welch's t-tests ($p < 0.05$). **Results:** At follow-up, there were no significant changes in the stability indices on the Biodex of both groups in all four conditions. However, there was a trend, that the stability index for foam surface, eyes open improved postoperatively in the surgical group (baseline: 1.23 ± 0.44, follow-up: 0.98 ± 0.22, $p = 0.095$), but not in the conservative group (baseline: 1.32 ± 0.48; follow-up 1.29 ± 0.45, $p = 0.681$). NDI scores tended to improve in the surgical group (baseline: 7.8 ± 9.8, follow-up: 3.9 ± 5.0, $p = 0.063$), while they remained constant in the conservative group (baseline: 9.8 ± 8.1, follow-up: 11.0 ± 9.4, $p = 0.568$). The change in NDI tended to be significantly greater in the surgical group ($p = 0.073$). Similarly, mJOA scores tended to increase in the surgical group (16 ± 1 vs. 17 ± 2, $p = 0.083$) but remained stable in the conservative group (16 ± 2 vs 16 ± 2, $p = 0.256$), with a significantly greater change occurring in the surgical group ($p = 0.036$). Additionally, the FES-I score tended to improve in the surgical group (from 23.3 ± 7.3 to 18.4 ± 1.8, $p = 0.051$), but not in the conservative group (22.3 ± 7.1 to 22.3 ± 9.1, $p = 1.000$), again with a trend of a greater change in the surgical group ($p = 0.061$). **Conclusion:** Comparison of postural balance between groups showed only subtle, non-significant changes, but surgically treated patients tended to show significantly improved NDI and FES-I scores. This means that surgery may reduce neck disability and improve subjective balance confidence after one year. Limited balance improvements may reflect the mild impairment of our cohort (mean mJOA 16), unlike prior studies with more severely affected patients. Larger studies are needed to investigate whether the observed trends can be confirmed.

ID: AGS26/2424
P0290: Soft tissue depth predicts blood loss and operating time for anterior cervical discectomy and fusion

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Introduction: Anterior cervical discectomy and fusion (ACDF) is widely performed for cervical radiculopathy and myelopathy, with dysphagia and dysphonia remaining prominent concerns during perioperative counseling. Prior research using body mass index (BMI) as a surrogate for habitus shows mixed associations with ACDF outcomes and does not capture local anatomy. We investigated whether anterior cervical soft-tissue thickness measured on preoperative MRI predicts intraoperative parameters (operative time, estimated blood loss [EBL]) and postoperative complications (dysphagia, dysphonia). **Materials and Methods:** Data was retrospectively collected via medical record at a single academic medical center for a cohort of adults undergoing primary ACDF from April 2018 to May 2024. Exclusions included revision ACDF, infection, malignancy, deformity, inadequate visualization of skin-to-cord intervals, and less than 6 months minimum follow-up. On midsagittal T2 MRI, we quantified (1) skin-to-spinal cord distance (STC) and (2) prevertebral soft-tissue depth (PVST) at all operative levels; a standardized horizontal measurement was also obtained at C5-6 in all patients. Outcomes were operative time, EBL, and postoperative dysphagia/dysphonia within 12 months. Multivariate regression analyses assessed for predictors of dysphagia or dysphonia, adjusted for age, sex, BMI, smoking status, number of operative levels, and posterior instrumentation. Significance was set at $p < 0.05$ and analyses run on R 4.4.2. Institutional Review Board approval was obtained with a waiver of informed consent. **Results:** Among 373 included patients, dysphagia occurred in 30.6% (114/373) and dysphonia in 7.0% (26/373) of patients. Greater STC measurements independently predicted longer operative time at C4-5 ($R^2 = 0.06$, $p = 0.007$) and C6-7 ($R^2 = 0.06$, $p = 0.002$); C5-6 trended toward significance ($p =$

0.051). EBL increased with greater STC measurements at C3-4 ($R^2 = 0.07$, $p = 0.01$), C4-5 ($R^2 = 0.06$, $p < 0.001$), and C5-6 ($R^2 = 0.06$, $p = 0.004$), and with greater PVST measurements at C3-4 ($R^2 = 0.50$, $p < 0.001$), C4-5 ($R^2 = 0.10$, $p = 0.005$), and C5-6 ($R^2 = 0.06$, $p = 0.024$). After adjustment, neither STC nor PVST measurements were associated with dysphagia or dysphonia at any level. **Conclusion:** MRI-derived anterior cervical soft-tissue thickness positively correlated with intraoperative complexity-manifested by longer operative time and higher EBL-at specific levels but did not predict dysphagia or dysphonia. Level-specific effects likely reflect anatomical and exposure considerations at proximal segments and differences in case distribution by level. These findings suggest that local soft-tissue depth, rather than global BMI, may provide additional guidance for operative planning while not being a driver of patient-reported swallowing or voice complications. Incorporating simple MRI-based measurements into preoperative workflows may improve resource allocation (time, personnel, blood management) for ACDF surgeries.

ID: AGS26/2482
P0291: Distribution of fixation methods in subaxial cervical spine: a single-center experience

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Introduction: Posterior subaxial cervical fixation is a critical component of surgical management in trauma, degenerative, and neoplastic pathologies. Various screw techniques-lateral mass, pedicle, and transfacet-are available, each with distinct biomechanical advantages and potential risks. Lateral mass fixation is generally considered safe and technically straightforward, pedicle fixation provides superior pull-out strength but carries a higher risk of neurovascular injury, while transfacet fixation has been suggested as a less invasive alternative. The optimal choice remains debated, and practice patterns vary worldwide. This study aims to describe the distribution of fixation methods across cervical levels in our single-center experience and to compare these findings with general trends reported in the literature. **Material and Methods:** We retrospectively reviewed 20 patients who underwent posterior cervical fixation between 2022 and 2024 at our institution. Patients with instrumentation spanning C3-C7 were included. Demographic data (age, sex, etiology: trauma, degenerative disease, or malignancy) and surgical details were collected. For each vertebral level (C3-C7, bilateral), screw type was recorded as lateral mass (M), pedicle (P), or transfacet (F). Descriptive statistical analysis was performed. Given the small cohort, no comparative or inferential statistics were attempted. **Results:** The study included 13 males (65%) and 7 females (35%), with a mean age of 48 years (range 15-74). Etiology was trauma in 12 patients (60%), degenerative disease in 7 (35%), and malignancy in 1 (5%). Across all levels, a total of 120 screws were placed: 86 (71.7%) lateral mass, 15 (12.5%) pedicle, and 19 (15.8%) transfacet. • **C3-C5:** Lateral mass fixation predominated, accounting for 70-80% of screws at these levels. • **C6:** A transitional pattern was observed, with lateral mass fixation still dominant, but pedicle usage increased (23.1% on the left side). • **C7:** Only pedicle screws were used. • **Transfacet screws:** Mainly employed at C3-C5, comprising up to 36% of fixation at some upper levels. A distinct cranio-caudal trend emerged: lateral mass screws predominated at upper cervical levels, gradually giving way to pedicle screws toward the cervicothoracic junction. **Conclusion:** Our findings confirm that screw selection in subaxial cervical fixation is strongly influenced by vertebral level and local anatomical considerations. Compared with international averages, pedicle screw utilization in our series was relatively limited, likely reflecting a cautious approach in the context of small pedicles and proximity to critical neurovascular structures. Although limited by sample size and retrospective design, this study contributes to understanding regional practice patterns. Future multicenter studies with larger cohorts and outcome analysis are warranted to refine guidelines for optimal screw selection in subaxial fixation.

ID: AGS26/2525
P0292: Evaluating the demographics and complications of North American surgical patients with ossification of the posterior longitudinal ligament

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Introduction: Ossification of the posterior longitudinal ligament (OPLL) is a hyperostotic spinal condition resulting from progressive endochondral ossification of the posterior longitudinal ligament, leading to spinal canal narrowing and potential spinal cord compression. Although predominantly studied in East Asian countries due to its higher prevalence in those regions, OPLL is increasingly recognized in North American cohorts. This shift can be attributed to a better

appreciation through publications that OPLL can present in any group. This study aims to evaluate the demographic characteristics and outcomes of patients undergoing surgery for OPLL in a North American cohort. **Material and Methods:** A single health system retrospective study of patients with OPLL undergoing surgery between July 2011 and November 2024 was conducted. Data collected included patient age, sex, race, body mass index (BMI), diabetic status, other comorbidities, surgical approach, OPLL classification, and K-line measurement. Estimated blood loss (EBL), intraoperative complications, postoperative complications, length of stay, and disposition status were also recorded. Descriptive statistics and multivariable analyses were conducted with a p value < 0.05 considered to be statistically significant. **Results:** In total, 81 patients underwent surgery for OPLL (mean age of 60 years; 50.6% male). The majority of the patients were Black (43 patients, 53.1%), followed by White (23 patients, 28.4%). The mean BMI was 33.1 kg/m^2 with 52 patients (64.2%) being obese (BMI > 30 kg/m^2). Forty-four patients (54.3%) had diabetes. Most of the surgeries were elective (88.9%). The classification of OPLL for the patients were: 31.7% segmental, 20% continuous, 40% mixed, and 8.3% localized. 73.3% of the patients had a positive K-line measurement and 27.6% had a negative K-line measurement. The posterior surgical approach (41 patients, 50.6%) was more common compared to the anterior approach (37 patients, 45.7%). Three patients (3.7%) underwent a combined anterior/posterior approach. A posterior approach was more likely to be utilized for patients with a positive K-line measurement ($p = 0.029$). The mean EBL was 344.7 mL. Obesity was associated with increased EBL ($p = 0.032$). Two patients (2.5%) had an intraoperative durotomy and one patient (1.2%) had loss of motor and sensory evoked potentials. One patient (1.2%) had postoperative pulmonary embolism. The mean length of stay for the patients following the surgery was 6.5 days. At follow-up visits (mean follow-up of 20.4 months), one patient (1.2%) had a burning sensation in their neck and arm, and one (1.2%) had lower extremity numbness. Three patients (3.7%) experienced mortality. None of the patients underwent a reoperation procedure. **Conclusion:** This study highlights the demographic and clinical characteristics of OPLL in a diverse North American cohort. Surgical management, predominantly via anterior or posterior approaches, was associated with low complication rates and no reoperations during follow-up, indicating overall safety and effectiveness. These results underscore the importance of tailored surgical planning and postoperative care in managing OPLL in diverse populations.

ID: AGS26/2611
P0293: Cervical myelopthy caused by motor TIcs in a patient with Tourette's syndrome

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Background: Tourette's syndrome is a neurological disorder characterized by involuntary motor and vocal tics. Recent reports have highlighted a potential link between severe motor tics in Tourette's syndrome and the development of cervical myelopathy. **Case Presentation:** A patient diagnosed with Tourette's Syndrome at the age of 10 exhibited violent cervical motor tics involving neck extension, rotation, jerking, and extremity posturing. Initially managed medically and with symptoms regressing over time, medications were discontinued at age 22. However, a gradual neurological decline ensued over six months marked by gait instability, neck pain, and motor skill deterioration. Neurological examination revealed spastic extremities and asymmetric motor strength. Cervical MRI showed a significant C2-C3 disc protrusion with resultant myelomalacia. Posterior decompression with spinal fusion was then performed. **Conclusion:** The intricate relationship between severe motor tics in Tourette's syndrome and their potential progression to cervical myelopathy underscores the need for vigilance and multidisciplinary collaboration. While a direct causal link remains uncertain, the presented cases highlight the role of repetitive and forceful neck movements in potentially contributing to spinal instability and myelopathy. Timely diagnosis and intervention are crucial to address the evolving neurological deficits. This complex interplay emphasizes the importance of addressing both motor tic symptoms and their potential consequences on spinal health.

Keywords: Tourette's syndrome, cervical myelopathy, motor tics, neurological disorder, spinal cord compression

ID: AGS26/2642
P0294: Does pre-operative neutrophil-lymphocyte ratio predict patient-reported pain and functional outcomes at 12 months after anterior cervical discectomy and fusion?

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Introduction: Preoperative neutrophil-lymphocyte ratio (NLR) has been found in various fields to be a predictor of post-operative pain and functional outcomes. To date no studies have looked at NLR in relation to patient outcomes after anterior cervical discectomy and fusion (ACDF). The primary aim is to determine the relationship between pre-operative NLR, pain and functional outcomes at 12-month

post elective ACDF. **Material and Methods:** This single-centre retrospective cohort study included 60 patients undergoing 1 or 2 level ACDF. Pre-operative NLR and demographic data were collected. Visual analogue scale (VAS) for neck and arm pain, and Neck Disability Index (NDI) were collected at baseline and 12 months postoperatively. Binary logistic regression was used to estimate the associations of demographic factors and NLR with improvement in VAS and NDI scores. **Results:** A unit increase in NLR was associated with a 56% decrease in the odds of improvement in neck pain (OR: 0.44; CI: 0.21-0.89, p = 0.02). NLR was not found to be a statistically significant predictor of improvement in VAS Arm or NDI. Higher baseline VAS arm and neck scores were associated with greater odds of improvement in pain postoperatively. Compared to patients with cervical disc herniation, those with cervical stenosis had a 72% decrease in the odds of substantial clinical benefit in NDI score (OR: 0.28 CI: 0.09-0.91, p = 0.03). **Conclusion:** Elevated preoperative NLR was associated with lower odds of neck pain improvement after ACDF but did not predict disability or arm pain improvement.

ID: AGS26/2766
P0295: Cervical disc arthroplasty versus anterior cervical discectomy and fusion: a propensity-matched cohort study

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Introduction: ACDF remains the gold standard for treatment of cervical disc degeneration. CDA is a newer surgical intervention aimed at decreasing post-operative complications associated with arthrodesis through motion preservation. Currently, long-term complication rates are not fully characterized. The purpose of this study is to compare complication rates between patients undergoing anterior cervical discectomy and fusion (ACDF) and cervical disc arthroplasty (CDA) at time intervals up to five years. **Material and Methods:** The TriNetX database was used to perform a retrospective cohort analysis of patients who had undergone either ACDF or CDA after excluding patients less than 18 years old and history of cancer or inflammatory/infectious bone conditions. Propensity score matching (1:1) was performed (n = 8,852) based on demographic data and medical comorbidities. Complication rates were analyzed and risk ratios with 95% confidence intervals were calculated up to five years postoperatively. **Results:** At thirty days postoperatively, patients in the ACDF cohort had higher rates of stroke, pneumonia, dysphagia, nerve root injury, and increased healthcare utilization metrics including readmissions, outpatient services, emergency department visits, and opioid prescriptions. At one year, patients in the ACDF cohort had higher rates of implant failure, posterior fusion, nerve root injury, and post-laminectomy syndrome. These complications, excluding implant failure, remained more frequent among patients in the ACDF cohort at both two and five years. **Conclusion:** ACDF was associated with higher rates of postoperative complications compared to CDA, including both short-term medical and long-term hardware complications. Within the limitations of a retrospective analysis, these findings suggest CDA may afford a lower complication profile and should be considered a viable motion-preserving alternative for cervical disc disease.

ID: AGS26/2771
P0296: Patients receiving GLP-1 agonists have reduced odds of pseudoarthrosis, PE, DVT, and revision following posterior cervical fusion surgery

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Introduction: In accordance with the aging population, a significant increase in the volume of posterior cervical fusion procedures is expected over the next two decades. This increase has coincided with a rise in postoperative complications, notably pseudoarthrosis-a failure in spinal fusion manifesting as recurring pain and mechanical instability. The association between glucagon-like peptide-1 (GLP-1) agonist use and complications following posterior cervical fusion surgery has yet to be explored. The goal of this study is to examine the association between GLP-1 agonist usage and the incidence of pseudoarthrosis, adjacent segment disease, revision surgery, and perioperative complications in patients undergoing posterior cervical fusion surgery. **Material and Methods:** TriNetX, a global health research network, was queried from 2004-2024 for patients undergoing posterior cervical fusion (CPT 22600) and who had documented GLP-1 agonist usage within 1-year post-operation. Analysis included chi-squared tests with a control cohort propensity score matched for age, sex, race, smoking, diabetes, BMI, and uremia who did not have post-operative GLP-1 agonist usage. Outcomes of interest were DVT, emergency department (ED) visits, inpatient hospitalization, opioid abuse, PE, sepsis, surgical site infection, wound complications within 90 days, adjacent segment disease, dysphagia, implant failure, pseudoarthrosis, and revision within 2 years. **Results:** A total of 1,943 patients who received GLP-1 were compared to propensity matched controls. Prior to matching, 83% of the GLP-

1 experimental cohort were diabetic compared to 21% in the control cohort. After matching, patients were 62.9 ± 10 years old, 47% male, 64% white, 83% diabetic, and 69% obese. GLP-1 agonist use within 1-year post-operation was significantly associated with reduced odds of ED visits (OR 0.61, CI 0.51-0.74), inpatient hospitalization (OR 0.09, CI 0.08-0.10), sepsis (OR 0.23, CI 0.14-0.36), post-operative SSI (OR 0.28, CI 0.18-0.43), wound complications (OR 0.31, CI 0.20-0.47), PE (OR 0.54, CI 0.35-0.84), DVT (OR 0.49, CI 0.33-0.73) within 90 days, pseudoarthrosis (OR 0.33, CI 0.27-0.40), dysphagia (OR 0.59, CI 0.48-0.73), and revision surgery (OR 0.55, CI 0.36-0.84) within 2 years post-operation. Odds of adjacent segment disease, implant failure, and opioid abuse were not significant. **Conclusion:** In this cohort study of patients undergoing posterior cervical fusion surgery, patients prescribed GLP-1 agonists during the post-operative period experienced lower rates of pseudoarthrosis, dysphagia, revision surgery, postoperative infection, PE, DVT, and overall hospitalizations compared to those who did not receive GLP-1 agonists. These results suggest that GLP-1 agonists may offer a therapeutic benefit in improving spinal fusion outcomes, and further prospective research is needed to validate these findings and investigate the underlying mechanisms.

ID: AGS26/2914
P0297: Musculoskeletal neck pain and cervical spine disorders in metalheads due to music associated head-banging

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Introduction: Metal/Rock music listeners often resort to 'Head-banging' at music concerts, which constitutes a violent flexion and extension of neck rhythmically. The systematic involvement of musculoskeletal neck pain and Cervical Spine disorders in 'Metalheads' has not been thoroughly researched upon. This study was done to investigate the association of Musculoskeletal neck pain and Cervical Spine disorders with 'Music associated Head-banging'. **Material and Methods:** A total of 178 'headbangers' aged between 18-40 years were investigated. The Neck disability index, Northwick neck pain index and Visual analogue pain score (VAS) was used to assess the participants musculoskeletal neck pain. Patients with significant neck pain were radiologically evaluated. **Results:** 121 individuals (68.1%) complained of acute neck pain following a concert which lasted around for a week. 69 individuals (38.7%) complained of chronic neck pain which lasted more than 4 weeks. 14 individuals (7.8%) had severe disabling neck pain/ Arm radicular pain who were further investigated. 10 individuals (5.6%) had MRI proven early Cervical spondylotic changes with/without disc prolapse. No patient underwent surgery for the same. **Conclusion:** Musculoskeletal neck pain had already commenced at a young age in 'Headbangers' and there was a gender difference (males more affected than females). Results of our study shows a need of prophylactic lifestyle modifications is needed among young Metalheads to prevent any Cervical spine issues in future.

ID: AGS26/2975
P0298: Systematic review and meta-analyses of radiographic spinal fusion rate: static versus dynamic plates with bone grafts in 1-, 2- and 3-level anterior cervical decompression and fusion (ACDF) procedures

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Introduction: Anterior cervical decompression and fusion (ACDF) is considered the gold standard for persistent cervical radiculopathy and is commonly used in myelopathy. The stability required to optimize fusion is unknown. Static or dynamic plate designs alter motion across the fusion site, however, their impact is unclear. This study aimed to establish whether current evidence favors static or dynamic plating in ACDF procedures for fusion. **Material and Methods:** MEDLINE, Embase and Scopus were searched for studies (Jan 1990 - Sept 2025) on clinical fusion rate in adult radiculopathy and/or myelopathy patients treated with 1-, 2- or 3-level ACDF using static, or dynamic (translational, rotational or hybrid motion) plate designs with bone graft and a minimum follow-up of 6 months. Single-arm studies' fusion proportions were pooled using a binomial-normal generalized linear mixed model with logit link and a random study intercept with between-study variance (τ^2) estimated by Restricted Maximum Likelihood. Comparative study risk ratios for fusion proportion were pooled using a random-effects model to account for between-study heterogeneity, with inverse-variance weighting. Variance was estimated using REML, and Hartung-Knapp small-sample adjustment was applied to calculate the pooled 95% confidence intervals (CIs) (estimated using Clopper-Pearson intervals). Heterogeneity

was assessed using I^2 statistics and 95% prediction interval for the pooled effect. GRADE was used for critical appraisal. Given insufficient studies for sub-group meta-analyses, we report narrative statistics for fusion proportion (total fusions/total population) for static plate, dynamic plate subtypes and levels fused. **Results:** From 1576 papers, twelve studies were included (222 static plates, 444 dynamic plates: 198 translational, 136 rotational, 110 hybrid). Appraisal identified 5 low-quality and 7 very low-quality studies. Pooled meta-analysis demonstrated a non-significant 3% decrease in relative likelihood of fusion with dynamic vs. static plate, however, single-arm studies found a larger difference between static - (91%) and dynamic - (97%) plates. Calculated fusion proportion was high and comparable between static - (91%) and dynamic - (92%) plates. Fusion rate is influenced by static plate brands: Orion (94%) vs. CSLP (84%), dynamic subtypes: translational (96%), rotational (93%), hybrid (83%), number of levels fused for dynamic plates (single-level (94%) vs. multi- (2- and 3-) level (86%)), but not for static plates (single-level (90%) vs. multi-level (91%)). **Conclusion:** While there may be theoretical benefit to dynamizing cervical plates for fusion, reflected in our descriptive statistics, meta-analysis of comparative studies identified a non-significant 3% decrease in relative likelihood of fusion with dynamic versus static plates. The poor overall quality of included studies limits interpretation. Our descriptive analysis showed fusion rates may be influenced by specific plate: e.g. Brands; Orion vs. CSLP, and plate motion: comparable fusion rates for translational and rotational motion, superior to hybrid motion (translational and rotational). The fusion rates between single-level dynamic, and single- and multi-level static plate result were comparable while, multi-level dynamic plating may introduce excessive motion that compromises fusion. Limited studies meeting inclusion criteria and poor reporting restricted in-depth inter-study variability assessment. Future studies should improve study quality with consistent reporting and minimizing risk of bias to determine the effect of plate designs on fusion.

ID: AGS26/3067

P0299: High-fidelity simulation of anterior cervical discectomy and fusion: establishing quantative performance thresholds on the upsurgeon anterior cervical box

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Introduction: High-fidelity surgical simulators may provide safer environments for developing anterior cervical discectomy and fusion (ACDF) skills compared to real-world training. However, the validity of simulator-based assessment for anterior cervical spine surgery remains poorly characterized. No validated simulation models exist specifically for ACDF procedures, representing a significant gap in surgical education. **Material and Methods:** A validation study was conducted at a tertiary UK neurosurgical center. Twenty participants were stratified into three experience groups: novice (n = 8), intermediate (n = 6), and expert surgeons (n = 6). All performed standardised ACDF simulation tasks using the high-fidelity UpSurgeOn Anterior Cervical Box incorporating 3D-printed anatomical models with realistic tissue properties. Performance was assessed by Four blinded expert reviewers using modified Objective Structured Assessment of Technical Skills (mOSATS). Face and content validity were evaluated through expert questionnaires. Task completion times were recorded as the primary construct validity measure. **Results:** All 20 participants completed the study with 100% operative time data and complete mOSATS scoring data. Expert surgeons demonstrated significantly superior performance: operative times were 31.1 ± 2 0.7 minutes (experts) vs 43.8 ± 20.1 minutes (intermediate) vs 64.9 ± 20.5 minutes (novices), representing 52.1% improvement from novice to expert level. Modified OSATS scores similarly discriminated between groups: expert 19.6 ± 5.2, intermediate 16.8 ± 3.2, novice 14.2 ± 6.1 (38.4% improvement). Large effect sizes demonstrated excellent construct validity for operative time (Cohen's d = 1.64) and good validity for mOSATS scores (d = 0.95). **Conclusion:** The UpSurgeOn Anterior Cervical Box demonstrates excellent face, content, and construct validity for ACDF training. Large effect sizes support the simulator's ability to discriminate surgical expertise levels. These findings validate this simulator as an effective training tool and support integration into surgical training programmes.

ID: AGS26/1708

P0300: Cervical Pedicle Screws: Multicenter Comparison of Freehand, Patient-Specific 3D-Printed Templates, Loop-X Navigation and OARM/CT Navigation Accuracy And Safety

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Introduction: This multicenter European study aimed to compare the accuracy, complication rates, and incidence of revision surgery associated with three distinct cervical pedicle screw (CPS) insertion techniques: freehand, navigation-assisted (Loop-X/O-arm), and patient-specific 3D-template guided approaches. The primary endpoint was to provide evidence to support decision-making in cervical spine instrumentation. **Material and Methods:** A retrospective, observational study analyzed prospectively collected data from 97 adult patients who underwent posterior cervical fusion with CPS between January 2019 and August 2024. Screw accuracy was assessed using intraoperative or postoperative CT scans, according to the Gertzbein–Robbins classification. Intraoperative and postoperative complications were systematically evaluated. **Results:** A total of 369 CPS were implanted, with an overall accuracy (Grade A/B) of 90.7%. Patient-specific 3D-templates yielded the highest accuracy (97.7% of grade A/B screws), significantly superior to navigation-assisted (85.5%) and freehand (80.0%) techniques ($p<0.001$). The lowest accuracy was observed at the C2 level (79.4%; $p<0.001$). Patients over 60 years of age undergoing surgery at the C2 level had a 4.7-fold increased likelihood of suboptimal (Grade > B) screw placement ($p=0.016$). The overall rate of intraoperative and postoperative complications was significantly higher in the freehand and navigation-assisted groups ($p<0.05$). **Conclusion:** CPSs are safe and effective for cervical fusion, with acceptable complication rates. Patient-specific 3D templates offer superior accuracy and fewer complications, but its applicability is limited in urgent cases. Navigation provides good accuracy but is associated with higher costs and potential technical inconveniences. Technique selection should consider surgeon expertise, resources, and patient-specific factors.

Degenerative cervical

ID: AGS26/3233
P0301: Early Assessment of Surgical Sufficiency in Degenerative Cervical Myelopathy: A Scoping Review

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Introduction: Degenerative cervical myelopathy (DCM) is the leading cause of non-traumatic spinal cord dysfunction worldwide. Surgical decompression is the standard therapy for patients with moderate and severe impairment, yet no consensus exists on intraoperative or early postoperative confirmation of decompression adequacy. The aim of this review was to synthesize available evidence on intraoperative and early postoperative methods for assessing surgical sufficiency in DCM and identify gaps for future research. **Material and Methods:** A scoping review was performed across PubMed, BASE, Cochrane Library, and Google Scholar. Eligible studies included adult DCM patients undergoing decompression with perioperative assessment of decompression adequacy. A scoring framework compared modalities across four domains: residual stenosis detection, real-time applicability, prognostic value, and feasibility in the operating room. **Results:** Of 279 records, 28 studies were included. Intraoperative ultrasound (IOUS) (N=7) was most extensively studied, reliably identifying residual compression, and guiding surgical decision-making. Echogenicity, cord expansion, and contrast-enhanced ultrasound patterns provided prognostic value. Intraoperative neurophysiological monitoring (IONM) (N=8), particularly motor evoked potential (MEP) amplitude increases ≥50%, correlated with superior functional outcomes. Postoperative MRI (N=8), including diffusion tensor imaging (DTI) and diffusion basis spectrum imaging (DBSI), predicted long-term recovery. Cerebrospinal fluid pressure (CSFP) monitoring (N=4) was sensitive to decompression events but prognostically limited. In comparative scoring, IOUS ranked highest (3.43/4), followed by IONM (2.88/4), CSFP (1.75/4), and MRI (1.29/4). Early postoperative MRI, including DTI and DBSI, was not a surrogate marker but a direct imaging modality, valuable for confirming decompression and predicting recovery. **Conclusion:** Objective tools to confirm the sufficiency of surgery remain a critical knowledge gap. Intraoperative techniques such as IOUS, IONM, and

CSFP monitoring show promise, while early postoperative MRI may serve as a useful adjunct. However, research on technical modalities to measure the sufficiency of surgery for DCM is still at an early stage of development and requires further prospective validation.

ID: AGS26/3268
P0302: Higher cervical paraspinal fat infiltration is associated with a negative metabolic profile in patients undergoing posterior cervical fusion

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Introduction: The objective of this study to investigate the association between cervical paraspinal Goutallier scores and patient-specific factors in a cohort undergoing multi-level posterior cervical decompression and fusion (PCDF). Fatty infiltration of paraspinal musculature, quantified by the Goutallier classification scores, is an established marker of poor muscle quality. There is a well-established strong association in the lumbar spine between high Goutallier scores and negative metabolic profiled, including diabetes and obesity. However, this relationship is not well-characterized in the cervical spine. **Material and Methods:** A retrospective review was conducted on 42 patients who underwent multi-level PCDF. Preoperative magnetic resonance imaging at the C5-C6 level was used to assign Goutallier grades of paraspinal muscle fatty infiltration. Patient data, including Body Mass Index (BMI), and a diagnosis of diabetes mellitus (DM), were collected. ANOVA and Chi-squared tests were used to assess the relationships between Goutallier scores and these variables, with a significance level of $p < 0.05$. **Results:** A total of 42 patients met inclusion criteria with a mean age of 67 years, mean BMI of 28.36, and mean Goutallier score of 2.48. Analysis revealed that higher Goutallier scores were significantly associated with older age ($p = 0.001$). Consistent with established findings in the lumbar spine, higher Goutallier scores were significantly associated with a higher BMI ($p = 0.002$), a higher prevalence of diabetes ($p = 0.004$), and a higher A1c ($p = 0.008$). **Conclusion:** In patients undergoing a multi-level PCDF, severe fatty infiltration of the cervical paraspinal muscles is associated with advanced age and an unfavorable metabolic profile, characterized by higher body mass and a greater prevalence of diabetes. These findings suggest that, similar to the lumbar spine, cervical paraspinal muscle degeneration is influenced by both age and systemic metabolic disease.

ID: AGS26/3304
P0303: Percutaneous endoscopic «over-the-top» decompression in the treatment of degenerative cervical myelopathy

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Introduction: Cervical spinal stenosis (CSS) is a common clinical spinal disorder with a high prevalence in the aging population. Causes of compression cervical myelopathy (CCM), except by disc herniations and the ossification posterior longitudinal ligament (OPLL), can often be caused by posterior supporting structures (facet joints, ligamentum flavum). Anterior surgical discectomy and corpectomy (ACDF) in patients with CCM can often associated with a high risk of complications due to ossification of the disc and OPLL. Open posterior surgery is very traumatic for patients and has a long recovery period. In recent years, minimally invasive techniques for cervical spine surgery have been rapidly developed. Endoscopic surgery possesses the advantage of reducing trauma and promoting recovery after surgery. The aim of this study is a comparative analysis clinical effectiveness of the ACDF, posterior laminoplasty (PL), posterior microsurgical (PM) and endoscopic bilateral decompression via unilateral approach (PE). **Material and Methods:** Pilot study (minimum follow-up 3 months) including 32 patients (from 2020 to 2025), divided into four groups. The average age of patients was: 66,2 years in the ACDF group, 69,3 in PL, 71.1 in PM group and 70,2 in PE group. To assess clinical outcomes, we used Visual Analog Scale of Arms (A-VAS) and Neck pain (N-VAS), Japanese Orthopedic Association score (JOA), Neck Disability Index (NDI). **Results:** The endoscopic group was significantly superior to the ACDF, PL, PM groups in terms of intraoperative blood loss, incision length, and hospital stay ($p < 0.005$). Upper limb pain (A-VAS): in 4 groups was noted reliable significant decrease from and no differences were noted ($p > 0.05$). N-VAS were noted significant regression in four groups and better in PE group with statistical difference with other 3 groups of patients ($p < 0.05$). When we assessed Macnab criteria, excellent and good outcomes were noted in more than 90% of cases in four groups with no statistically significant difference ($p > 0.05$). **Conclusion:** Percutaneous endoscopic «over-the-top» decompression is a relatively new technique for the treatment of CSS with myelopathy. This technique provides adequate decompression of the cervical spine with less surgical trauma than the

standard open technique with lower risk of complication having all the advantages of open methods.

ID: AGS26/3312
P0304: Cervical spondylotic myelopathy: comparative analysis of decision-making, management strategies and surgical techniques

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Introduction: Cervical spondylotic myelopathy (CSM) is a spinal cord dysfunction caused by chronic mechanical and/or ischemic injury secondary to degenerative changes of the cervical spine, such as disc degeneration, osteophyte formation, and ossification of the posterior longitudinal ligament (OPLL). Patients typically present with neck pain, paresthesia, paresis, loss of fine motor skills, gait disturbance, and sphincter dysfunction. Clinical findings include hyperreflexia, pathological reflexes, and motor and sensory deficits. Radiological cervical spinal stenosis is observed in 20-25% of individuals under the age of 50 and in 70-95% of those aged 65 years and older; however, the prevalence of clinically evident CSM has been reported as approximately 2-4%. Several scoring systems have been developed to determine disease severity, including the modified Japanese Orthopaedic Association (mJOA) score, the Nurick Grading System, and the European Myelopathy Score (EMS). These systems evaluate motor and sensory function of the upper and lower extremities as well as sphincter function. They are utilized both for grading clinical severity and for comparing pre- and postoperative outcomes. **Material and Methods:** Literature review. **Results:** Multiple surgical strategies exist for the treatment of CSM. Radiological parameters such as the K-line and Patterns of Cord Compression (POC), the type of OPLL, sagittal alignment (lordosis vs kyphosis), number of involved levels, degree of canal compromise, and patient comorbidities are considered in surgical planning. Anterior approaches (anterior cervical discectomy and fusion [ACDF], corpectomy with fusion) are generally preferred for one- or two-level anterior compression, whereas posterior approaches (laminoplasty, laminectomy with or without fusion) are more suitable for multilevel disease in patients with preserved lordosis. Combined approaches may also be considered. In cases of kyphosis or instability, fusion is recommended. With appropriate patient-tailored planning, adequate decompression, deformity correction, and stabilization can be achieved. **Conclusion:** CSM is a progressive disorder requiring early diagnosis and proper surgical management. While scoring systems such as the mJOA help quantify clinical severity, radiological and etiological factors guide the surgical approach. Patient-specific evaluation ensures sufficient decompression and stabilization, leading to improved functional outcomes.

ID: AGS26/3334
P0305: A service evaluation of inpatient perioperative rehabilitation provision in degenerative cervical myelopathy

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Introduction: Degenerative cervical myelopathy (DCM) is a condition of symptomatic cervical spinal cord dysfunction secondary to degenerative changes causing mechanical compression. Neurorehabilitation refers to an integrated, multidisciplinary care programme that aims to optimise function following a nervous system disorder. Neurorehabilitation is standard of care following many neurological conditions. However, this is not widely the case for patients with DCM. This work aimed to characterise current inpatient perioperative rehabilitation provision for patients with DCM who underwent surgical management at a single tertiary centre. **Materials and Methods:** In this retrospective service evaluation, routine data were collected from electronic healthcare records for patients who had undergone surgery for DCM in a single tertiary neurosciences centre since 2014 (n = 593). Data were analysed for patient demographics, operative management, complications, and evidence of perioperative inpatient rehabilitation. Outcomes were assessed using the modified Japanese Orthopaedic Association (mJOA) score. **Results:** Mean patient age was 62.7 years at surgery; 58.8 % (349/593) were male. The most common surgery was an anterior cervical discectomy and fusion (62 %, 349/593); overall complication rate was 6.1 % (36/593). Mean hospital stay was 5.6 ± 10.3 days; modal stay was one day. Sixty-seven percent (398/593) of patients received perioperative rehabilitation with a mean of 4.8 sessions per patient. Physiotherapy (64 %, 380/593; mean 2.4 sessions) and occupational therapy (27 %, 160/593; mean 1.2 sessions) were the most common forms of rehabilitation. The average wait for therapy to start was 1.4 days. A total of 30 % (178/593) of patients had an mJOA assessment preoperatively: 99 patients had severe DCM, 59 moderate DCM, and 20 mild DCM. Mean preoperative mJOA score was 11.20; mean post-operative mJOA score at one year was 12.95 ($p < 0.01$). There was no statistically significant difference in change in mJOA score for patients who received perioperative rehabilitation and those who did not ($p = 0.32$). A greater proportion of patients with severe DCM received physiotherapy (82 %, 81/99) compared to those with moderate (73 %, 43/59) and mild DCM (55 %, 11/20) ($p = 0.03$). **Conclusion:** Neurorehabilitation has been predicted to optimise functional recovery following decompressive surgery for DCM, however its exact role

and what it should constitute remains undefined. This service evaluation has highlighted the need to improve understanding of the provision of perioperative rehabilitation and use scoring systems to quantitatively determine outcomes. Future studies should prospectively investigate the efficacy of DCM rehabilitation.

ID: AGS26/3384
P0306: Work ability and productivity after surgery for cervical radiculopathy - A secondary analysis of the FACET multicenter trial

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Introduction: Surgery is a common treatment for cervical radiculopathy in working-age adults, but its long-term effect on work outcomes remains unclear. This study evaluated work ability, absenteeism, and presenteeism over a two-year postsurgical period and identified factors associated with various recovery patterns. **Material and Methods:** We performed a secondary analysis of 219 employed patients (≤ 65 years) from the multicenter FACET-study, all of whom underwent surgery for cervical radiculopathy. Work outcomes were measured at six time points from baseline to two years postoperatively. Work ability was measured using the Work Ability Single Item (WAS). Absenteeism and presenteeism were assessed with the iMTA Productivity Cost Questionnaire (iPCQ). Absenteeism was defined as more than four consecutive weeks off work. Presenteeism was described qualitatively due to substantial missing data. Multivariable generalized mixed-effects models with multiple imputation identified baseline predictors of work ability and absenteeism. Model performance was evaluated using ROC curves (for absenteeism) and calibration. Latent class analyses identified subgroups with distinct recovery patterns. The study was registered in the Netherlands Trial Register (NTR5536). **Results:** The mean participant age was 49.4 years (SD 7.3), with an even distribution of men (108) and women (111). Job types included white-collar (49%), blue-collar (29%), and pink-collar (23%) roles; 52% held physically demanding jobs. At baseline, 66% had poor work ability and 43% were on sick leave for more than four consecutive weeks. In the final model, higher baseline quality of life predicted smaller improvements in work ability (β = -0.41, $p < 0.001$), while full-time absenteeism at baseline predicted greater improvements (β = 0.4; $p = 0.01$). For absenteeism, significant predictors were higher baseline neck disability (NDI; OR = 1.0; $p = 0.01$), and lower baseline work ability (OR = 0.7; $p < 0.001$). Model performance for absenteeism was strong (AUC = 0.93). Presenteeism declined over time but its analysis was limited by missing data. Latent class analyses identified three distinct work ability trajectories and two sick leave patterns, with physically demanding jobs overrepresented in the persistent low work ability group. **Conclusion:** Baseline quality of life, absenteeism, neck disability, and work ability significantly predict long-term productivity after cervical radiculopathy surgery. Recognizing these factors and recovery patterns can help tailor interventions to improve work reintegration.

ID: AGS26/3397
P0307: Radicular arachnoid cysts from cervical to sacral levels: a rare cause of persistent paresthesias

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Introduction: Cervical myelopathy due to spondylotic stenosis and disc herniation is a common cause of neurological deficits and gait limitation in older adults. However, persistent paresthesias after surgical decompression may indicate additional underlying pathology. **Material and Methods:** We report the case of a 68-year-old patient presenting with paresthesias in all four limbs and severe cervical claudication limiting her walking distance to a few meters. Cervical MRI demonstrated a narrow spinal canal with multiple disc herniations causing cervical spondylotic myelopathy. **Results:** The patient underwent anterior cervical triple discectomy with osteosynthesis. Postoperatively, she showed significant improvement in walking distance with resolution of cervical claudication; however, she continued to experience bothersome paresthesias affecting daily life. Follow-up MRI revealed multiple radicular arachnoid cysts involving the nerve roots from the cervical to sacral levels, likely explaining the persistent sensory symptoms. **Conclusion:** This case highlights that in patients with persistent paresthesias after successful decompressive cervical surgery, additional causes such as diffuse radicular arachnoid cysts should be considered. Recognition of such lesions is essential for accurate diagnosis and potential further management to improve quality of life.

ID: AGS26/3399
P0308: Systematic review of bioactive glass cages in ACDF: similar safety profile, clinical and radiologic outcomes to allograft and PEEK

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Introduction: Anterior cervical discectomy and fusion (ACDF) is a standard procedure for cervical degenerative pathologies, typically using allograft or PEEK cages. Bioactive glass (BG) cages have emerged as a novel interbody option with osteoconductive and bioactive properties. This review aimed to compare clinical and radiologic outcomes between BGC cages and traditional graft options (allograft or PEEK) in ACDF. **Material and Methods:** This systematic review was conducted in accordance with the PRISMA Guidelines to compare background knowledge (BG) and traditional techniques. PubMed and Google Scholar were queried for studies comparing BG and traditional methods. Studies that were non-English and pediatric were excluded. Visual analog scale (VAS)-Neck, VAS-UE, NDI, CT fusion rate, and interspinous motion (ISM) were recorded. Mean differences, ranges, and p-values were extrapolated to assess comparative trends between different techniques. **Results:** Our final review included nine studies with 542 patients, 235 of whom were treated with BG and 307 with traditional methods (allograft or PEEK). The VAS-Neck Mean Difference range was -.25 to 0.5; $p > 0.05$. VAS-Neck Mean Difference range was -1.2 to 1.0 ($p > 0.05$). NDI Mean Difference ranges were -3.02 to 3.9; $p > 0.05$. The CT fusion rate range for BG was 75 to 97.8, and traditional methods ranged from 70.4 to 100, with no statistically significant differences. The ISM range for BG was 0.54 to 33 and 0.54 to 23, with no statistically significant difference. **Conclusion:** We found that all studies reported comparable clinical and radiologic outcomes for BG compared to traditional methods for cages in ACDF. Outcomes, including VAS, NDI, CT fusion, and ISM, were similar. Only nine studies have been performed so far, thus research is necessary to establish bioactive glass as a compelling alternative to traditional techniques.

ID: AGS26/3452
P0309: Efficiency profile of stand alone cage and boner graft in ACDF for degenerative cervical disc prolapse with myelopathy in maintaining stability, balance and cervical lordosis

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Introduction: Degenerative conditions of cervical spine are one of the significant diseases in relatively older age groups. It creates disabilities for the patient, and a burden for family and the society as well. Thus the surgical treatment is worthwhile. ACDF with the Stand-alone cage is relatively a feasible implant that allows sufficient stability after decompression for treatment of cervical degenerative disc disease. This study is to evaluate the Clinico-radiological outcomes in the patients undergone anterior cervical discectomy and fusion (ACDF) with stand alone cage and bone graft in patients with Degenerative cervical spondylotic myelopathy or radiculopathy for cervical disc prolapse of single or multiple level. **Materials & Methods:** This Prospective interventional study included a total of 32 cases were included in the study from July 2023 to June 2024 through non-randomized purposive sampling. All the patients were between 20 to 75 years of age and operated (ACDF) with Stand-Alone Anchored Spacer in cervical degenerative disc disease. The postoperative outcome was assessed by NDI and JOA score. Postoperative follow up was conducted at 1st, 3rd and 6th month. **Results:** The mean age was found 53.41 ± 12.17 years with male dominancy (68.75%). Most of them were service holder (31.25%) and the most common presentation was radiculopathy (43.8%). The most commonly affected level was C5/6 (43.8%). Dysphagia rate was 12.5% after 2 weeks and no dysphagia after 3months. Evaluation of outcome 6 months after operation showed that mean NDI score 13.8 ± 1.5, JOA score 14.7 ± 1.3 and Bridwell Grade-I fusion 92.85% with excellent outcome clinically, functionally and radiologically. **Conclusion:** ACDF is one of the best surgical treatment for cervical disc diseases. Stand-alone cages acts as a spacer that improves it's outcome, Because it is a safe and reliable implant for the treatment in terms of fusion and stability in cervical degenerative disc disease with neurological symptoms.

ID: AGS26/3469
P0310: Endoscopic posterior approach for resection of OPLL and central osteophytes: a case series with more than 10 year follow up

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Introduction: Ossification of the posterior longitudinal ligament (OPLL) which usually causes cervical myelopathy is a challenging-to-treat condition. Minimally invasive approaches including endoscopic posterior decompression including resection of the central OPLL and osteophytes potentially offer less complications and quick recovery, may be an alternative to traditional laminectomy or laminoplasty surgery. **Material and Methods:** 12 patients with 1-3 level OPLL and symptomatic cervical myelopathy were treated with uniportal endoscopic posterior decompression and resection of OPLL and central osteophytes from

2015 through 2018. In this consecutive observational cohort study, pre- and postoperative Japanese Orthopaedic Association (JOA) score and Neck Disability Index (NDI) were analyzed at a final follow-up of more than 10 years. **Results:** Intraoperative data and clinical outcomes were analyzed and reported. For all the 12 patients, intra-operative blood loss was minimal. Three patients developed significant upper extremity weakness immediate post-operatively which recovered at approximately 12 months post-op. There were no infections, wound complications, or reoperations. At the final 5-year follow-up, the JOA score improved from a preoperative value of 11.9 ± 2.7 to 16.8 ± 2.1 postoperatively ($p < 0.001$). The corresponding NDI scores decreased from 29.6 ± 8.9 to 10.1 ± 7.2 ($p < 0.001$). **Conclusion:** Uniportal posterior endoscopic decompression, including resection of OPLL and central osteophytes for cervical OPLL is feasible and safe in myelopathic patients.

ID: AGS26/3484
P0311: The degenerative cervical myelopathy subjective and objective score (DCM-SOS): final content of a novel outcome measure derived by a modified Delphi process

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Introduction: Assessment of Degenerative Cervical Myelopathy (DCM) severity and disease progression are critical to guiding treatment decisions, as emphasized in current clinical practice guidelines. The modified Japanese Orthopaedic Association (mJOA) scale is a popular and useful severity measure, but relies on subjective reporting, lacks physical testing, and is frequently influenced by patient comorbidities. We aimed to develop and preliminarily validate the DCM Subjective Objective Score (DCM-SOS), a brief assessment that augments mJOA with additional patient-reported symptoms and clinician-assessed neurological findings to better quantify DCM severity. **Material and Methods:** A prospective study of 139 DCM patients and 108 healthy controls was conducted, and its results, in addition to recent systematic reviews, informed a modified Delphi process. An array of symptoms and physical tests were evaluated for inclusion based on diagnostic accuracy, convergent/divergent validity, and feasibility. A multidisciplinary panel of spine surgeons, neurologists, rehabilitation clinicians, and outcomes researchers discussed and voted on content. **Results:** The DCM-SOS consists of two distinct tools: a 60-point "subjective" Patient-Reported Outcome (PRO) assessing symptoms, and a 40-point "objective" Clinician-Reported Outcome (CRO) measuring neurological function, while formally recording comorbidities that may impact scoring. The subjective subscore includes upper extremity (UE) clumsiness, weakness, numbness, and pain measured bilaterally, in addition to walking balance, urinary function, and neck pain. The objective subscore measures UE strength in 5 muscle groups, UE reflexes, UE sensation to light touch, and tandem gait. The DCM-SOS demonstrated strong diagnostic accuracy (sensitivity = 87%, specificity = 97%), comparing favorably with mJOA (sensitivity = 82%, specificity = 90%) while correlating well with mJOA ($r = 0.88$). The expert panel of 42 members unanimously approved final content after 2 rounds of voting. **Conclusion:** The DCM-SOS is a practical tool that can accurately assess DCM severity, constituting a brief history and physical exam. 20% of content addresses pain, previously identified by patients as the most important recovery priority, while mJOA score can also be directly calculated for reference. The objective subscore provides validation of subjective reporting, potentially enhancing accuracy in subjects that over or under-report symptoms. Further validation in a prospective multicenter study is planned.

Degenerative lumbar

ID: AGS26/29
P0312: Influence of metabolic bone status and nutritional status on patient reported outcomes: a prospective study of lumbar spinal fusion patients with 12-month follow-up

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Introduction: The impact of preoperative metabolic and nutritional parameters on patient reported outcomes (PROs) after spine surgery is unclear. The objective of this study was to examine the relationship between nutritional and metabolic parameters to PROs and after lumbar fusion in patients undergoing open posterior lumbar fusion surgery due to degenerative spinal conditions between 2014-2021. **Material and Methods:** Prospectively collected data of patients undergoing open posterior lumbar fusion surgery due to degenerative spinal conditions between 2014-2021 was analyzed. Preoperative volumetric

bone mineral density (vBMD), metabolic and nutritional parameters such as 25-hydroxyvitamin D (VitD), Urinary N-telopeptide (uNTX), serum N-telopeptide (sNTX), bone alkaline phosphatase (BAP), parathyroid hormone (PTH), Procollagen type I N-terminal Propeptide (P1NP) and albumin were analyzed. PROs included the Oswestry Disability Index (ODI), numeric rating scale for leg (NRS-L) and back (NRS-B) pain and the 12-item Short Form Health Survey (SF-12) were collected at baseline before and 6 weeks (6W-FU), 3 months (3M-FU), 6 month (6M-FU) and 12 months (12M-FU) after surgery. Spearman correlation and multivariable regression analyses (confounder: age, BMI, sex, baseline PROs) were performed. **Results:** 125 patients with a median age of 62.1 (IQR 54.2-69.5) years and a median BMI of 29.1 (IQR 26.1-33.0) kg/m^2 were analyzed. The univariate analysis showed that lower 25-hydroxyvitamin D was inversely associated with ODI (3M-FU, 12M-FU), NRS back pain (3M-FU) and leg pain (12M-FU). Lower preoperative vBMD was associated with more leg pain at the 12M-FU. The univariate analysis demonstrated no significant associations between uNTX, BAP, sNTX, PTH and PROs, besides a negative correlation between sNTX and PCS-12 at the 3M-FU. The multivariable regression analysis showed that lower Vitamin D levels were associated with worse ODI outcomes at the 3M-FU, 6M-FU and 12M-FU and worse SF-12 physical component scores (3M-FU, 6M-FU and 12M-FU). **Conclusion:** This prospective investigation demonstrated that lower preoperative Vitamin D levels were associated with worse ODI and SF-12 scores after lumbar fusion. This might support the routine assessment of Vitamin D as a preoperative biomarker in fusion surgery. Vitamin D supplementation might be a therapeutic intervention that can improve PROs in elective spine surgery.

ID: AGS26/90
P0313: Expandable lumbar transforaminal interbody cages: do they modify radiological parameters?

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Introduction: The use of transforaminal expandable interbody cages is controversial, and there is no evidence that they modify radiological parameters in the lumbar spine, for which they were designed. The objective of this study was to retrospectively assess whether expandable interbody cages modify the following radiological parameters: local and regional lumbar lordosis, anterior and posterior disc height, and foraminal height. **Material and Methods:** A total of 18 expandable cages implanted in 2022 were reviewed in 17 patients: 10 cases in the L5-S1 segment, 7 cases in L4-L5, and one at the L3-L4 dual level. The patients ranged in age from 35 to 64 years, 10 women and 7 men. The cages implanted on 15° lordotic implants, and 3 cages had a 10° lordosis. Radiological assessments: the following distances were measured on lateral lumbar spine X-rays: anterior disc heigh, posterior disc height, segmental lordosis at the treated level, lumbar lordosis, foraminal height. These measurements were taken on the preoperative and immediate postoperative radiographs. Both radiographs were compared to assess whether there was a significant change in the radiological parameters. **Results:** The preoperative and postoperative foraminal height, although it has increased, has not shown a statistically significant improvement, going from 1.4 cm in preoperative x-ray to 1.6 cm in postoperative. The anterior disc height has obtained an improvement or statistically significant increase, going from 0.6 cm to 1.1 cm. The posterior disc height has also recorded statistically significant changes going from 0.4 cm to 0.9 cm. The global lumbar lordosis has gone from 38° to 40°, these data not being statistically significant. **Conclusion:** In our hands, expandable intersomatic lumbar cages have not achieved a statistically significant modification of the radiological parameters assessed.

ID: AGS26/194
P0314: Long-term efficacy and safety of basivertebral nerve ablation for chronic low back pain: a single-center 5-year prospective study

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Introduction: Chronic low back pain (CLBP) is a significant global health issue with profound physical, emotional, and socioeconomic impacts. Conventional treatment options, including medications, physical therapy, and surgical interventions, often provide limited long-term relief. Basivertebral nerve ablation (BVNA) is an emerging minimally invasive treatment aimed at addressing vertebrogenic back pain by targeting the basivertebral nerve. The primary aim of this study is to evaluate the long-term clinical outcomes of patients undergoing BVNA for CLBP. Specifically, we aim to assess improvements in pain and disability, the achievement of clinically significant improvements, the use of adjunctive treatments, and patient-reported functional recovery. We hypothesize that BVNA leads to clinically and statistically significant improvements in pain (VAS) and disability (ODI) scores at long-term follow-ups, with a majority of patients experiencing sustained functional recovery. **Material and Methods:** This prospective, single-arm follow-up study enrolled 15 patients (6 male and 9 female) with CLBP who underwent BVNA at a single center. Baseline data included demographic characteristics, Visual Analog Scale (VAS) scores for pain, and Oswestry Disability Index (ODI) scores. Follow-up assessments were conducted at 3, 4, and 5 years, capturing VAS, ODI, medication and injection usage, and patient-reported outcomes. Clinically significant improvements were defined as patients achieving a $\geq$ 15-point reduction in ODI and a $\geq$ 2-point reduction in VAS. **Results:** The mean age of our cohort was

55 years (± 8.2 yeras). At baseline, the mean VAS and ODI scores were 6.7 ± 1.2 and 47.8 ± 9.3, respectively. At 3, 4, and 5 years, the mean % improvements in VAS were 60.8%, 53.6%, and 67.8%, respectively, while ODI improvements were 72.3%, 77.6%, and 74.1%. Clinically significant improvements in both ODI and VAS scores were achieved by 93.3% of patients at 3 years, 80.0% at 4 years, and 86.7% at 5 years. Medication usage was reported by 13.3% of patients at 3 and 4 years, while injection usage remained consistent at 6.7% across all follow-ups. Functional recovery, defined as resuming pre-back-pain activity levels, was reported by 80.0%, 66.7%, and 86.7% of patients at 3, 4, and 5 years, respectively. Importantly, no serious device- or procedure-related adverse events were reported throughout the study. Additionally, 100% of enrolled patients completed the 5-year follow-up, ensuring robust data collection and analysis. **Conclusion:** The findings of this study demonstrate that BVNA is an effective long-term treatment for CLBP, resulting in significant reductions in pain and disability. A high percentage of patients achieved clinically significant improvements in both ODI and VAS scores, with sustained functional recovery observed over 5 years. The minimal need for adjunctive treatments and the absence of serious adverse events highlights the safety and efficacy of BVNA.

ID: AGS26/195
P0315: Sustained satisfaction and reduced dependency: a single center 5-year evaluation of basivertebral nerve ablation for chronic low back pain

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Introduction: Chronic low back pain (CLBP) is a prevalent condition that significantly affects quality of life. Basivertebral nerve ablation (BVNA) is a novel treatment for vertebrogenic CLBP, offering a minimally invasive approach. This study provides a detailed analysis of patient satisfaction, the relationship between baseline scores and improvement, medication reduction, and adverse events over a 5-year follow-up period. We aim to evaluate the long-term effectiveness and safety of BVNA, with a focus on patient-reported satisfaction, baseline predictors of improvement, medication dependency, and adverse event rates. Our hypothesis was that BVNA will result in clinically and statistically significant long-term reductions in pain (VAS) and disability (ODI) scores, accompanied by high levels of patient satisfaction, minimal reliance on adjunctive treatments, and no serious adverse events. Patients with higher baseline scores are expected to experience greater percentage improvements. **Material and Methods:** This single-center, prospective study followed 15 patients (6 males, 9 females; mean age 55 ± 8.2 years) treated with BVNA. Outcomes were assessed at 3-, 4-, and 5-year follow-ups. Measures included VAS and ODI scores, patient satisfaction (whether they would undergo the procedure again), correlation between baseline scores and improvement, and trends in medication use. Clinically significant improvement was defined as a ≥ 15-point reduction in ODI and a ≥ 2-point reduction in VAS. **Results:** Patient satisfaction was consistently high across all follow-ups; with the majority (88.9%) reporting they would undergo BVNA again for the same condition. A weak negative correlation was observed between baseline scores and percentage improvement in VAS (-0.10) and ODI (-0.23), indicating that improvement was not strongly influenced by baseline severity. Medication usage significantly declined over time; only 13.3% of patients reported taking pain medications at 3 and 4 years, with limited data available for 5 years. Injection reliance was minimal, with just 6.7% of patients requiring injections across follow-up visits. Importantly, no serious device- or procedure-related adverse events were reported during the 5-year study. **Conclusion:** BVNA provides sustained improvements in pain and disability, coupled with high levels of patient satisfaction and minimal reliance on adjunctive treatments. The lack of serious adverse events reinforces its safety and long-term effectiveness as a treatment option for vertebrogenic CLBP. These findings highlight the procedure's broad applicability, independent of baseline symptom severity.

ID: AGS26/233
P0316: The role of pelvic incidence in predicting functional outcomes after lumbar fusion: a retrospective cohort study

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Introduction: Spinopelvic alignment plays a crucial role in spinal pathology and surgical outcomes. Pelvic Incidence (PI) and Pelvic Tilt (PT) are key radiographic parameters influencing postoperative function and disability. Understanding their relationship with patient-reported outcomes can optimize surgical planning and improve clinical outcomes for patients undergoing lumbar fusion for degenerative disc disease. This study does not address PI-LL mismatch or global sagittal balance issues; all patients had PI-LL values less than 10°, indicating adequate spinopelvic harmony across the cohort. This study aims to assess the predictive value of Pelvic Incidence and Pelvic Tilt on patient-reported outcomes, including PROMIS Physical Function (PF), Pain Interference (PI), Social Role (SR), and Oswestry Disability Index (ODI), in patients who underwent one or two-level lumbar fusion for degenerative disc disease. A subgroup analysis was performed to evaluate differences between low and high PI groups. We hypothesized that Pelvic Incidence is a stronger predictor of patient-reported outcomes than Pelvic Tilt and that patients with high PI may have worse functional outcomes postoperatively compared to those with low PI. **Material and Methods:** This was a retrospective cohort study of patients who underwent one or two-level lumbar fusion for

degenerative disc disease. Demographic data, radiographic parameters (PI and PT), and patient-reported outcomes (PROMIS-PF, PROMIS-PI, PROMIS-SR, and ODI) were collected. Linear regression analysis was performed to evaluate the predictive value of PI and PT for each outcome measure. Subgroup analysis was conducted by stratifying patients into Low PI (< 55°) and High PI (≥ 55°) groups. **Results:** A total of 140 patients were analyzed (Low PI: 76; High PI: 64). The mean age was 67.8 ± 8.0 years for the Low PI group and 65.4 ± 11.6 years for the High PI group. Females comprised 54.7% of the Low PI group and 51.3% of the High PI group. Regression analysis demonstrated that PI had a moderate correlation with PROMIS-PF ($r = -0.50$, $R^2 = 0.25$), PROMIS-PI ($r = 0.40$, $R^2 = 0.16$), and PROMIS-SR ($r = 0.44$, $R^2 = 0.19$), whereas PT showed weak correlation with all outcomes ($r \leq -0.04$, $R^2 \approx 0.00$-0.09). The subgroup analysis revealed that patients with High PI had significantly lower PROMIS-PF scores and higher ODI scores than those with Low PI. The Chow Test confirmed a significant difference in the predictive strength of PI between Low and High PI groups for PROMIS-PF ($p = 0.05$). **Conclusion:** This study highlights the clinical relevance of Pelvic Incidence as a predictor of patient-reported outcomes in lumbar fusion patients. PI demonstrated a stronger predictive relationship with functional and disability scores compared to PT. Patients with High PI had worse postoperative functional outcomes, reinforcing the need for individualized surgical planning based on spinopelvic parameters. These findings support the consideration of PI in preoperative assessments to optimize patient selection and postoperative rehabilitation strategies.

ID: AGS26/258
P0317: Independent risk factors for sacral fracture after lumbosacral fusion in adults: a Cox proportional hazards retrospective analysis

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Introduction: Sacral fractures are an uncommon complication after lumbosacral fusion, with recent research suggesting that osteoporosis is an independent risk factor. However, there is a paucity of data regarding other potential risk factors, potentially hindering risk stratification. The purpose of this study is to determine the independent risk factors for sacral fracture after lumbosacral fusion in adults to optimize patient care. **Material and Methods:** This preregistered retrospective database study (TriNetX) included adults (≥18 years) who underwent first-time lumbosacral fusion between 2005-2023, divided into two cohorts based on osteoporosis diagnosis: the osteoporosis cohort and the no osteoporosis cohort. Patients with history of spinal fusion/instrumentation, sacral fracture, spinal neoplasm, and pelvic instrumentation were excluded. The primary outcome was the incidence of sacral fracture after lumbosacral fusion through two years, estimated using Kaplan-Meier analysis, with hazard ratios (HRs) estimated for each covariate using a multivariable Cox proportional hazards model ($p < 0.05$). Covariates included those associated with the sacral fracture risk based on existing literature. A forest plot was created to graphically display HRs. **Results:** There were 592 sacral fractures (2.3%) among 25,598 adults who underwent lumbosacral fusion with 470 cases (2.8%) in the osteoporosis cohort and 122 cases (1.3%) in the no osteoporosis cohort. Independent risk factors ($p < 0.05$) for sacral fracture after lumbosacral fusion included previous pelvic radiation [95% CI] (HR: 3.04 [1.26, 7.36]), history of falls (HR: 2.65 [2.21, 3.18]), osteoporosis (HR: 2.02 [1.64, 2.49]), long-term systemic corticosteroid use (HR: 1.47 [1.10, 1.98]), age at index lumbosacral fusion (HR: 1.01 [1.00, 1.02] per year), while protective factors included overweight and/or obesity status (HR: 0.79 [0.65, 0.97]), and male sex (HR: 0.64 [0.48, 0.85]). Variables determined not to be independent risk factors ($p > 0.05$) in our model included nicotine dependence, history of total hip arthroplasty, anterior surgical approach, posterior surgical approach, long lumbosacral spinal fusion with instrumentation (7-12 vertebral levels), diabetes mellitus, bone density medications, inflammatory polyarthropathies, pelvic fixation, vitamin D prescription, chronic kidney disease, as well as glucagon-like peptide-1 analogues. **Conclusion:** Based on a retrospective study with the largest sample size of sacral fractures after lumbosacral fusion to date, clinically meaningful independent risk factors for sacral fractures after lumbosacral fusion include pelvic radiation, prior falls, osteoporosis, and long-term systemic corticosteroid use, while protective factors include male sex, and being obese/overweight. Despite being plausible risk factors, variables such as nicotine dependence, history of THA, surgical approach, long lumbosacral spinal fusion with instrumentation, diabetes mellitus, bone density medications, inflammatory polyarthropathies, pelvic fixation, vitamin D prescription, chronic kidney disease, and GLP-1 analogues were not independently associated with sacral fractures after lumbosacral fusion. However, these

results should be taken with caution due to the retrospective study design. Clinicians should integrate the knowledge of these independent variables into surgical planning, education, and postoperative detection to optimize care.

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P0318: The guiding value of ultrasound-guided selective nerve root block in the surgical treatment of multilevel lumbar degeneration

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Introduction: At present, the surgical options for multilevel lumbar degeneration remain controversial. The aim of this study is to explore the guiding value of ultrasound-guided selective nerve root block (SNRB) in surgical treatment decision making in patients with multi-level lumbar degenerative diseases. **Material and Methods:** A retrospective analysis was performed on 90 patients with multi-level lumbar degenerative disease who were surgically treated in our hospital from January 2020 to December 2023. The patients were divided into SNRB group and non-SNRB group according to whether or not they underwent SNRB before surgery. There were 48 patients in the SNRB group. Their responsible segments were identified by ultrasound-guided SNRB, combined with symptoms and imaging examination before surgery. Then decompression was performed on the responsible segments. A total of 42 patients in the non-SNRB group, and conventional multi-level lumbar spinal canal decompression was performed because their responsible segments were not clear. The operative time, intra-operative blood loss, the VAS score and JOA score of lumbar and leg pain before surgery, the 3rd day after surgery, 6 months after surgery, and the last follow-up were recorded and compared between the two groups, and the occurrence of intra-operative complications were also recorded. **Results:** The operation was successfully completed in both groups, and no serious complications occurred during surgery. One case of dural tear occurred in the non-SNRB group and was repaired intraoperatively. The operative time and blood loss in SNRB group were significantly less than those in non-SNRB group ($p < 0.05$). The VAS scores and JOA scores of low back pain and leg pain in SNRB group were better than those in the non-SNRB group on the 3rd day after surgery, 6 months after surgery and at the last follow-up, with statistical significance ($p < 0.05$). No loosening, or displacement of the instrumentation were found in the two groups, and the bone grafting healed well. **Conclusion:** This study showed that preoperative ultrasound-guided SNRB could identify the responsible segments and provide surgical guiding value for patients with multi-level lumbar degeneration.

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P0319: High-resolution characterization of quality-of-life recovery trajectories after degenerative lumbar spine surgery using an integrated digital health platform: a prospective feasibility study

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Introduction: Patient-reported outcome measures (PROMs) are crucial for evaluating recovery following lumbar spine surgery, but traditional assessment schedules frequently miss critical early postoperative changes. This creates an early "black box," limiting timely, patient-centred interventions. High-frequency, digitally integrated PROMs initiated immediately post-surgery can capture detailed, real-time recovery trajectories, potentially improving clinical responsiveness, precision, and patient outcomes. We aimed to implement and assess a novel electronic high-frequency PROM system directly integrated into clinical workflows. **Material and Methods:** From February 1 to May 15, 2025, we prospectively enrolled 73 patients undergoing surgery for lumbar disc herniation (LDH, n = 25) or spinal canal stenosis (SCS, n = 48). Surgical indications were confirmed via multidisciplinary neurosurgical discussions integrating clinical and imaging data. PROMs (overall health status, wound, leg pain, and sensory disturbances) were recorded every second day over four weeks using the secure, web-based MyEDC platform integrated into the hospital's electronic health record. **Results:** Significant demographic differences existed between groups; SCS patients were older (67·0 vs 51·9 years; $p < 0.001$) and had higher comorbidity burden (ASA 2·2 vs 1·8; $p = 0.01$). High-frequency monitoring revealed distinct recovery trajectories: SCS patients initially had lower overall health status but surpassed LDH patients at four weeks (74·1% vs 64.5%; $p < 0.0001$). Initial wound pain was greater in the SCS group but resolved similarly by four weeks. Sensory disturbances were significantly worse in LDH patients ($p < 0.0001$), while leg pain was slightly higher in SCS patients ($p = 0.035$). Younger LDH patients (< 40 years) reported significantly lower postoperative QoL ($p = 0.0003$). Elevated baseline depressive symptoms negatively correlated with postoperative health status (LDH: $r = -0.15$, $p = 0.034$; SCS: $r = -0.33$, $p = 0.045$). Electronic assessment response rates reached approximately 95% within two weeks. **Conclusion:** High-frequency electronic PROM collection immediately after

lumbar spine surgery uncovers distinct, clinically relevant recovery trajectories, significantly influenced by psychological factors. By addressing the early postoperative "black box," this approach enables personalized care, timely interventions, and establishes a new benchmark for precision medicine in spine surgery.

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P0320: Postoperative radiculitis in interlaminar endoscopic discectomy secondary to decompensated diabetes mellitus: case report and literature review

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Introduction: Type 2 Diabetes Mellitus (T2DM) is a major global public health issue and remains one of the leading causes of morbidity and mortality worldwide. Beyond its systemic complications, T2DM has been recognized as an important perioperative risk factor, particularly in spine surgery. Diabetic patients are more prone to postoperative infections, delayed wound healing, accelerated disc degeneration, and peripheral nerve injury. Although radiculitis is a known complication of lumbar discectomy, the association between poorly controlled diabetes and postoperative radicular pain has been infrequently reported. We present the case of a patient who developed severe radiculitis after interlaminar endoscopic discectomy, in the context of uncontrolled diabetes mellitus, and we review the relevant literature. **Material and Methods:** Case Report: A 59-year-old male with a history of hypertension, coronary artery disease, and pre-diabetes managed with metformin 850 mg/day was admitted through the Chilean GES program for surgical treatment of a left L5-S1 lumbar disc herniation (LDH). Preoperative evaluation revealed a fasting glucose of 142 mg/dL, attributed to prior intramuscular betamethasone. An interlaminar endoscopic discectomy was performed without intraoperative complications, and the patient was discharged 12 hours postoperatively in stable condition. Seven days after surgery, he developed severe left-sided sciatica, more intense than his preoperative symptoms. Initial outpatient management with high-dose analgesics and pregabalin for seven days failed to provide relief; corticosteroids were not administered. Due to persistent symptoms, he was readmitted for pain management and further evaluation. Magnetic resonance imaging excluded recurrent herniation and revealed only expected postoperative edema. A transforaminal epidural block was planned. However, pre-procedure laboratory tests demonstrated marked hyperglycemia (642 mg/dL) and an HbA1c of 10.1%, indicating uncontrolled diabetes. The procedure was canceled, and the patient was evaluated by internal medicine. Insulin therapy was initiated, and he was discharged with optimized analgesia and a structured insulin regimen. **Results:** During follow-up, the patient experienced a progressive reduction in radicular pain. At his most recent outpatient visit, HbA1c had improved to 7%, and he remained asymptomatic with no recurrence of neurological symptoms. **Conclusion:** This case highlights the potential impact of uncontrolled diabetes on the development of postoperative radiculitis following spine surgery. Several mechanisms may explain this relationship, including microvascular compromise of the nerve roots, metabolic stress, and impaired healing in the setting of hyperglycemia. Prior studies have reported an increased risk of neuropathic pain in diabetic patients undergoing lumbar procedures, although specific reports linking decompensated diabetes to acute postoperative radiculitis remain scarce. We emphasize the importance of preoperative metabolic optimization in patients with diabetes or pre-diabetes undergoing elective lumbar discectomy. Comprehensive evaluation of glycemic status, including HbA1c measurement, should be mandatory to reduce the risk of complications. Early involvement of internal medicine in perioperative management may help prevent adverse outcomes and improve surgical recovery. Decompensated diabetes mellitus can act as a contributing factor in the development of postoperative radiculitis after endoscopic lumbar discectomy. Careful preoperative metabolic assessment and optimization are essential, even in patients with prediabetes or mild disease, to ensure safe surgical outcomes

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P0321: Regional variety in severity of indication and outcomes of patients with discectomy for lumbar disc herniation: the Finspine Register Study

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Introduction: Lumbar disc herniation treated with lumbar discectomy is a common surgical procedure. Finland's public healthcare system aims to provide equitable access for treatment but regional differences in patient characteristics and

surgical outcomes may exist. The aim of the present study is to evaluate preoperative factors and postoperative outcomes after lumbar discectomy across Finland's five university hospital catchment areas. **Material and Methods:** We analyzed data from 18,954 patients undergoing primary lumbar discectomy between 2017 and 2024 from the Finnish National Spine Register (FinSpine). Preoperative demographics and patient-reported outcomes measures (PROs) - Oswestry Disability Index (ODI), Visual Analogue Scale (VAS) for pain, and EQ-5D-5L quality of life instrument - were compared across regions. Follow-up assessments occurred at 3 months, 1 year, and 2 years postoperatively. **Results:** Baseline disability (median ODI 42-48 points), pain, BMI, smoking status, and employment varied significantly between regions ($p < 0.001$). Pain duration also differed, with some regions reporting longer preoperative symptoms. Postoperatively, all regions demonstrated marked improvements: median ODI scores decreased to 10-15, and over 50% of patients reported at least a 50% reduction in pain at 2 years. EQ-5D scores improved significantly (median increase from 0.47-0.51 to 0.65-0.73 points). Patient satisfaction was consistently high (75%-88% across regions), with a majority reporting symptom improvement. Differences in preoperative PROs diminished by 2 years, indicating convergence of outcomes nationwide. **Conclusion:** Despite regional variations in baseline health and socioeconomic factors, lumbar discectomy outcomes are uniformly positive across Finland, supporting equitable surgical care. Further research should address referral and waiting time disparities to improve preoperative health equity.

ID: AGS26/442
P0322: Comorbidity prevalence of degenerative lumbar scoliosis in patients with degenerative lumbar spinal stenosis: age distribution pattern and clinical characteristics

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Introduction: With the deepening of population aging, the incidence of degenerative lumbar spinal stenosis (DLSS) is increasing year by year, while, due to the overall degeneration of the spine, the comorbidities in elderly DLSS patients have become more complex. Among these, preoperative degenerative lumbar scoliosis (DLS) is one of the most common conditions, which significantly affects the surgical strategy. Although the incidence of DLS in the elderly population has been reported, the comorbidity prevalence of DLS in patients with DLSS hasn't been well demonstrated, and there still lack the Large-scale comprehensive studies on the comorbidity of DLS in patients with LSS. **Material and Methods:** This is a retrospective cross-sectional study on 1689 patients hospitalized for DLSS at our institution between January 2018 and September 2020. The inclusion criteria of DLS was defined as a coronal curvature (main lumbar curve) $\geq 10°$ measured using the Cobb method and older than 45 years without history of scoliosis. The preoperative radiograhic and clinical data of these patients including Visual Analogue Score (VAS), Oswestry Disability Index (ODI), C7 plumb line-center sacral vertical line (C7PL-CSVL), Cobb angle, sagittal vertical axis (SVA), pelvic incidence minus lumbar lordosis (PI-LL) and pelvic tilt (PT) is reviewed. Pearson correlation analysis is used to explore the relationship between coronal deformity and sagittal deformity, and to demonstrate the association between radiographic parameters and clinical symptoms. **Results:** Among the patients, 443 (157 males and 286 females, mean age 65.54 ± 7.49 years, mean Cobb angle $17.95 \pm 7.93°$) met the criteria for scoliosis (Cobb angle $\geq 10°$), resulting in a combined prevalence of 26.2%. In LSS patients aged 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, and 75 years and older, the DLS comorbidity rates were 12.0%, 18.3%, 21.0%, 26.6%, 28.4%, 30.6%, and 35.6%, respectively. In comorbid patients with C7PL-CSVL $\leq$ 20 mm, sagittal imbalance rate was 37.3%; in comorbid patients with C7PL-CSVL between 20mm and 40 mm, the rate was 47.2%; and in comorbid patients with C7PL-CSVL $\geq$ 40 mm, the rate was 51.1%. VAS low back pain was significantly correlated with Cobb angle (0.140, $p = 0.003$), PI-LL (0.147, $p = 0.002$) and SVA (0.097, $p = 0.04$). ODI was significantly correlated with C7PL-CSVL (0.126, $p = 0.008$), PT (0.129, $p = 0.007$) and SVA (0.249, $p < 0.001$). **Conclusion:** The comorbidity prevalence of DLS in patients with DLSS is 26.2%, which increases from 12.0% to 35.6% with age from 45 to 75 years older. Generally, the sagittal imbalance deteriorates along with the aggravating coronal deformity, which reminds us of the three-dimensional characteristic in spinal deformity. During the management of DLSS patients combined with DLS, the evaluation of sagittal balance should also be noticed. Preoperative sagittal and coronal imbalance is significantly associated with patient's clinical symptom. In view of the high comorbidity rate of DLS in elderly

patients with DLSS and its close relationship with preoperative clinical symptom, surgical planning should be prudent and comprehensive.

ID: AGS26/552
P0323: Elaboration of predictive algorithms to help decison-making in lumbar degenerative pathologies: categorical variables

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Background: The ability to predict categorical outcomes, such as the need for intensive care or significant clinical improvement, is crucial for managing patient expectations and resources in degenerative lumbar spine surgery. This study developed machine learning models to predict key binary and multinomial outcomes in a Brazilian population. **Methods:** A retrospective analysis was conducted using the Brazilian Spine Study Group database on adult patients undergoing surgery for degenerative lumbar conditions. A suite of classification models, including Logistic Regression, SVM, XGBoost, and Neural Networks, was developed to predict: hospital stay > 2 days, need for ICU admission, and significant clinical improvement based on the Oswestry Disability Index (ODI) at 1-3 and 6-12 months. Models were evaluated using balanced accuracy, F1-score, and Area Under the Curve (ROC). **Results:** For predicting hospital stay > 2 days, the Logistic Elastic Net model demonstrated the best overall performance. The most important predictor was the amount of blood loss. For ICU admission, a Rule-Based model was superior, with blood loss and surgical time being the most influential variables. For ODI improvement at 1-3 months, a Simple Tree model performed best, with the baseline ODI score and patient age as key predictors. For ODI improvement at 6-12 months, the LGBM model was the most accurate. **Conclusion:** Machine learning algorithms can effectively predict important categorical outcomes after lumbar spine surgery. Different models excelled at predicting specific outcomes, highlighting the importance of selecting the appropriate algorithm for each clinical question.

ID: AGS26/629
P0324: GLP-1 receptor agonist use reduces risk of pseudoarthrosis in non-diabetic patients undergoing spinal fusion: a propensity-matched comparative cohort study

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Introduction: Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as effective treatments for obesity in non-diabetic populations. While obesity is associated with impaired bone healing and higher complication rates following spinal fusion, it remains unknown whether GLP-1 RA therapy improves postoperative outcomes in this group. This study evaluated the impact of perioperative GLP-1 receptor agonist (RA) use on one-year outcomes following cervical and lumbar spinal fusion in non-diabetic patients. **Material and Methods:** We conducted a retrospective cohort study using the TriNetX US Collaborative Network. Adult obese patients undergoing cervical or lumbar spinal fusion between 2004 and 2024 were identified. Diabetic patients were excluded. The treatment group included patients prescribed GLP-1 RAs within 6 months before or after surgery (N = 1,084), and the control group included those with no GLP-1 exposure (N = 171,151). After 1:1 propensity score matching, 851 patients remained in each group; subgroup analyses included 377 cervical and 447 lumbar fusion pairs. The primary outcome was diagnosis of pseudoarthrosis at one year. Secondary outcomes included mechanical loosening, revision surgery, wound complications, infection, and readmission. **Results:** GLP-1 RA use was associated with a significantly lower rate of pseudoarthrosis at one year in the pooled cohort (10.0% vs. 16.0%; OR, 0.586; p = 0.001), consistent across cervical

(8.2% vs. 17.0%; OR, 0.486; $p < 0.001$) and lumbar (11.1% vs. 16.0%; OR, 0.657; $p = 0.045$) subgroups. Kaplan-Meier analysis confirmed improved pseudoarthrosis-free survival ($p < 0.05$ for all). Readmission rates were lower in cervical patients (9.5% vs. 14.9%; $p = 0.026$). ED visits (22.1% vs. 17.4%; $p = 0.015$) and infection (3.5% vs. 2.1%; $p = 0.035$) were more frequent in GLP-1 users. **Conclusion:** In obese, non-diabetic patients undergoing spinal fusion, perioperative GLP-1 RA use was associated with significantly lower pseudoarthrosis rates. These benefits were observed despite persistent obesity, suggesting bone- or healing-related effects independent of weight loss.

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P0325: Unilateral biportal endoscopy versus posterior lumbar interbody fusion for single-level lumbar spinal stenosis with Grade I spondylolisthesis: a retrospective cohort study

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Introduction: The optimal surgical strategy for lumbar spinal stenosis with Grade I spondylolisthesis remains debated, particularly regarding decompression alone versus decompression with fusion. Unilateral biportal endoscopy (UBE) allows adequate decompression while preserving motion, but its safety and efficacy in patients with Grade I spondylolisthesis-specifically, whether it may exacerbate instability-are uncertain. This study aimed to compare perioperative outcomes, clinical efficacy, and radiographic results between UBE decompression and fusion surgery. **Material and Methods:** A total of 168 patients with single-level lumbar spinal stenosis and Grade I degenerative spondylolisthesis treated between June 2021 and August 2024 were retrospectively reviewed. They were divided into a UBE group ($n = 66$) and a fusion group ($n = 102$). Perioperative parameters were recorded. Clinical outcomes were assessed using Visual Analog Scale (VAS), Oswestry Disability Index (ODI), and Japanese Orthopaedic Association (JOA) scores. Radiographic evaluations included lumbar MRI to measure central sagittal diameter and cross-sectional area (CSA) of the spinal canal, and dynamic lumbar radiographs to assess spondylolisthesis percentage and intervertebral angle changes. Stability was defined as <3% increase in slippage and < 5° angular change. Complications were documented. **Results:** Preoperative baseline characteristics showed no significant differences. The UBE group had significantly less intraoperative blood loss (45.8 ± 20.4 mL vs. 120.5 ± 45.1 mL, $p < 0.01$) and shorter postoperative hospital stay (2.5 ± 1.3 days vs. 6.2 ± 2.1 days, $p < 0.01$). Operation time was shorter in the UBE group (108.7 ± 28.9 min vs. 142.3 ± 25.6 min, $p < 0.05$). At 12 months postoperatively, both groups showed significant improvements in VAS, ODI, and JOA scores ($p < 0.01$), with no significant differences between groups. Radiographic parameters improved significantly in both groups, with no intergroup differences. All UBE patients met stability criteria at final follow-up, with no progression of spondylolisthesis or need for revision fusion. Complications in the fusion group included 2 dural tears and 1 surgical site infection; the UBE group had 1 minor intraoperative dural tear (managed conservatively with good recovery) and no nerve root injuries. **Conclusion:** Both UBE decompression and fusion surgery yield excellent clinical and radiographic outcomes in patients with single-level lumbar spinal stenosis and Grade I spondylolisthesis. UBE offers advantages including less bleeding, shorter hospitalization, and faster recovery, while avoiding internal fixation and fusion. This study demonstrates that in selected patients with Grade I spondylolisthesis, UBE did not lead to radiographic instability or progression at 1-year follow-up. Larger studies with longer follow-up are needed to confirm long-term stability.

ID: AGS26/650
P0326: The association between low virulence organisms in lumbar spine and intervertebral disc structural failure a prospectice study

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Introduction: Many factors may trigger intervertebral disc (IVD) structural failure (intervertebral disc degeneration (IDD) and endplate changes), including inflammation, infection, dysbiosis, and the downstream effects of chemical factors. Of these, microbiome dysbiosis has been considered as one of the potential reasons for disc structural failure. The exact relationships between microbial colonisation and IVD structural failure are not well understood. This prospective study aimed to investigate the impact of microbial colonisation and its location (such as skin, IVD, muscle, soft tissues, and blood) on IVD structural failure and corresponding low back pain (LBP) if any. **Material and Methods:** First, we searched four online databases for potential studies. The potential relationships between microbial colonisation in different sample sources (such as skin, IVD, muscle, soft tissues, and blood) and IDD and endplate change were considered as primary outcomes. Odds ratio (OR) and 95% confidence intervals (CI) for direct comparisons were reported. Grading of Recommendations Assessment, Development and Evaluation (GRADE) scale was used to assess the quality of evidence. Second, this study recruited 66 patients who underwent lumbar discectomy surgery for testing of gut microbiota, fecal metabolites, and IVD. 16S rRNA gene sequencing was used to

detect the composition of gut bacteria, while liquid chromatography-mass spectrometry (LC-MS) was used to analyze metabolites in feces and intervertebral discs. **Results:** Twenty-five cohort studies met the selection criteria. Overall pooled prevalence of microbial colonisation in 2419 patients with LBP was 33.2% (23.6%-43.6). The pooled prevalence of microbial colonisation in 2901 samples was 29.6% (21.0%-38.9%). Compared with the patients without endplate change, the patients with endplate changes had higher rates of microbial colonisation of disc (OR = 2.83; 95% CI = 1.93-4.14; I2 = 37.6%; p = 0.108). The primary pathogen was Cutibacterium acnes which was present in 22.2% of cases (95% CI = 13.3%-32.5%; I2 = 96.6%; p = 0.000). 16S rRNA gene sequencing analysis revealed significant changes in the alpha and beta diversity of gut microbiota in patients with endplate alterations. Endplate degeneration group (Modic II type) is enriched with tumor bacteria. Metabolomics analysis revealed significant changes in tissue metabolites such as branched chain amino acid (BCAA) levels and their corresponding signaling pathways. **Conclusion:** This study found low-quality grade evidence for an association between microbial colonisation of disc with endplate changes. The primary pathogen was Cutibacterium acnes. Due to lack of enough high-quality studies and methodological limitations of this review, further studies are required to improve our understanding of the potential relationships and mechanisms of microbiota and IVD structural failure.

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P0327: Physician-artificial intelligence comparison in the radiological interpretation of spondylolisthesis: a retrospective single center study

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Introduction: Spondylolisthesis is a common clinical condition in orthopedic practice that can be difficult to diagnose. Artificial intelligence is expected to assist in the diagnosis and treatment process. The evaluation of X-rays by orthopedic specialists and artificial intelligence, and the integration of artificial intelligence into the diagnosis and treatment process in clinical practice are planned. **Material and Methods:** 1,000 X-rays were reviewed by 2 orthopedic residents and 2 orthopedic specialists (with junior and senior members in each group) and their performance was compared with artificial intelligence. **Results:** Artificial intelligence diagnosed with a reliability rate close to that of senior orthopedic specialists. In future processes, it is planned to make greater use of artificial intelligence in diagnosis and treatment. **Conclusion:** Results related to artificial intelligence hold promise for assisting physicians in clinical practice in the long term.

ID: AGS26/683
P0328: Association between MRI changes of degenerative lumbar spine and Oswestry Disability Index in patients with chronic low back pain: a cross-sectional study

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Introduction: Degenerative changes in the lumbar spine, such as disc degeneration, facet joint osteoarthritis, and spinal stenosis, are commonly observed on magnetic resonance imaging (MRI) in patients with chronic low back pain (CLBP). While some studies suggest a link between MRI-detected degenerative changes and higher Oswestry Disability Index (ODI) scores and Numerical Pain Rating Scale (NPRS), others report weak or inconsistent associations. Understanding this relationship is crucial for clinical decision-making in patients with CLBP. This cross-sectional observational study aims to evaluate the correlation between MRI-identified degenerative changes of the lumbar spine, e.g., lumbar disc degeneration (LDD), lumbar disc herniation (LDH), facet joint arthritis (FJA), and Schmorl's nodes, and ODI in patients with CLBP. **Material and Methods:** This cross-sectional study included 100 participants (mean age: 39.9 ± 10.82, Male: Female = 51:49) with chronic low back pain and had MRI analysis of 300 discs at the level of L3/L4, L4/L5, and L5/S1. These patients completed questionnaires for the Oswestry Disability Index and the Numerical Pain Rating Scale to assess back pain. The ODI was categorized into two groups for logistic regression analysis to identify predictors among demographic features and MRI findings of degenerative changes for disability. **Results:** The most common finding was disc herniation (63%), followed by disc degeneration (Pfirmann's grade $\geq$ 3) (47.67%), foraminal stenosis (36%), facet joint arthritis (32%), lumbar canal stenosis (19.67%), and Schmorl's nodes (10.33%). Facet joint arthritis at L5/S1 significantly correlated with ODI ($\rho = 0.355$, $p < 0.001$), as did the Schmorl's nodes ($\rho = 0.297$, $p = 0.003$). Severity of disc herniation at the L5/S1 level correlated with both higher NPRS scores ($R = 0.260$, $p = 0.009$) and higher ODI scores ($R = 0.211$, $p = 0.035$). In contrast, no significant correlation was between MRI degenerative findings at L3/L4 and L4/L5 levels with respect to ODI scores and NPRS scores. Logistic regression analysis showed age (p = 0.02, OR:0.94, CI: 0.89-0.99), female gender, (p = 0.001, OR:6.09, CI: 2.06-17.94) presence of Schmorl's nodes in L5/S1 (p = 0.03, OR: 9.60, CI: 1.28-71.54), and L5/S1 facet joint arthritis

(p = 0.001, OR:3.38, CI: 1.6-7.15) significantly predicted the ODI. **Conclusion:** Facet joint arthritis, severity of disc herniation and Schmorl's nodes at L5/S1 significantly correlated with ODI. Severity of disc herniation at the L5/S1 also correlated with NPRS. Though disc herniation and disc degeneration are the most frequently observed MRI findings in patients with CLBP, they do not correlate with ODI. Age, female gender, the presence of Schmorl's nodes at L5/S1, and L5/S1 facet joint arthritis are the significant predictors of disability due to CLBP.

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P0329: Interspinous process device as a screwless fusion technique for lumbar spondylolisthesis

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Introduction: Interspinous process devices (IPD) have been developed as an alternative to pedicle screw constructs for lumbar stabilization. By anchoring between spinous processes, they provide segmental rigidity while preserving the facet joints, thereby potentially lowering the incidence of adjacent segment disease. When combined with posterior lumbar interbody fusion (PLIF) or transforaminal lumbar interbody fusion (TLIF), or used as supplemental fixation after anterior or lateral interbody fusion, IPDs offer a less invasive option for selected patients. **Material and Methods:** We retrospectively analyzed 50 patients with degenerative lumbar pathology who underwent PLIF or TLIF procedures with adjunctive IPD implantation. Postoperative fusion status, clinical improvement, and perioperative parameters were evaluated. Radiographic evidence of fusion was confirmed in 47 patients, corresponding to a 94% success rate, which parallels outcomes commonly reported with pedicle screw fixation. **Results:** Implantation of IPDs achieved stable fixation and facilitated solid arthrodesis. Patient-reported outcome measures demonstrated meaningful improvement, although restoration of lateral bending was limited. The technique was associated with shorter operative time, reduced intraoperative blood loss, and decreased fluoroscopic exposure compared with conventional pedicle screw instrumentation. **Conclusion:** IPD-assisted lumbar fusion appears to be a reliable alternative to screw-based fixation in well-selected cases. The procedure is technically straightforward, requires a relatively short learning curve, and reduces surgical invasiveness without compromising fusion rates. Optimal results depend on proper device placement and sufficient bone quality. In one- to two-level fusions, particularly when combined with anterior column support, IPDs can achieve outcomes comparable to traditional pedicle screw systems.

ID: AGS26/694
P0330: Influence on physical activities of short segmental lumbar surgery

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Introduction: Lumbar short-interbody fusion surgery is reported to improve quality of life (QOL) without causing limitations in activities of daily living (ADL). However, few reports exist on postoperative return to physical activities, including sports. Furthermore, comparisons between pre- and postoperative states, as well as between fusion and decompression procedures, are lacking. We compared exercise habits and QOL before and after lumbar short-interbody fusion and decompression surgery. **Material and Methods:** Self-administered questionnaires were completed postoperatively for degenerative disease after lumbar short-level (1-2 levels) surgery. The study included 103 responding patients (54 in the fusion group, 49 in the decompression group). For exercise habits, physical activity intensity was classified into three levels using METs (light: 0-2.9, moderate: 3.0-5.9, vigorous: 6.0 or higher). The maximum activity intensity performed during the year before surgery and the year after surgery was investigated. Additionally, RDQ and SF-36 summary scores (PCS, MCS, RCS) were assessed preoperatively and one year postoperatively. Statistical analysis was performed, with $p < 0.05$ considered significant. **Results:** No significant differences were observed between groups for age, gender, or number of operated intervertebral levels. Preoperative scores for all evaluation items also showed no significant differences between groups. Exercise habits showed a slight tendency toward decrease compared to preoperative levels, but no significant difference was found (Fusion: light 35%→32%, moderate 52%→59%, vigorous 13%→9%; Decompression: light 39%→43%, moderate 37%→39%, vigorous 24%→18%). Cases showing an increase in METs postoperatively were also observed in both groups. Weight training, Judo, and other activities clearly placing high loads on the spine were not performed postoperatively. QOL showed significant improvement in both groups for RDQ (Fusion: 10.8→6.8, Decompression: 11.0→6.8), PCS (Fusion: 26→34, Decompression: 26→32), and MCS (Fusion: 51→54, Decompression: 47→54). RCS improved significantly only in the decompression group (35→41). No significant differences were observed between groups postoperatively. **Conclusion:** Lumbar short-interbody fusion surgery improved QOL without changing exercise habits. Patients in the fusion group also performed exercise equivalent to the decompression group postoperatively, indicating no physical activity restrictions due to fusion. However, since some sports may become impossible postoperatively, suggesting modifications to exercise content can

provide useful information for maintaining motor function and improving QOL.

ID: AGS26/709
P0331: Dynamic screw-based instrumentation with non-parallel screws trajectory angulation

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Introduction: The Dynamic screws fixation system (COSMIC, Ulrich medical, Ulm Germany) allows for 8 degrees flexion-extension only. Initial recommendation for screws insertion was to insert the screws always parallel. However, parallel insertion is often not feasible due to anatomical and technical limits. We aim in this study to check the outcome of doing the COSMIC dynamic fixation with non-parallel screw trajectory. **Material and Methods:** A Prospective observational study of patients undergoing one segment dynamic screw fixation between July 2024 to August 2025 was performed. We measured by computerized tomography the angle between the right and left screws in each instrumented vertebra. The Inter-Screws Angle Difference (ISAD) was defined as the absolute difference in this angle between the upper instrumented vertebra and the lower instrumented vertebra. ISAD value of zero indicates parallel screws placement, and the higher the value the less parallel the screws are. We recorded the complications, the postoperative course, and the time to ambulation. **Results:** 23 Patients were analyzed. Patients were 9 males and 14 females, age 25-87 years (average 64.9 years). All patients had degenerative lumbar diseases with symptoms including radiculopathy, claudication, or axial pain. Operated Level L3-L4 (1 patient), L4-L5 (17 patients), L5-S1 (5 patients). Spondylolisthesis preoperatively ranged from 2.4 mm retrolisthesis to 9.8 mm anterolisthesis with an average of 4.5 mm. All patients except 4 underwent some sort of decompression ranging from foraminotomy to full laminectomy. 17 patients had open surgery, and 6 patients had minimally invasive techniques. ISAD values ranged from (0.6 degrees) to (24.4 degrees) with an average of (7.2 degrees) and standard deviation of (5.6 degrees). Time to ambulation ranged from 1 day to 5 days with an average of 1.7 days. Complications: 1 screw misplacement, 2 unintentional durotomies, 1 postoperative hemorrhage, 1 wound leak, 2 needed reoperation for further decompression, 1 wound healing issue. Apart from the one screw misplacement, presumably none of the mentioned complication may be related to the angle of screw placement. The correlation coefficient between the ISAD and the time to ambulation was 0.370 ± 0.397 with a P-value 0.083, which implies insignificance. **Conclusion:** Insertion of dynamic screws non-parallel with various angles is practical with no recorded adverse results at short term follow up. This makes the screws insertion more considering for the anatomy and presumably reduces the complications related to screw insertion as trying to force the screw trajectory to be parallel against the anatomical consideration presumably leads to more pedicular breach. Further study is needed for the long-term results of those patients after adequate follow-up time elapses.

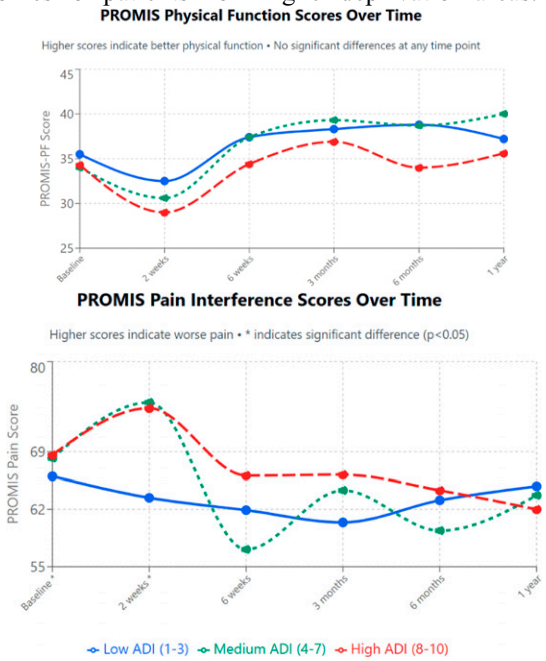
ID: AGS26/745
P0332: Lower social economic status impacts early recovery but not long-term outcomes after sacroilliac joint fusion

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Introduction: Sacroiliac joint (SI-J) fusion procedures continue to increase as diagnostic and treatment approaches gain broader acceptance. While socioeconomic disparities are known to influence surgical outcomes across spine procedures, their impact on SI-J fusion recovery remains poorly characterized. The Area Deprivation Index (ADI), a validated composite measure of neighborhood socioeconomic disadvantage, provides a quantifiable approach to investigating this relationship. We examined how socioeconomic status affects recovery trajectories following SI-J fusion, focusing on patient-reported outcomes and satisfaction rates. **Material and Methods:** A retrospective review identified 135 isolated SI-J fusions performed at a single tertiary center between 2016 and 2024. Exclusion criteria included fusions done as part of complex lumbosacral surgeries, trauma and insufficiency. State-decile ADI scores classified patients into low (1-3), medium (4-7), or high (8-10) deprivation cohorts. PROMIS-Physical Function (PROMIS-PF) and PROMIS-Pain Interference, were collected pre-operatively and at 2 weeks, 6 weeks, 3 months, 6 months, 12 months, and 24 months when available. Binary satisfaction data was collected at 1 year follow-up. Two-year outcomes were limited due to the conclusion of care for most patients by one year. Normally distributed variables were compared with t-tests or one-way ANOVA; non-normal data with Mann-Whitney U or Kruskal-Wallis tests; categorical data with χ^2 or Fisher's exact tests ($\alpha = 0.05$). Caaes were excluded on a pair-wise basis. **Results:** A total of 135 isolated SI-joint fusions were analysed (low-ADI = 50, medium = 64, high = 21). High-ADI patients were younger than both medium- and low-

ADI cohorts (45.8 ± 12.8 yr vs 54.9 ± 12.7 yr and 61.0 ± 11.6 yr, respectively; $p < 0.001$) and were more frequently female (86 % vs 56 % vs 38 %; $p = 0.001$). Body-mass index, smoking status, osteoporosis/osteopenia, and other baseline comorbidities were comparable across groups; diabetes differed only modestly (0 % high vs 23 % medium vs 16 % low; $p = 0.045$). Baseline PROMIS-Pain was higher in the medium/high strata than in the low-ADI group (median 68-70 vs 67; $p = 0.042$), while pre-operative PROMIS-PF was similar ($p = 0.436$). At 2 weeks, pain remained greater in medium/high ADI patients (median 75) than in low ADI (64; $p = 0.030$); PROMIS-PF did not differ ($p = 0.505$). By 6 weeks-and at 3 months, 6 months, 1 year, and 2 years-no statistically significant differences were detected in pain or function (all $p \geq 0.07$).Satisfaction at last follow-up was 77.6 % in low-ADI, 85.9 % in medium-ADI, and 61.9---% in high-ADI patients, demonstrating a non-significant trend toward lower satisfaction with greater deprivation ($p = 0.060$). Post-operative complication rates (15 %) and subsequent lumbosacral surgery rates (30 %) were not associated with ADI stratum ($p > 0.1$ for both). **Conclusion:** Patients from areas of higher socioeconomic deprivation are younger and worse off at time of surgery and show poorer early postoperative outcomes following SI-J fusion, as reflected in higher pain levels. However, these disparities dissipate by as early as 3 months out, with long-term outcomes, complications and satisfaction rates remaining comparable across socioeconomic strata. Notably, a nonsignificant trend toward lower satisfaction persists in the most deprived cohort. These findings support offering SI-J fusion surgery regardless of socioeconomic status, while emphasizing the potential benefit of tailored early postoperative support and careful monitoring of long term outcomes for patients from higher deprivation areas.



ID: AGS26/752

P0333: Misdiagnosis between coccygeal dislocation fracture and lumbosacral disc herniation

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Introduction: Coccydynia, first described by Simpson in 1859, is incapacitating pain in the coccyx that is usually caused by sitting or moving from a sitting to a standing position. This pain in the coccyx can radiate to the sacrum or lumbar spine or laterally to the buttocks. In rare cases, patients may experience rectal pain or associated radicular symptoms. One-third of patients have associated back pain, which contributes to misdiagnosis. Due to a lack of awareness of this condition among spine specialists, many patients may suffer for years without adequate treatment. Diagnosis is based on history and physical examination, supplemented by radiological imaging findings. Coccydynia is a common cause of pain that is often misdiagnosed. Coccydynia is usually caused by a coccygeal fracture-dislocation and causes symptoms that resemble lumbosacral pathology. Many patients undergo surgery for lumbosacral pathology without improvement. Diagnosis is straightforward, as all patients experience pain on digital palpation of the coccyx, ideally with the index finger, and most show coccyx instability on dynamic X-rays. Surgery is simple, and all patients experience pain relief. The aim of this study is to show how poor examination and overestimation of lumbosacral data can confuse a coccyx disease, as well as to identify patients diagnosed with lumbosacral pathology who will improve with coccyx surgery. **Material and Methods:** Forty patients, 36 women and 4 men, with an average age of 41.75 years, underwent coccygectomy. All patients suffered from coccydynia diagnosed by coccygeal palpation and dynamic radiographs: the patient standing and a lateral radiograph taken, then the patient sitting with the back in moderate extension. The duration of symptoms and signs ranged from 0.5 to 96 months, with a mean of 24.3. The causes were idiopathic in 21 patients, postpartum in 6, and trauma in 13. All patients presented with coccydynia, 30 reported lumbar pain radiating to the pelvic limbs, 13 were diagnosed with lumbar pathology, 10 patients had undergone spinal surgery without improvement, and in 6 we performed coccygectomy and spinal surgery in a single procedure. **Results:** The results 15 days after surgery on the VAS scale showed a significant change from a preoperative score of 9.63 to 1.6, with a $p < 0.001$. Likewise, 4 months later there was an additional improvement on the VAS scale from 1.6 to 0.50. On the MACNAB scale, the results were excellent in 35 patients, good in 3, fair in 1, and poor in 1. There were reports of

infection, which improved completely with antibiotics and daily wound cleaning in 3 patients; 9 had superficial and partial wound dehiscence. **Conclusion:** This study presents 40 cases, of which 32.5% were confused with lumbosacral pathology, and of these, 25% underwent lumbosacral spine surgery despite having coccygeal pathology. It has been forgotten that a coccyx disease can produce symptoms of low back pain or lumbar sciatica. To improve this confusion, two components can make a difference: a) Clinical examination, finding, above all, pain caused by digital palpation of the coccyx, as a pathognomonic sign of the disease, in our opinion. b) Dynamic X-rays of the coccyx: lateral standing and lateral sitting. The data from this study show a statistically significant reduction ($p < 0.001$) in pain reduction on the VAS scale (Delta -8.03). Coccygeal fracture-dislocation is a cause of pain that is confused with lumbosacral pathology and is rarely diagnosed if there is no history of direct trauma to the coccyx. Many patients undergo lumbosacral spine surgery, most for herniated discs or some for spondylolisthesis, even on several occasions, and obviously do not improve because the pathology is coccygeal. Therefore, as this study shows, in cases of low back pain or lumbar sciatica, it is advisable to examine the coccyx, both clinically, by provoking pain on coccygeal palpation, and by dynamic X-rays, since in most cases these show instability of the coccyx. Surgery significantly improves patients' condition, as shown by the MACNAB scale and 8 to 9 points on the visual analog scale (VAS). Although it is a small sample of patients, this study seeks to emphasize the clinical importance of making a differential diagnosis in lumbosacral pathology and coccygeal pathology. Other authors have reported coccyx surgeries, especially in traumatic pathology or coccygectomies in pelvic tumors, sacrum, or metastases. Others have reported coccyx surgery to prevent or improve bedsores, but there are few studies that make a differential diagnosis between spinal pathology and coccygeal pathology. The authors of this study suggest examining the coccyx in all patients with lumbosacral pathology.

ID: AGS26/790
P0334: Lumbar disc arthroplasty versus anterior lumbar interbody fusion: a propensity-matched cohort analysis

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Introduction: There is a paucity of long-term data investigating the purported benefits of lumbar disc arthroplasty (LDA). This study aims to compare the short- and long-term complication profiles following LDA and anterior lumbar interbody fusion (ALIF). **Materials and Methods:** A propensity-matched retrospective cohort study was conducted on a multi-institutional electronic health record database for patients undergoing single-level LDA or ALIF. Exclusion criteria included prior lumbar surgery, <18 years old, and a history of spine neoplasms, trauma, inflammatory, or infectious bone conditions. Patients at a mean age of 41 years (n = 1,156) were evenly divided into the LDA and ALIF cohorts (n = 578). Comparisons were made with independent sample t-tests. **Results:** At thirty days, there were similar rates of medical complications between patients undergoing single-level LDA and ALIF. Patients undergoing ALIF had higher odds of emergency room admissions at thirty days compared to LDA (OR: 2.6, 95% CI: 1.3-4.9, $p = 0.004$). At five-years, patients undergoing single-level ALIF demonstrated a higher risk of pseudoarthrosis (OR: 3.3, 95% CI: 2.3-4.9; $p < 0.001$) and subsequent lumbar spine fusion surgery (OR: 3.1, 95% CI: 1.7-5.6; $p < 0.001$) than patients undergoing single-level LDA. There were similar rates of adjacent segment disease at five-years between the two cohorts (OR: 1.4, 95% CI: 1.0-2.0; $p = 0.088$). **Conclusion:** LDA was associated with lower rates of pseudoarthrosis and subsequent rates of reoperation at five years when compared to ALIF. Future prospective studies are warranted to confirm these associations.

ID: AGS26/813
P0335: Therapeutic effect of Biocage on single-level lumbar degenerative diseases in non-fusion high-risk patients - A prospective controlled study based on at least two years of follow-up

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Introduction: To evaluate the clinical application of biocage in single lumbar degenerative diseases and to observe the value of biocage in lumbar fusion. **Material and Methods:** A prospective, non-randomized controlled study was conducted in 183 patients with single-segment degenerative lumbar spine disease diagnosed before operation from January 2013 to December 2016. They were divided into Bio according to the choice of fusion cage according to the high risk factors of non-fusion (osteoporosis, age > 65 years old, smoking > 20 branches per day and > 5 years, diabetes mellitus). The cage group (102 cases) and Peek group (81 cases) were followed up for 24-48 months, with an average of 36 months. The operation time, intraoperative bleeding volume, hospitalization time, intervertebral space height, intervertebral foramen area, fusion time, fusion rate, failure rate of internal fixation, VAS score and ODI index were compared between two different fusion cages. **Results:** All 183 patients successfully completed the operation. There were no significant differences in gender, age, clinical diagnosis, lesion segment, operation time, bleeding volume, VAS score and ODI index between the two groups. Although there was no significant difference in fusion rate and fusion time, the fusion rate of Biocage group was higher than that of PPEK group at the same time point, and the fusion time was shorter. During follow-up,

the height of intervertebral space in Biocage group recovered significantly compared with that in PPEK group ($p < 0.05$), and the height and width of intervertebral foramen recovered significantly different between the two groups. The recovery effect of Biocage group was better than that of PPEK group. **Conclusion:** Biocage has good clinical efficacy and safety in patients with non-fusion, high-risk, single-level lumbar degenerative diseases. However, for patients with high risk factors such as osteoporosis, there is still a risk of non-fusion, and further research is needed to analyze the impact of different factors on bone fusion.

ID: AGS26/848
P0336: Predicting clinically important difference in lumbar decompression surgery: the influence of demographic, clinical and radiographic characteristics

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Introduction: Lumbar decompression is a common intervention for spinal stenosis and disc herniation, yet many patients fail to achieve a Minimal Clinically Important Difference (MCID) in disability. Identifying predictors of MCID may optimize patient selection and improve surgical outcomes. The purpose of this study is to identify demographic, clinical, and radiographic predictors of MCID achievement one year after lumbar decompression, and to develop a preoperative risk stratification tool. **Material and Methods:** This was a Prospective cohort study using a single-center spine registry. 190 patients undergoing 1-4 level lumbar decompression (laminectomy, microdiscectomy, or laminotomy) from 2020-2023. Outcome Measures were Oswestry Disability Index (ODI) improvement meeting MCID, defined as ≥ 12.8-point improvement or ≥ 50% improvement if baseline ODI ≤ 26, per validated thresholds. Patients were grouped by MCID status (MCID+ vs. MCID-). Comparative statistics, ROC analysis, and stepwise logistic regression were used to identify independent preoperative predictors. **Results:** Mean age was 60.2 years; 64% were male. At one year, mean ODI improved from 41.9 to 16.3 ($p < 0.001$). Predictors of successful outcomes (MCID+) included: Demographic (age < 62.2yrs, CCI < 1.5, Clinical (symptom duration < 6 months, ODI > 41%) and Radiographic (segmental lordosis > 14°, pelvic tilt < 20.9°, pelvic incidence < 54°). Symptom duration < 6 months was the strongest individual predictor of meeting MCID+. A 3-point risk score was developed using the three strongest independent predictors: symptom duration < 6 months, ODI > 41, and pelvic tilt < 20.9°. MCID achievement ranged from 33% (0 predictors) to 92% (3 predictors). **Conclusion:** Shorter symptom duration, greater baseline disability, and favorable pelvic alignment were independently associated with MCID achievement. The derived 3-point risk score is a practical tool for individualized preoperative counseling and surgical planning.

ID: AGS26/857
P0337: Multimodal intervention targeting sarcopenia-osteoporosis complex improves functional outcomes and reduces complications in elderly patients undergoing spinal surgery: a prospective propensity-matched cohort study

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Introduction: The coexistence of sarcopenia and osteoporosis in elderly patients undergoing spinal surgery is associated with increased postoperative disability and complications. However, evidence-based, resource-efficient perioperative management strategies remain scarce, particularly in resource-limited settings. To evaluate the efficacy of a multimodal intervention (nutrition, exercise, and pharmacotherapy) targeting the muscle-bone axis in improving functional recovery and reducing complications in sarcopenic-osteoporotic patients undergoing spinal surgery. **Material and Methods:** A prospective propensity-matched cohort study was conducted from January 2023 to December 2024. A total of 160 patients aged ≥50 years with sarcopenia (EWGSOP2 criteria) and osteoporosis (T-score ≤ -2.5) undergoing lumbar/thoracic surgery (TLIF/PLIF/vertebroplasty) were enrolled. After propensity score matching (1:1 for age, sex, diabetes, fracture type), 80 patients were allocated to the intervention group and 80 to the control group. • **Intervention group:** Received whey protein (30 g/day), vitamin D_3 (2000 IU/day), calcium (1200 mg/day), structured elastic band resistance training (pre- and postoperatively), and denosumab or zoledronic acid. • **Control group:** Received routine care with calcium supplementation as needed. Primary outcomes included ODI success (≥ 30% improvement at 12 months) and fusion success (Bridwell grade I-II on CT). Secondary outcomes included VAS pain scores, instrumentation failure, and serum biomarkers (IL-6, IGF-1, CTX, PINP). **Results:** All 160 patients completed the 12-month follow-up. The intervention group showed significantly better outcomes: • **ODI success:** 58% (46/80) vs. 28% (22/80) in controls (aOR = 2.8, 95% CI: 1.5-5.3, p = 0.002). • **Fusion success:** 83% (66/80) vs. 65% (52/80) in controls (absolute increase 18%, NNT = 5.6, p = 0.01). • **Complications:** 7.5% (6/80) vs. 15.6% (12/80) in controls (HR = 0.48, 95% CI: 0.25-0.91, p = 0.02). • **Biomarkers:** Reduction in IL-6 correlated with ODI improvement ($r = -0.41$, $p < 0.001$). No serious adverse events related to the intervention were observed. **Conclusions:** A low-cost, multimodal intervention targeting sarcopenia and osteoporosis significantly improves functional recovery, fusion rates, and

reduces complications in elderly spinal surgery patients. This protocol offers a scalable and practical model for resource-limited healthcare settings.

Keywords: Sarcopenia; Osteoporosis; Spinal Surgery; Multimodal Intervention; Functional Outcomes; Propensity-Matched Cohort

ID: AGS26/864
P0338: Modified MIS-TLIF technique in primary hospitals: clinical efficacy and cost-effectiveness analysis - A prospective cohort study

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) offers advantages such as reduced tissue injury and faster recovery in the treatment of lumbar degenerative diseases. However, its application in resource-limited primary hospitals remains challenging due to high equipment costs and a steep learning curve. This study introduces a modified MIS-TLIF technique using conventional instruments combined with a low-cost access system and evaluates its clinical value in a county-level hospital setting. To evaluate the clinical efficacy, safety, and cost-effectiveness of the modified MIS-TLIF technique for single-level lumbar degenerative disease. **Material and Methods:** A prospective cohort study was conducted from January 2023 to December 2024, including 60 patients with single-level lumbar degenerative disease. Participants were divided into a modified MIS-TLIF group (n = 30) and an open TLIF group (n = 30). The modified technique featured: (1) conventional instruments with a low-cost tubular access system, (2) unilateral biportal endoscopy-assisted decompression, and (3) a simplified bone grafting protocol. Perioperative indicators, VAS, ODI, and JOA scores were recorded. Fusion was assessed using Brantigan criteria, and cost-effectiveness analysis was performed. **Results:** The modified group had longer operative time (142.3 ± 15.6 min vs. 118.7 ± 12.4 min, $p < 0.05$) but significantly less blood loss (145.6 ± 18.3 ml vs. 325.4 ± 26.8 ml, $p < 0.01$). Drain removal time (2.1 ± 0.6 days vs. 4.3 ± 0.9 days) and hospital stay (5.8 ± 1.2 days vs. 9.6 ± 2.1 days) were significantly shorter in the modified group ($p < 0.01$). At 12 months, ODI scores were superior in the modified group (18.3 ± 4.2 vs. 23.7 ± 5.1, $p < 0.05$), while VAS scores showed no significant difference. Fusion rates (93.3% vs. 90.0%) and complication rates (6.7% vs. 10.0%) were comparable. The modified technique also demonstrated lower direct surgical costs ($5,243 ± $423 vs. $6,385 ± $587, $p < 0.05$) and a better cost-effectiveness ratio (373.9 vs. 433.3). **Conclusion:** The modified MIS-TLIF technique is a safe, effective, and cost-efficient surgical option for single-level lumbar degenerative disease in resource-limited settings. Despite longer operative times, it offers advantages such as reduced blood loss, faster recovery, and shorter hospital stays, making it a feasible minimally invasive alternative in primary hospitals.

Keywords: minimally invasive TLIF, lumbar degenerative disease, county hospital, cost-effectiveness

ID: AGS26/885
P0339: Multilevel lumbar spine stenosis in patients with Parkinson's disease

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Introduction: Parkinson's disease belongs to the group of neurodegenerative diseases and has still unknown causes. Although PD its clinical manifestations are largely related to the musculoskeletal system. In addition to poor bone quality and an increased risk of fractures, muscle dysfunction is another important clinical manifestation. Scoliosis, thoracic kyphosis, and other deformities are more common in patients with PD. Severe and involuntary forward flexion of the thoracolumbar spine is a disabling process in the course of PD. **Material and Methods:** Comparative prospective study was performed in 2013-2020 yy. in Priorov Central Institution. 36 patients with PD and lumbar spine stenosis were enrolled and divided in two groups according to type of surgery. The results of treatment of 36 patients with degenerative pathology of the lumbar spine and PD were analyzed. Spinal fusion and decompression surgery using transpedicular constructions was performed in 21 patients (group I), only decompression at the most significant level of stenosis was performed in 15 patients (group II)**.** Evaluation criteria preOP: mean duration of PD, age, gender, prePO visual analog pain scale (VAS) for low back pain, comorbidities. PostOP evaluated: VAS, the presence/absence of complications, and X-ray control. **Results:** Clinical results were satisfactory in 2 patients in group I, the remaining patients noted dissatisfaction with surgical treatment. The mean postoperative VAS at the time of the last follow-up was higher than the mean before surgery; painkillers were taken by all patients after surgery. The mean postoperative VAS was 6.4, while the mean preoperative VAS was 5.9. ($p = 0.19$). All patients in this group continued to take levodopa. During the first 12 months after the operation, 17 out of 21 patients underwent revision surgery due to instability of the structure (n = 7) or fractures of the hardware elements (n = 10). In 24 months after the surgery complete removal of the instrumentation was performed in 8 patients in this group. Group II patients in the early postoperative period showed greater satisfaction with the surgical intervention. Thus, 12 patients were fully satisfied, despite the fact that VAS before surgery and after surgery was equivalent to the indicators of group I: 6.1 before surgery and 5.8 after surgery. Revision interventions were not performed in this

group. **Conclusion:** The outcomes of surgical treatment of lumbar spine stenosis in patients with Parkinson's disease (PD) are controversial and might be improved by minimization of surgical activity. Given the progressive natural course of Parkinson's disease, a poor prognosis for surgical treatment is inevitable. The mainstay of treatment for patients with PD should be medical or surgical treatment of PD itself, thereby also improving the outcome of spinal surgery. Minimization of surgical activity for patients with PD is the only possible treatment option for degenerative spinal pathology with severe clinical manifestations.

ID: AGS26/904
P0340: Indirect decompression by lateral lumbar interbody fusion (LLIF): the impact of facet joint fluid

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Introduction: Lumbar spinal canal stenosis (LSCS) is a common degenerative condition, particularly in older adults, characterized by compression of neural and vascular elements and frequently leading to neurogenic claudication. Surgical treatment, such as lateral lumbar interbody fusion (LLIF), has shown efficacy in achieving indirect decompression by restoring disc height and tensioning the posterior ligamentous complex. However, precise predictors of indirect decompression success remain elusive. A sparsely explored factor is T2 hyperintensity within the facet joints on magnetic resonance imaging (MRI), which may indicate segmental instability and greater potential for ligamentotaxis. This study investigates the correlation between facet joint fluid and the effectiveness of indirect decompression after LLIF. The study objective was to evaluate whether T2-weighted hyperintensity in lumbar facet joints on preoperative MRI can be considered an indicator of greater effectiveness of indirect decompression of the lumbar canal in patients undergoing LLIF. **Material and Methods:** We conducted a single-center, retrospective, comparative, nonrandomized study including 42 patients (mean age 52 years, 56% female) who underwent LLIF for lumbar stenosis between 2011 and 2024, totaling 38 operated levels (five patients had two levels treated, and one patient had two staged procedures). Inclusion criteria required preoperative MRI within six months and postoperative MRI between nine and twelve months, acquired on 1.5T or 3T scanners. Axial T2-weighted images were assessed for canal dimensions using a modified Schizas grading (A-D). The spinal canal area (CV) and vertebral body area (VB) were measured in arbitrary units in RadiAnt DICOM Viewer with a correction factor for standardization. Statistical analyses were performed in R (v4.2). Canal decompression across groups-fluid in both facets, in one facet, or absent-was compared with Welch's t test with bootstrap. Changes in Schizas grades were evaluated with Fisher's test. A generalized linear mixed-effects regression was used to explore the relationship between facet fluid and canal decompression. **Results:** Across 38 levels, the postoperative CV/VB ratio increased significantly ($p < 0.001$) compared with preoperative values: postoperative median 0.111 (IQR 0.084-0.157), mean 0.126 (SD 0.060); preoperative median 0.067 (IQR 0.037-0.095), mean 0.070 (SD 0.044). This represents an average increase of approximately 5% and a median increase of 4% in canal size. Operated levels were L2-L3 (18.4%), L3-L4 (34.2%), and L4-L5 (47.3%). Facet fluid was bilateral in 28.9%, unilateral in 23.6%, and absent in 47.3%. Improvement in Schizas grade from pre to postoperative was observed more frequently in cases with bilateral facet hyperintensity than with unilateral or absent hyperintensity. Nonetheless, multivariable linear regression did not show a significant impact of facet fluid on the delta change in canal decompression ($p = 0.7$ for two facets, $p = 0.4$ for no fluid, $p = 0.3$ for one facet). **Conclusion:** Bilateral T2 hyperintensity may serve as a clinical marker of greater effectiveness of LLIF-mediated indirect decompression of the lumbar canal, potentially refining patient selection and optimizing surgical outcomes. Limitations include the single-center design, modest sample size, and MRI quality variability, supporting the need for multicenter, standardized future studies.

ID: AGS26/924
P0341: Prognostic modeling of the long-term clinical outcome of minimally invasive lumbar interbody fusion based on complex clinical, radiological and neuroimaging analysis in railway workers

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Introduction: The incidence of unsatisfactory surgical outcomes in degenerative lumbosacral spine diseases varies depending on the surgical technique used and is difficult to predict

due to heterogeneity of clinical and instrumental characteristics of patient groups. Development and use of predictive models of clinical outcomes can assist the surgeon in decision making and improve surgical outcomes. The aim of the study was to develop and test the effectiveness of a multivariate prognostic model for assessing the risks and benefits of minimally invasive decompressive and stabilizing interventions in the treatment of railway workers with degenerative diseases of the lumbar spine. **Material and Methods:** A retrospective analysis of a prospectively collected database of 457 patients operated on between 2020 and 2023 using minimally invasive decompression and stabilization techniques was performed. Comprehensive clinical, radiological and neuroimaging assessments were performed before surgery and 24 months after the intervention. Regression analysis was used to create prognostic models of long-term clinical outcomes (y0 - ODI; y1 - SF-36 PCS (physical component score); y2 - SF-36 MCS (mental component score); y3 - Macnab scale). **Results:** All analyzed clinical parameters (ODI, VAS, SF-36) significantly improved after surgery compared to preoperative values ($p < 0.05$). Within 90 days after surgery, the reoperation rate was 5.7%, and the number of readmissions during the observation period was 8.3%. 87.3% of railway workers returned to their previous work activities. Clinical deterioration was observed in 51 patients (11.2%). It was found that preoperative variables allow predicting long-term clinical outcome, playing a different role and dominance depending on the developed prognostic model. **Conclusion:** The study confirmed acceptable errors in the approximation of regression models for y1 (SF-36 PCS), y2 (SF-36 MCS) and y3 (Macnab) - 13.9%, 15% and 17.3%, respectively, which confirms the possibility of their clinical use. The y0 (ODI) model has significantly lower predictive capabilities of 39.2%, but it can be effectively used as an additional tool for identifying factors influencing the output variable and quantitatively assessing the degree of this influence. Overall success in the study population, defined as postoperative back pain and lower extremity pain VAS less than 20 mm, ODI less than 20 points, and freedom from reoperation or readmissions, was 88.8%.

ID: AGS26/931

P0342: Comparative analysis of the effectiveness and safety of anesthetic care during neurosurgical interventions on the lumbar spine in patients with high-risk factors

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Introduction: Provision of anesthetic care during neurosurgical treatment of patients with degenerative diseases of the lumbar spine, having high-risk factors for anesthesia and surgery, is associated with an increase in the number of perioperative complications, an extension of the duration of inpatient treatment and an increase in financial costs. The aim of the study is to conduct a comparative analysis of the effectiveness and safety of providing anesthetic care during neurosurgical interventions on the lumbar spine in patients with high-risk factors. **Material and Methods:** The prospective comparative study included patients who had a high risk of anesthesia and surgery. All patients underwent open posterior decompressive and stabilizing interventions in the period from 2021 to 2023. Depending on the type of anesthesia and the method of postoperative analgesia, 3 groups of patients were identified: in group 1 (n = 41), intravenous anesthesia based on propofol and fentanyl was used; in group II (n = 40), prolonged epidural analgesia with ropivacaine was additionally performed for 3 days after surgery; In group III (n = 43), multimodal analgesia was combined with preoperative intramuscular administration of ketoprofen, infiltration of the paraspinal muscles, subcutaneous fat and skin with ropivacaine before performing the approach, intraoperative dexmedetomidine, and postoperative paracetamol. Comparative analysis included an assessment of perioperative hemodynamic parameters, postoperative pain intensity, perioperative use of opioids, the dynamics of recovery of psychomotor functions, side effects of anesthesia and postoperative surgical complications. **Results:** Compared with patients in groups I and II, in group III there were no significant changes in hemodynamics, better results were obtained in the rate of recovery of psychomotor functions and a smaller amount of opioid drugs was noted. In groups II and III, a minimal level of postoperative local pain syndrome and a lower need for analgesics were recorded. The number of side effects of anesthesia in group I was 29.3%, in group II - 27.5%, in group III - 9.3% ($p = 0.01$). The number of postoperative surgical complications was comparable: in group I - 7.3%, in group II - 7.5%, in group III - 4.7% ($p = 0.56$). **Conclusion:** The use of complex perioperative analgesia, compared with traditional anesthesia, including prolonged epidural analgesia, has the advantages of no depression of perioperative hemodynamic parameters, fewer side effects of anesthesia and postoperative surgical complications.

ID: AGS26/950

P0343: Factors associated with immediate postoperative pain control after elective lumbar fusion surgery

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Introduction: Postoperative pain management is a pivotal component of recovery after elective lumbar fusion surgery, with inadequately controlled pain contributing to patient dissatisfaction and suboptimal outcomes. Identifying preoperative factors associated with severe immediate postoperative pain may enable personalized care pathways and improve overall recovery. **Material and Methods:** This ambidirectional cohort study was conducted between 2022 and 2025, included patients undergoing elective lumbar spine fusion. Poorly controlled postoperative pain was defined as severe pain (VAS ≥ 4) within the immediate postoperative period. Exclusions were intrathecal or epidural analgesia, revision or trauma surgeries, concurrent thoracolumbar procedures, multiple same-day surgeries, tumors, infections, tandem stenosis, or refusal. Demographic, surgical, and perioperative data were collected. Univariable and multivariable logistic regression were performed on 25 candidate variables identified by systematic review and expert consensus. **Results:** A cohort of 124 elective lumbar spine surgery patients, 52% experienced poorly controlled pain in the immediate postoperative period. Univariable analyses ($p < 0.05$) revealed nine variables were significantly associated with this outcome, including principal pathology, any nicotine use, surgical approach, involvement of ≥ 3 motion segments, fusion level, decompression level, estimated blood loss, and operative time. Age, sex, BMI, preoperative medications, preoperative back pain, and history of epidural steroid injection were not significantly associated with immediate postoperative pain outcomes in the current study. **Conclusion:** Poor pain control after spinal fusion surgery is a common problem. In this study, nine factors were found to be linked with worse outcomes. These results highlight the importance of careful preoperative assessment and tailored pain management, especially for patients having posterior fusion with associated disc herniation, a history of smoking, or multilevel surgery, to improve recovery and lower the risk of complications.

Keywords: lumbar fusion surgery, post-operative pain, immediate post-operative, pain, fusion surgery, spine, fusion, elective surgery

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P0344: Investigating the relationship between glucagon-like peptide-1 receptor agonist use and incidence of vertebral fractures in female patients aged > 50 years with osteoporosis: a propensity-matched analysis

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Introduction: Vertebral fractures are relatively common in patients with osteoporosis and frequently result in substantial morbidity, such as persistent pain and functional deficit. Although primarily indicated for the management of Type 2 diabetes mellitus and obesity, glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have demonstrated positive effects on bone mineral density (BMD) in the lumbar spine. However, it remains unknown if this effect translates to positive clinical outcomes for patients with osteoporosis. The purpose of this study is to investigate the relationship between GLP-1 receptor agonist exposure and the incidence of vertebral fracture and surgical intervention for these injuries in patients with osteoporosis. **Material and Methods:** This study utilized the TriNetX database to identify female patients aged > 50 years diagnosed with osteoporosis without a current pathological fracture within the 10-year period ended January 1, 2025. The study group included patients with a history of GLP-1 RA use after osteoporosis diagnosis compared to a control group with no GLP-1 RA exposure. Cohorts were propensity-matched based on baseline demographic characteristics, BMI, HbA1c, eGFR, medical comorbidities, osteoporotic medication use, and serum calcium, phosphate, and Vitamin D levels. Outcomes assessed included lifetime incidence of vertebral collapse and kyphoplasty or vertebroplasty. **Results:** There were 56,142 matched pairs. The rate of vertebral fracture in the experimental group was approximately 1.9% compared with 4.3% in the control group (RR 0.434, 95% CI 0.404 - 0.467, $p < 0.001$). Additionally, GLP-1 RA exposure was associated with lower incidence of kyphoplasty or vertebroplasty (RR 0.453, 95% CI 0.381 -0.538, $p < 0.001$). **Conclusion:** Glucagon-like peptide-1 receptor agonist use is associated with lower incidence of vertebral fracture and osteoporotic fracture intervention in female patients aged 50+ with osteoporosis. These findings underscore the potential protective effects of GLP-1 receptor agonists in patients with poor bone quality.

ID: AGS26/1685
P0345: Is Anchored Stand-Alone ALIF Effective and Safe for the Treatment of Low-Grade L5-S1 Isthmic Spondylolisthesis? A Comparative Study With Posterior Lumbar Interbody Fusion

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Introduction: Optimal surgical treatment for low-grade L5-S1 isthmic spondylolisthesis (IS) is still subject of debate. While various surgical approaches exist, minimally invasive anchored stand-alone (SA) ALIF has emerged as a promising technique, offering distinct advantages in terms of biomechanical stability and potential for neural decompression. This study aimed to compare the efficacy, as well as the clinical and radiological outcomes of anchored SA-ALIF and posterior lumbar interbody fusion in the management of low-grade L5-S1 IS. **Material and Methods:** A total of 53 patients, 26 from the anterior group and 27 from the posterior group, met the inclusion criteria. Intraoperative blood loss, operative time, radiation exposure and postoperative length of hospitalization were retrospectively evaluated. Clinical outcomes were assessed using the ODI and VAS scales. Upright lumbosacral X-ray and lumbosacral CT scan were used to evaluate spinopelvic parameters and intersomatic fusion according to Brantigan-Steffee-Fraser (BSF) scale, respectively. **Results:** The mean postoperative follow-up was 39 months. Intraoperative blood loss, radiation exposure, operative time, and postoperative length of hospitalization were significantly lower in anchored SA-ALIF group. Effective ODI and VAS improvement was achieved in both anterior and posterior groups. No significant differences were observed between the two groups in postoperative spinopelvic parameters assessment. Effective spinal fusion was achieved in 23 patients (88.4%) in the anchored SA-ALIF group, and in 21 patients (77.8%) in the posterior group. **Conclusion:** While both techniques effectively achieve spinal fusion and symptom relief, minimally invasive anchored SA-ALIF offers significant advantages over posterior fusion techniques in terms of intraoperative blood loss, radiation exposure, operative time, and postoperative length of hospitalization.

ID: AGS26/1051
P0346: Fragility of randomized trials comparing decompression alone and decompression with fusion for lumbar spinal stenosis

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Background: Degenerative lumbar spinal stenosis (DLS) is a common condition that increases with age. While many patients improve with conservative care, severe disease often requires surgical treatment. Lumbar decompression is the standard option, with fusion added when instability is present, though fusion carries risks such as hardware failure, pseudarthrosis, and adjacent segment disease. Randomized controlled trials (RCTs) have shown similar outcomes for decompression alone compared to decompression with fusion in patients without instability, yet fusion remains widely used. Fragility analysis, which evaluates the robustness of statistically significant findings through measures such as the fragility index (FI) and fragility quotient (FQ), has been applied in other orthopaedic subspecialties but rarely in spine surgery. No prior study has assessed the fragility of RCTs comparing decompression alone and decompression with fusion in DLS, highlighting the need for this analysis. **Materials and Methods:** We conducted a meta-analysis in accordance with PRISMA guidelines. A specific search strategy was applied to three online databases (PubMed, Embase and CENTRAL) to identify all trials comparing outcomes between decompression and decompression with fusion for treating LSS. A predetermine set of incision criteria was used to screen articles for appropriateness. All fragility calculations were performed on IBM SPSS Statistics software. **Results:** Seven articles were included in our analysis. The fragility index (FI) for all the dichotomous outcomes was 6 (IQR: 5-11), with a corresponding fragility quotient (FQ) 0.046 (IQR: 0.024-0.061). This indicates that only 6 events or 4.6% of events, is sufficient to reverse the aggregated significance of these trials. Sub-analysis found significant events to be more fragile than non-significant ones (FI: 4 versus 8). Radiographic findings and minimal clinical important different (MCID) were the most and least fragile outcomes (FI: 4 vs 15), respectively. **Conclusion:** The Fragility Index (FI) provides useful insight into the robustness of

trial outcomes, with our analysis showing a median FI of 6 (FQ: 0.046), indicating that few event changes can reverse statistical significance. Significant outcomes were generally more fragile than non-significant ones, with radiographic findings being the most fragile. However, this review is limited by its focus on dichotomous outcomes, a small number of included studies, and the FI's inability to assess study bias or methodological quality. These findings highlight the importance of using FI alongside traditional statistical measures to better interpret clinical evidence.

ID: AGS26/1123
P0347: Morphometric variations in oblique lumbar interbody fusion corridors in degenerative lumbar scoliosis: a comparative study of the apex direction

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Introduction: Degenerative lumbar scoliosis (DLS) alters spinal anatomy, impacting the feasibility and dimensions of surgical corridors for oblique lumbar interbody fusion (OLIF). This study aimed to compare the morphometric characteristics of OLIF corridors between patients with left and right curves, focusing on corridor dimensions, psoas muscle asymmetry, and segmental artery positioning. **Material and Methods:** A retrospective analysis of 80 patients with DLS (left apex: n = 43; right apex: n = 37) was conducted. Corridor angles and distances, psoas muscle cross-sectional areas, and segmental artery locations were measured at L2-3, L3-4, and L4-5 using T2-weighted MRI. Multivariate regression analysis identified key anatomical predictors of corridor variation at L2-3. **Results:** Regardless of the apex direction, the left-sided corridor was consistently larger across all levels. Corridor angles were significantly greater on the left side in both groups (left apex: L2-3: 39.7° vs. 13.5°, L3-4: 38.3° vs. 11.9°, L4-5: 38.6° vs. 6.9°; right apex: L2-3: 53.7° vs. 18.1°, L3-4: 43.1° vs. 18.5°, L4-5: 28.6° vs. 11.9°). Psoas muscle areas were larger on the concave side of the curve (left apex: 125.7 mm^2 vs. 67.9 mm^2; right apex: 125.4 mm^2 vs. 77.4 mm^2). Segmental artery positioning exhibited curve-dependent asymmetry at L2-3 (left apex: 8.8 mm vs. 7.9 mm; right apex: 9.6 mm vs. 8.0 mm). Multivariate regression analysis revealed that in the left apex group, the left psoas area (β = -0.132) and segmental artery distances were significant predictors of corridor angle variation (R^2 = 0.517). In the right apex group, psoas asymmetry (β = 0.123) and sagittal alignment (β = -0.851) were associated with corridor differences. **Conclusion:** OLIF corridors in DLS patients demonstrate consistent left-sided dominance, regardless of apex direction. Psoas muscle asymmetry and segmental artery positioning contribute to corridor variations. While the left-sided approach remains standard, right-sided access may be feasible in select cases, particularly at L4-5. These findings provide insights for optimizing preoperative planning and surgical decision-making in DLS patients.

ID: AGS26/1136
P0348: Comparison of clinical and radiological results of polyetheretherketone cage and cage-shaped allograft use in lumbar interbody fusion surgery

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Introduction: This study compared the clinical and radiological results of polyetheretherketone(PEEK) cage and cage-shaped allograft use in lumbar interbody fusion surgery. **Material and Methods:** In the study, the results of 30 patients who underwent lumbar interbody fusion surgery and used a PEEK cage for fusion were compared with those of patients who used a cage-shaped allograft. The Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) were used in the clinical evaluation of the patients. The 'Brantigan classification' was used in the computerized tomography scans taken in the first postoperative year to evaluate the interbody fusion radiologically. **Results:** While the preoperative VAS scores of patients in whom cage-shaped allografts were used were 9.1, it was observed that they decreased to 2.87 at the 1st year controls. Again, it was observed that the preoperative ODI score, which was 48.87 in the allograft group, reduced to 18.53 in the 1st year. In the PEEK cage group, the preoperative VAS score decreased from 8.8 to 3.97, and the ODI score decreased from 42.13 to 24.87. The change in VAS and ODI scores was better in

the allograft group (p = 0.002, p = 0.012). According to the Brantigan classification, no statistically significant difference was observed in the intervertebral fusion evaluation between the groups (p = 0.301). **Conclusion:** In lumbar interbody fusion surgery, using PEEK cages and cage-shaped allografts provides similar radiological results in fusion. However, allografts provided better clinical results in the first postoperative year.

ID: AGS26/1148

P0349: Microbiome impacts surgical outcomes - Comparison of gut microbiome dysbiosis in patients undergoing lumbar microdiscectomy: results from the MISO Pilot Study

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Introduction: More than 10% of patients undergoing lumbar microdiscectomy for symptomatic lumbar disc herniation (LDH) develop failed back surgery syndrome (FBSS) often without clear cause. Recent findings of pathobiont gut bacteria in degenerative intervertebral discs (IVDs) suggest a potential "gut-disc axis," where microbiome-mediated inflammation and disc colonization might undermine surgical outcomes. This novel pilot study aims to determine whether changes in gut microbial composition (dysbiosis) can predict FBSS after one level lumbar microdiscectomy for symptomatic LDH. **Materials and Methods:** 20 adult patients undergoing one-level lumbar microdiscectomy for symptomatic LDH were prospectively studied. Numerical Rating Scale (NRS) and Oswestry Disability Index (ODI) scores were collected preoperatively and at 3 months and 6 months postoperatively. Achievement of minimum clinically important difference (MCID) was defined as a > 30% improvement in NRS and ODI score. Preoperative Stool samples were analyzed using 16S rRNA sequencing. Alpha diversity and beta diversity were assessed to determine microbial diversity differences. Taxonomic composition was compared at the phylum and genus levels. **Results:** Of the 20 patients, 16 achieved MCID, while 4 developed FBSS at 3 and 6 months. There were no significant differences in age, sex, BMI, race, level of surgery, and pre-operative NRS and ODI between groups. Alpha diversity was similar (p = 0.437), but beta diversity showed significant differences in microbial community structure ($p < 0.05$). Differential abundance analysis identified patients who experienced FBSS had higher levels of pro-inflammatory *Prevotella* (U = 2, p = 0.002) and lower levels of commensal *Bacteroides* (U = 61, p = 0.003)) and *Faecalibacterium* (U = 53, p = 0.047). **Conclusion:** This study is the first to identify a *Prevotella*-dominant enterotype, along with a reduction in the anti-inflammatory genera *Bacteroides* and *Faecalibacterium*, as potential contributors to an increased risk of FBSS. Studies of higher power are required to estimate the effect sizes of these associations, investigate causation, and consider the viability of synbiotic therapy to improve spine surgery outcomes.

ID: AGS26/1151

P0350: Effect of age on sagittal alignment characteristics in patients with symptomatic lumbar spinal stenosis: a systematic review and meta-analysis

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Introduction: Symptomatic lumbar spinal stenosis (sLSS) is considered a degenerative disease. However, few people have investigated whether the sagittal alignment of patients with sLSS and their symptoms change with age. Sagittal alignment plays a crucial role in maintaining an efficient posture, balanced load distribution, and optimal spinal function and is changed in patients with sLSS. In a meta-analysis of healthy persons, sagittal alignment was associated with age. In addition, the Oswestry Disability Index (ODI) is a questionnaire used to assess patient symptoms and is widely used for patients with LSS. We systematically reviewed the literature to investigate the influence of age on sagittal alignment parameters and ODI in patients with sLSS. **Material and Methods:** A systematic literature search on sagittal spinal alignment in adult patients with degenerative sLSS was performed in Embase, Medline, and the Web of Science Core Collection. Peer-reviewed studies were included if measurements were obtained from standing radiography. We excluded conference abstracts, case reports, systematic reviews, and studies with

postoperative data only, missing patient age, adolescent-only populations, or non-standing measurements. Associations between age and sagittal alignment parameters and ODI were assessed using meta-regression in R using the package "meta". **Results:** From 1,593 articles screened, 214 met our inclusion criteria (163 Asian, 51 non-Asian; total n = 17,339). The average age of the patient in the included study ranged between 42-85 years. Hundert-seventy-eight articles reported lumbar lordosis (LL) measurements, 90 sagittal vertical axis (SVA), 105 sacral slope (SS), 120 pelvic incidence (PI), 116 pelvic tilt (PT), 12 T1 Pelvic Angle (TPA), 6 cervical lordosis (CL), 51 thoracic kyphosis (TK) and 85 ODI. The meta-regression analysis showed that age was associated with LL, SVA, PT and TPA. Specifically, LL (β = -0.3 degree per year; 95% confidence interval (CI) [-0.6,-0.1], p = 0.002, R^2 = 4.92%) decreased with age, while SVA (β = 2.6mm per year; 95%CI [1.8,3.1], p < 0.001, R^2 = 32.27%), PT (β = 0.2 degree per year; 95%CI [0.1,0.3], p < 0.001, R^2 = 9.51%) and TPA (β = 0.8 degree per year; 95%CI [0.0,1.6], p = 0.0429, R^2 = 23.33%) increased with age. Age was not associated with ODI and other sagittal alignment parameters (SS, PI, SSA, TK and CL). **Conclusion:** In patients with sLSS, LL, PT, SVA and TPA but not ODI were associated with age. Two-thirds of the included studies were performed in Asia. Hence, an influence of ethnicity on the observed relationships between age and sagittal alignment cannot be excluded and warrants further investigation.

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P0351: Side of approach does not affect outcomes in direct lateral lumbar interbody fusion. A non-inferiority retrospective cohort study

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Introduction: Lateral lumbar interbody fusion (LLIF) is a minimally invasive surgical technique with various clinical benefits. However, there is no consensus on the optimal side of approach. This study investigates clinical and radiographic outcomes associated with surgical laterality, where the approach side was chosen based on operating room theatre flow rather than anatomy. **Material and Methods:** Retrospective analysis of prospectively collected data from 233 patients (2016-2021) who underwent LLIF by two surgeons, each consistently using a specific side due to operating room setup. Outcomes included Oswestry Disability Index (ODI), Visual Analog Scale (VAS), SF-12, and radiographic fusion. Statistical comparisons included predefined non-inferiority margins for operative time (15 min) and fusion (10%). **Results:** Left-sided (n = 116) and right-sided (n = 117) approaches showed no significant differences in operative time (p = 0.39), fusion rates at 12 months (p = 0.66), VAS, ODI, or complication rates. Fusion at 12 months was 94.9% vs. 93.2% respectively. **Conclusion:** LLIF outcomes did not differ by side of approach. While anatomical considerations may apply in selected cases (e.g., coronal deformity), theatre flow factors can guide side selection without compromising outcomes. This study is limited by surgeon-side bias and absence of randomization.

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P0352: The prevention of infectious complications in degenerative spine surgery with sodium aminodihydrophthalazinedione use

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Introduction: A surgical site infection (SSI) is defined as an infection that occurs after surgery in the part of the body where the operation was performed. SSIs lead to increased costs, repeated hospitalizations, longer hospital stays and, in some cases, death of patients. At the same time, according to a number of authors, from 40% to 60% of these infections can be prevented. Modern immunomodulation is also becoming important in spinal surgery. **Purpose:** To evaluate the immunological status of patients operated on for degenerative diseases of the lumbar spine and how it could be effected by sodium aminodihydrophthalazinedione. **Material and Methods:** A prospective, comparative, non-randomized, single-center study. The study included 60 patients, 30 in the experimental group, 30 in the control group. Each patient signed informed consent. When the patient was included in the study, a laboratory examination was performed: T-lymphocytes (CD3+); T-helpers (CD3+CD4+); T-cytotoxic lymphocytes (CD3+CD8+); immunoregulatory index (IRI); B-lymphocytes (CD19+); Natural killers (NK cells, CD3-CD16+/CD56+); T-natural killers (CD3+CD16+CD56+); indicators of phagocytosis of granulocytes and monocytes; circulating immune complexes (CIC), immunoglobulins A (IgA), M (IgM), G (IgG), E (IgE); leukocyte formula with the determination of the proportion (in%) and concentration (thousand cells / μl) of neutrophils, lymphocytes, monocytes, eosinophils, basophils. The described laboratory examination was repeated in patients on the 10th day PostOp after the course of the 200 mg sodium aminodihydrophthalazinedione 1 time per day. **Results:** It was found that the percentage of patients with positive dynamics of immunological indicators was significantly (p < 0.05) higher after the course of sodium aminodihydrophthalazinedione (T-, B-cell immunity, IgG level, indicators in the CBC - the level of lymphocytes, neutrophils), thus this chemical compound potentiates,

enhances the positive effect on the main links of immunity in a much larger number of patients with this pathology. Sodium aminodihydrophthalazinedione demonstrated a pronounced immunomodulatory activity in patients with degenerative diseases of the spine, acting as a true immunomodulator, potentiating anti-infective protection in a significantly larger percentage of individuals compared to the control group ($p < 0.05$). **Conclusion:** Sodium aminodihydrophthalazinedione significantly effected on cellular immunity, thereby reduced the possible risks of infectious complications in the surgical area in patients with degenerative diseases of the lumbar spine. Further studies, including multicenter ones, will make it possible to more clearly formulate the indications for the use of this chemical compound in the orthopedic patients treatment.

ID: AGS26/1286
P0353: The psychological effect of using back orthoses post one/two level lumbar fusion

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Introduction: Back orthoses have evolved over decades, and the effect of different types of braces have been well established over time. Despite substantial evidence indicating that bracing does not improve post-operative outcomes in one- or two-level lumbar fusion, many patients continue to prefer wearing a brace. Patients often report feeling vulnerable without it, fearing they may cause further damage to their spine. This perception leads to increased caution in movement when not wearing a brace. While bracing does not provide a measurable improvement in clinical outcomes, it appears to offer a sense of stability and protection. Existing literature indicates that the use of back orthoses post-lumbar fusion does not result in significant differences in post-operative pain relief, recovery time, complication rates, or fusion success compared to cases where no orthosis is used. Conversely, studies highlight potential complications associated with bracing. Despite clear evidence against its effectiveness, bracing remains controversial, largely due to patient preference. This raises the question of whether the continued use of back braces is influenced by a placebo effect, providing psychological comfort rather than physiological benefit. Unfortunately, there is a notable gap in research investigating the psychological impact of orthoses post-lumbar fusion and how this affects patient management and recovery. This study aims to assess the psychological impact of brace use following one- or two-level lumbar fusion. The primary objective is to determine whether bracing continues to play a significant role in post-operative care, primarily as a psychological support mechanism rather than a tool for physical recovery. **Material and Methods:** This study was conducted at a single facility, with all surgical procedures performed by the same surgeon. Eligible participants included patients undergoing a one- or two-level open posterior interbody lumbar fusion. Exclusion criteria included revision surgeries, trauma-related procedures, and patients with an elevated BMI. Pre-operatively, patients were randomized to either receive a Miami Lumbar orthosis or no brace. Postoperatively, patients completed the Pain Anxiety Symptom Scale (PASS) along with additional questionnaires addressing brace usage, perceived support, and overall satisfaction. **Results:** A total of 30 patients were included in this study and were followed up at 2 weeks, 6 weeks, and 3 months post-operatively. Our findings indicate that brace use did not provide an advantage in terms of comfort, mobility, sitting tolerance, or overall clinical outcomes. The only significant difference observed was a reduction in patient anxiety among those who wore a brace. **Conclusion:** The use of a lumbar brace in the post-operative period following a one- or two-level lumbar fusion does not appear to contribute meaningfully to clinical recovery, serving primarily as a psychological support mechanism. Based on these findings, we recommend considering brace use selectively for patients who present with high levels of pre-operative anxiety.

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P0354: Anterior and transforaminal lumbar interbody fusion at L5-S1 level: clinical outcomes and factors predicting failure

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Introduction: Lumbar interbody fusion at the L5-S1 level is a common surgical procedure for degenerative lumbar conditions. Among the various approaches, anterior lumbar interbody fusion (ALIF) and transforaminal lumbar interbody fusion (TLIF) are frequently employed. ALIF provides direct access to the disc space, theoretically offering superior restoration of disc and foraminal height, as well as correction of lumbar lordosis. TLIF, on the other hand, involves less soft tissue dissection and is typically favored when posterior access is preferable. Although both techniques have shown efficacy, direct comparisons of clinical and radiographic outcomes, fusion rates, and complication profiles remain limited. This study aimed to evaluate and compare the outcomes of ALIF and TLIF at

L5-S1 in patients with degenerative lumbar conditions. **Material and Methods:** A retrospective cohort study included patients who underwent either ALIF or TLIF at the L5-S1 level. A total of 44 patients were included: 9 (20.5%) underwent ALIF and 35 (79.5%) TLIF. Data collected included demographics, comorbidities, surgical parameters (operative time, blood loss, hospital stay), and radiographic measurements (anterior and posterior disc height, lumbar lordosis). Fusion status was assessed at 1-year follow-up, and complications were documented. Statistical analyses were performed to evaluate differences between groups. **Results:** The mean age was 50.34 ± 11.02 years, with a predominance of female patients (56.8%), particularly in the ALIF group (100% women). No significant demographic differences were found between groups, aside from sex distribution. Mean operative time was slightly longer for ALIF (214.3 vs. 188.8 minutes, $p = 0.150$). Blood loss data were unavailable for ALIF but varied widely in TLIF (50-600 mL). Hospital stay was similar (median 3 days, $p = 0.549$). At 1-year follow-up, fusion rates were 100% for ALIF and 88.6% for TLIF. Radiographically, ALIF achieved superior restoration of anterior and posterior disc height ($p < 0.01$ and $p = 0.003$, respectively), whereas no significant differences were observed in lumbar lordosis correction. Complications occurred at similar rates (22.2% in ALIF vs. 22.9% in TLIF, $p = 0.672$), with foraminal compression predominating in ALIF and radicular pain or implant-related issues in TLIF. **Conclusion:** Both ALIF and TLIF demonstrated high effectiveness in the management of degenerative lumbar disease at L5-S1, with comparable fusion rates and complication profiles. ALIF offered superior disc height restoration, while TLIF was equally effective in restoring lumbar lordosis. Operative time, hospital stay, and complications did not significantly differ between groups. Patient-specific factors such as age, comorbidities, and obesity influenced surgical outcomes and should be considered in preoperative planning. Despite the limitations of sample size and retrospective design, this study contributes valuable data supporting the use of both techniques. Larger prospective studies are warranted to confirm these findings.

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P0355: Functional recovery and pain reduction after surgery for lumbar spinal stenosis - A retrospective analysis using the Oswestry Disability Index

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Introduction: Lumbar spinal stenosis (LSS) is a clinical syndrome characterized by reduced space for neurovascular structures in the lumbar spinal canal. This study aimed to describe and analyze recovery outcomes related to disability and functionality following LSS surgery, using the Oswestry Disability Index (ODI). **Material and Methods:** A retrospective cohort study was conducted on 230 patients who underwent LSS surgery between January 2016 and December 2022. The ODI was assessed preoperatively, at six months, and twelve months postoperatively. Statistical analyses included Wilcoxon, Kruskal-Wallis, and Spearman correlation tests, with a significance threshold of $p < 0.05$. **Results:** The mean patient age was 69.05 years, and 62.3% were female. Preoperatively, the median ODI score was 48.88 (IQR 37.7-62), indicating severe disability. At six months, the ODI significantly improved to 10 (IQR 0-26), $p < 0.05$, with no further significant changes at twelve months (10 [IQR 0-26.6], $p = 0.938$). Pain severity on the Visual Analog Scale (VAS) decreased from 8.39 preoperatively to 1.74 at six months and 1.53 at twelve months ($p < 0.017$). Correlation analysis demonstrated a statistically significant negative relationship between preoperative ODI scores and postoperative improvements ($r = -0.21$ at six months, $p < 0.05$; $r = -0.14$ at twelve months, $p < 0.02$). **Conclusion:** Surgical intervention for LSS improved functional outcomes and pain scores, with almost all the recovery occurring within the first six months. These findings highlight the role of ODI as a critical measure in postoperative assessment and support early surgical intervention in patients with severe functional impairment. Future studies should assess long-term ODI trends beyond twelve months to better understand sustained functional recovery.

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P0356: Radiographic and clinical outcomes of indirect decompression via extreme lateral interbody fusion (XLIF): a retrospective case series of 89 patients (2019-2022)

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Introduction: Extreme Lateral Interbody Fusion (XLIF) is a minimally invasive lumbar fusion technique that uses a lateral transpsoas approach to achieve interbody fusion and indirect decompression. By restoring disc height, foraminal area, and spinal alignment via ligamentotaxis, XLIF relieves nerve root compression without direct neural manipulation, potentially reducing morbidity compared to posterior approaches. This is

particularly relevant for degenerative lumbar conditions, including severe stenosis. Evidence on XLIF's indirect decompression efficacy in moderately sized cohorts is limited. This retrospective review evaluates radiographic and clinical outcomes of indirect decompression via XLIF in 89 patients at a single center from January 2019 to December 2022, focusing on disc height, foraminal area, and symptom relief. **Material and Methods:** We analyzed 89 consecutive patients (aged 18-80 years) undergoing XLIF for degenerative disc disease, low-grade spondylolisthesis (Meyerding I-II), or adjacent segment degeneration with radiculopathy/claudication, confirmed by MRI/CT. Exclusion criteria included prior lumbar fusion, active infection, or severe osteoporosis (T-score <-3.0). Three fellowship-trained surgeons performed XLIF using a standardized protocol: lateral decubitus positioning, transpsoas access, neuromonitoring, and PEEK/allograft cage implantation (10-12 mm height, 18-22 mm width). Posterior fixation supplemented 67% of cases. Data included preoperative and postoperative (6, 12, 24 months) radiographic metrics (disc height, foraminal area, lordosis via X-rays/CT) and clinical outcomes (Visual Analog Scale [VAS] for leg/back pain, Oswestry Disability Index [ODI]). Indirect decompression was quantified by foraminal area and disc height increases. Perioperative data included operative time, blood loss (EBL), length of stay (LOS), and complications. Statistical analysis (SPSS v26) used paired t-tests, Pearson correlation, and multivariate regression ($p < 0.05$). Institutional Review Board approval was obtained. **Results:** The cohort included 89 patients (mean age 60.2 ± 11.0 years; 58% female) undergoing 1-3 level XLIF (mean 1.5 levels; L3-L5 predominant). Operative time was 135 ± 32 minutes per level, EBL 72 ± 38 mL, and LOS 2.2 ± 1.1 days. Indirect decompression increased disc height by 4.3 ± 1.7 mm (67%, $p < 0.001$) and foraminal area by 23.8 ± 7.9% ($p < 0.001$) at 6 months, sustained at 24 months ($n = 76$; 85% follow-up). Lordosis improved by 6.5° ± 3.0° ($p < 0.001$). VAS-leg decreased from 7.0 ± 1.8 to 2.5 ± 1.5 ($p < 0.001$), VAS-back from 7.3 ± 1.6 to 3.2 ± 1.7 ($p < 0.001$), and ODI from 50.9 ± 14.2 to 24.3 ± 10.8 ($p < 0.001$); 75% achieved ODI > 15 points. Foraminal area correlated with VAS-leg improvement ($r = 0.49$, $p < 0.01$). Complications (16%) included transient dysesthesia (10%), subsidence (3%), and infection (1%). Severe stenosis ($p = 0.02$) and larger cages ($p = 0.01$) predicted better decompression; obesity increased neuropraxia risk (OR 2.0, $p = 0.03$). **Conclusion:** XLIF achieves effective indirect decompression, with significant disc height and foraminal area restoration correlating with pain and disability improvements. Indirect decompression via XLIF is valid even for severe lumbar stenosis, as disc heightening, foraminal restoration, and ligamentotaxis often eliminate the need for direct decompression. Its low morbidity supports its utility, though neuropraxia is a concern in obese patients. Retrospective design is a limitation; prospective studies are needed. XLIF is a reliable option for selected patients.

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P0357: Transforaminal endoscopic lumbar discectomy versus microdiscectomy for surgical management of lumbar disc herniation: experience from a single tertiary center

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Introduction: Transforaminal Endoscopic Lumbar Discectomy (TELD) represents a minimally invasive and full-endoscopic method for surgical treatment of Lumbar Disc Herniation (LDH). This procedure is associated with minimal skin incision and intraoperative hemorrhage, preservation of dorsal musculature and relative spine elements, minimal epidural scarring as well as rapid postoperative mobilization with return to daily activities. However, conventional microdiscectomy (MD) remains the gold standard method for surgical management of LDH to date, whilst existent data from high quality studies remain scarce. Hence, aim of this study is to present our single-center experience regarding clinical outcomes of TELD versus MD in patients with surgically treated LDH. **Material and Methods:** Patients with LDH fulfilling current established indications for surgical management and operated from 2013-2019 in the single tertiary center and from the same operating surgeon were considered eligible for participation in this study. Finally, eight hundred and eighty five (885) patients were included and retrospectively evaluated. Data for defined outcome measures were retrieved from hospital registry. Except for standard demographic parameters, length of incision, operative time, postoperative mobilization time and hospitalization duration were considered primary outcome measures. Furthermore, established patient-reported outcome measures as Visual Analogue Scale (VAS), Short-Form 36 Medical Health Survey Questionnaire and functional status - according to modified McNab criteria- and type and rate of recorded complications were secondary outcome measures. Available data were derived from preoperative assessment as well as from standard evaluation in outpatient clinics at 6 weeks and 3, 6, 12, 24 months and 5 years postoperatively. **Results:** Enrolled individuals were successfully subjected to TLED or MD with no significant perioperative complications. Demographic parameters were standardized between two groups, featuring no statistically significant differentiation. Regarding primary outcome measures, all parameters were defined to be statistically significantly ameliorated in TELD group, advocating for its minimal invasiveness (p value < 0.05).

Contrariwise, self-reported secondary outcome measures were not demonstrated to differ significantly between groups in recorded follow-up checkpoints, featuring, however, statistically significant amelioration in each follow-up interval in comparison with previous in each group. Moreover, type and frequency of recorded complications were similar between two groups. **Conclusion:** Results from our single large-series analysis demonstrate that TELD is non-inferior with MD in terms of clinical effectiveness, exhibiting also superiority in specific parameters as operation duration, skin incision length and postoperative mobilization and hospitalization duration. However, selection of TELD should be thoughtfully conducted on a case-by-cases basis, considering meticulously patient- as well as surgeon-related parameters, taking also into account the established steep learning curve of this technique.

ID: AGS26/1400
P0358: Risk factors for reherniation following lumbar microdiscectomy: an institutional retrospective analysis

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Introduction: Lumbar disc herniation is a leading cause of radiculopathy, and microdiscectomy remains the most common surgical treatment. Despite its effectiveness, reherniation occurs in up to 20% of patients and often necessitates revision surgery. Prior studies have examined both clinical and imaging predictors of recurrence, but risk stratification remains challenging. The purpose of this study was to evaluate clinical and MRI-based predictors of reherniation after single-level microdiscectomy at a single institution. **Material and Methods:** We retrospectively reviewed patients who underwent primary single-level lumbar microdiscectomy between 2012 and 2022. Exclusion criteria included prior lumbar surgery, trauma, tumor, or infection. Clinical variables included age, sex, body mass index (BMI), hypertension (HTN), diabetes mellitus (DM), obesity, and smoking status. Preoperative MRI parameters included sagittal disc size, anterior-posterior (AP) and mediolateral (ML) herniation dimensions, and the ratio of disc herniation to canal area (Disc/Canal ROI ratio). The primary outcome was symptomatic reherniation confirmed by MRI and managed surgically. Univariate and multivariate logistic regression analyses were performed to identify independent predictors. **Results:** A total of 491 patients were included (mean age 41 ± 13 years; 72% male). Reherniation occurred in 102 patients (20.8%). On univariate analysis, higher BMI ($p < 0.001$), smoking ($p = 0.026$), and HTN ($p = 0.003$) were significantly associated with reherniation. MRI-based parameters including sagittal disc size, AP size, ML size, and disc height were not significantly different between groups. The Disc/Canal ROI ratio showed a trend toward significance ($p = 0.13$). In the multivariate model, smoking (OR 1.85, 95% CI 1.00-3.45; $p = 0.049$) and HTN (OR 1.94, 95% CI 1.14-3.33; $p = 0.016$) remained independent predictors of reherniation. BMI demonstrated a nonsignificant trend ($p = 0.097$). **Conclusion:** In this large institutional cohort, reherniation occurred in approximately one-fifth of patients following lumbar microdiscectomy. Clinical factors, particularly smoking and hypertension, were significant independent predictors of recurrence, whereas MRI-based measurements were not independently predictive. These findings highlight the importance of addressing modifiable clinical risk factors when counseling patients and planning perioperative care. Future studies may clarify the role of advanced imaging metrics in refining risk stratification.

ID: AGS26/1453
P0359: PROMIS physical function scores more strongly predict two-year satisfaction than pain outcomes following lumbar spine surgery

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Introduction: Patient-reported outcomes (PROMIS) increasingly influence healthcare quality metrics and reimbursement. Although both PROMIS Physical Function (PF) and subjective pain scores are routinely collected, their relative ability to predict patient satisfaction remains unclear. We hypothesized that improvements in PROMIS-PF scores would show stronger associations with satisfaction compared to changes in back and leg pain scores. **Material and Methods:** The Michigan Spine Surgery Improvement Collaborative (MSSIC) data was queried for patients undergoing lumbar spine surgery at University of Michigan

from 2013-2023. Patient satisfaction was evaluated at 90 days, 1 year, and 2 years postoperatively using a 4-point scale PROMIS-PF and pain scores were obtained at baseline, 90 days, 1 year, and 2 years. MCID was defined as a decrease of ≥ 2 points for pain scores and an increase of ≥ 4.5 points for PROMIS-PF. Analysis included chi-square, Kruskal-Wallis tests and multivariate logistic regression. **Results:** The study cohort included 1,161 patients with a mean age 60.4 ± 14.1 years, 56% mal. At 2-year follow-up, 83.4% of patients reported improvement, with 59.7% reporting met expectations and 23.7% indicating they would repeat the surgery despite not meeting all expectations. MCID achievement at 2 years varied: 55.5% for PROMIS-PF, 66.6% for back pain, and 75.1% for leg pain. PROMIS-PF scores at 2 years showed the strongest association with satisfaction (χ^2 = 303.706), followed by back pain (χ^2 = 287.723) and leg pain (χ^2 = 186.951; all $p < 0.001$). Baseline-to-2-year score changes demonstrated similar but weaker associations (PROMIS-PF: χ^2 = 227.092; back pain: χ^2 = 172.066; leg pain: χ^2 = 143.525; all $p < 0.001$). Multiple regression analysis confirmed PROMIS-PF at 2 years as a significant independent predictor of satisfaction ($p = 0.019$), with the overall model demonstrating robust predictive value (Nagelkerke $R^2 = 0.562$). Notably, failure to achieve MCID in back pain remained independently significant ($p = 0.018$) as a negative predictor, suggesting a complementary role alongside PROMIS-PF in predicting satisfaction. **Conclusion:** While PROMIS-PF demonstrated lower MCID achievement rates than pain measures, it showed superior association with satisfaction in both absolute and change scores. This suggests that PROMIS-PF may be a more stringent but more meaningful measure of surgical success. The stronger association of absolute scores versus change scores indicates that final functional status may be more important than degree of improvement in determining patient satisfaction. These findings reinforce the value of PROMIS-PF in outcomes assessment for spine surgery and suggest the need to reevaluate MCID thresholds for different metrics.

ID: AGS26/1465
P0360: Adult-onset acute lumbar spondylolysis in athletes: case-series

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Introduction: Acute spondylolysis is typically observed in skeletally immature patients. However, a few small case series of adult-onset acute spondylolysis have been reported. We aim to present three cases of adult athletes who developed acute spondylolysis. **Methods:** This is a descriptive case series of adult patients (≥ 18 years) with documented acute lumbar spondylolysis. Demographic data, sport activity, treatment, and clinical outcomes were recorded. **Results:** Three male patients were included, with a mean age of 19.3 years (range, 18-22). Two were soccer players and one a volleyball player, all presenting with acute L5 spondylolysis. Diagnosis was confirmed using CT and MRI, showing bone marrow edema on STIR sequences. All patients were treated non-operatively with activity cessation, immobilization, and physiotherapy. The mean time to return to sport was 5 months. **Conclusion:** We report three cases of adult-onset acute spondylolysis successfully treated non-operatively, resulting in good clinical outcomes and full return to sport activity.

ID: AGS26/1510
P0361: Symptomatic retroperitoneal fluid collection following anterior lumbar interbody fusion: a single institution study

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Introduction: Retroperitoneal fluid collection (RFC), including hematomas and seromas, is a known complication of anterior lumbar interbody fusion (ALIF), contributing to patient morbidity due to extended hospital stays and drainage procedures. Identifying risk factors is essential to mitigate its occurrence. This study evaluates the incidence of and risk factors for symptomatic RFC following ALIF. **Materials and Methods:** We conducted a retrospective review of consecutive ALIF cases (2014-2023) at a single-center academic hospital. Patients were stratified based on the development of symptomatic RFC, confirmed through advanced imaging (CT/MRI/Ultrasound). Exclusion criteria included patients under 18 years old, asymptomatic RFCs, and those with surgical indications for trauma, malignancy, or infection. Chi-squared and Student's t-tests compared patient demographics and surgical variables. Univariable logistic regression analyses were performed to identify predictors of RFC. **Results:** Of 554 included ALIF cases, 44 (7.94%) developed a symptomatic RFC, with 28 (63.64%) requiring drainage. There were no significant differences between the RFC and non-RFC cohorts in terms of age (62.16 ± 10.34 years vs. 58.87 ± 12.44 years), BMI (28.20 ± 5.19 kg/m^2 vs. 28.95 ± 15.05 kg/m^2) sex distribution (Males: 43.18% vs. 47.25%), tobacco use (29.55% vs. 29.41%), or other recorded comorbidities (all p >

0.05). However, American Society of Anesthesiologists (ASA) score (2.65 vs. 2.41, p = 0.005) was significantly higher in the RFC cohort. Comorbidities such as hypertension (56.82% vs. 51.18%), diabetes (15.91% vs. 13.33%), and coronary artery disease (11.36% vs. 7.45%) were more prevalent, but non-significantly (all p > 0.05). Intraoperative transfusion (59.09% vs. 23.92%, p < 0.001) and venous injury (31.82% vs. 15.29%, p < 0.001) were significantly more prevalent in the RFC cohort. Additionally, estimated blood loss (1,657 ± 2,066 mL vs. 633.29 ± 1,135 mL, p < 0.001), operative time (8.38 ± 3.04 hours vs. 6.57 ± 2.82 hours, p < 0.001), and number of ALIF levels (≥ 2 levels 75.0% vs 39.4%, p < 0.001) were all found to be significantly higher in the RFC cohort. Finally, univariable logistic regression identified several risk factors: intraoperative venous injury (OR: 2.51, [1.27-4.94], p = 0.008), multi-level ALIF (OR: 2.11, [1.36-3.29], p < 0.001), and intraoperative transfusion (OR: 4.59, [2.44-8.66], p < 0.001). **Conclusion:** This study found a 7.94% incidence of symptomatic RFC following ALIF and identified multiple risk factors. Spine surgeons should remain vigilant-particularly in cases with venous injury, multi-level ALIF, or those requiring intraoperative transfusions-and may benefit from use of risk-stratified perioperative planning, explicit preoperative counseling, and a lower threshold for early postoperative imaging with timely drainage.

ID: AGS26/1562
P0362: Bucks fixation - for spondylolysis & low grade spondylolisthesis in young adolescent's

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Introduction: Thoracolumbar and lumbar fractures are among the most common spinal injuries and pose significant challenges in surgical stabilization. Traditional short-segment posterior fixation has been associated with higher failure rates compared with long-segment fixation. To overcome this, inclusion of the fractured vertebra with index-level screws has been proposed as a biomechanically advantageous strategy, aiming to preserve motion segments while enhancing stability. Aim of this study is to signify the role of index-level pedicle screws in thoracolumbar fracture fixation, comparing them with conventional short- and long-segment constructs. **Material and Methods:** Those cases who had a thoracolumbar and lumbar fractures, coming to the health facility were enllored for this study from the year 2024 to 2025. A total of 20 cases were recruited for this study. **Results:** Cases showed favourable radiological correction and functional recovery, with significant improvements in VAS and ODI scores at 2 years. **Conclusion:** Evidence consistently supports the biomechanical and clinical advantage of including index-level pedicle screws in thoracolumbar fracture fixation. This approach offers comparable correction and pain relief to long-segment constructs while preserving motion segments, reducing implant failure, and facilitating minimally invasive techniques. Long-segment fixation remains preferable for highly unstable fractures, but fracture-level fixation represents a reliable, motion-preserving alternative for selected cases.

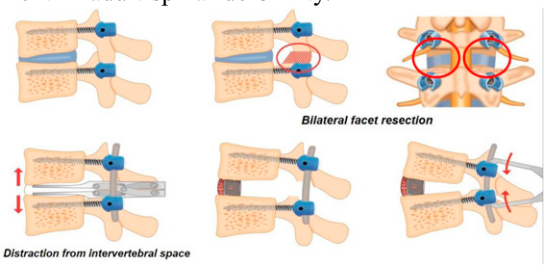
ID: AGS26/1565
P0363: Efficacy of multi-level interbody fusion with bilateral facetectomy and discectomy in restoration of segmental lordosis and lumbar sagittal balance in adult spinal deformity surgery

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Hypothesis: Multi-level interbody fusion with bilateral facetectomy and discectomy will improve segmental and overall lumbar lordosis restoration in surgical treatment of ASD. **Introduction:** The main goal of the surgical treatment in adult spinal deformity is to restore of the ideal lumbar lordosis (LL) and sagittal balance. In the presence of open and mobile disc, complete bilateral facetectomy and discectomy provide additional flexibility for sagittal plane restoration at the thoracolumbar and lumbar spine. The aim of this study is to compare the efficacy of multi-level interbody fusion with bilateral facetectomy and discectomy (BFD) procedure in restoring segmental lordosis and lumbar sagittal alignment. **Methods:** 46 pts (27F,19M), mean age 63 (36-77) years in whom instrumentation started from L1 level or above, down to sacrum and underwent a multi-level interbody fusion with bilateral facetectomy and discectomy were included. Coronal and sagittal parameters were measured on preop and f/up x-rays. Clinical assessment was done with ODI and VAS. **Results:** Mean f/up was 43 (26-63) months. Mean interbody fusion levels were 2.9 (2-5). PI-LL mismatch was mean 23°. Preop lumbar lordosis of 27.5° was restored to 48.3° (75%) with BFD. The mean improvement in LL was 20° (13°-45°). Segmental lordosis and overall LL improved significantly in all pts (p < 0.05). The mean segmental lordosis increase per interbody fusion level was 7.44°. The contribution of segmental lordosis was greater in L2-L3, L3-L4 and L4-5 than other levels (7.55°, 7.57°, 10.4°). ODI and VAS scores

improved significantly in both groups. **Conclusion:** In the presence of open disc in lumbar spine, multi-level interbody fusion with bilateral facetectomy and discectomy provide improvement in both segmental lordosis (7.44° per level) and overall lumbar lordosis ($p < 0.01$). When interbody fusion with bilateral facetectomy is performed at 3 or more levels, it can serve as an alternative technique to 3-Column Osteotomy for the restoration of thoracolumbar and lumbar sagittal alignment in adult spinal deformity.



ID: AGS26/1578
P0364: Clinical advantages of minimally invasive TLIF over open TLIF: lower incidence of adjacent segment disease and reoperations: meta-analysis

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Introduction: Open TLIF is effective for lumbar fusion but is associated with greater soft tissue disruption and prolonged recovery. MIS-TLIF minimizes morbidity, but its impact on ASD and long-term outcomes remains unclear. **Objective:** To compare minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) with open TLIF regarding adjacent segment disease (ASD), pseudarthrosis, reoperation, and perioperative outcomes. **Material and Methods:** PubMed, Cochrane Library, Scopus, Embase, Web of Science, and Google Scholar were searched (2000-2025) for comparative studies in adults with degenerative lumbar disease or isthmic spondylolisthesis. Primary outcomes included ASD, pseudarthrosis, and reoperation. Random-effects meta-analyses with logit transformation for rare events were performed. Multivariate meta-regression evaluated age, BMI, fusion level, follow-up, and smoking. **Results:** Fourteen studies (1,827 patients) were included. MIS-TLIF reduced odds of ASD (OR 0.51, 95% CI 0.37-0.69; $p < 0.001$) and reoperation (OR 0.53, 95% CI 0.31-0.90; $p = 0.018$) with low heterogeneity. Pseudarthrosis rates were similar (OR 0.96, 95% CI 0.38-2.48; $p = 0.94$). Multivariate meta-regression identified multiple-level fusion as increasing ASD risk ($p = 0.002$) and older age as protective ($p = 0.002$). BMI, smoking, and follow-up duration were not significant predictors. No publication bias was detected. **Conclusion:** MIS-TLIF offers lower risk of ASD and reoperation compared to open TLIF, with comparable fusion outcomes. Fusion level and patient age are important predictors of ASD. MIS-TLIF is an effective technique for degenerative lumbar spine disorders with minimized adjacent segment complications.

ID: AGS26/1668
P0365: Correlation between preoperative sarcopenia and postoperative complications in adult scoliosis surgery

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Introduction: Adult scoliosis surgery carries substantial morbidity. Sarcopenia reduced skeletal muscle mass and function has been linked to adverse outcomes in various surgical fields, but its impact on adult spinal deformity surgery is underexplored. This study evaluates the correlation between preoperative sarcopenia and postoperative complications. **Materials and Methods:** We retrospectively reviewed adult patients (≥ 18 years) undergoing elective scoliosis correction between 2018 and 2023. Preoperative sarcopenia was assessed using CT or MRI measurements of paraspinal muscle cross-sectional area normalized for height. Postoperative complications within 90 days-including wound infection, neurological deficit, pulmonary complications, and reoperation-were recorded. Multivariate logistic regression analyzed the association between sarcopenia and complications. **Results:** Sixty patients were included; 35% had sarcopenia. Overall complication rate was 25%. Patients with sarcopenia had a higher complication rate than non-sarcopenic patients (30% vs 15%, $p = 0.01$). Multivariate analysis identified sarcopenia as an independent predictor of postoperative complications. **Conclusion:** Preoperative sarcopenia is significantly associated with increased postoperative complications in adult scoliosis surgery. Early identification of sarcopenic patients may allow targeted prehabilitation and perioperative optimization, potentially improving surgical outcomes.

ID: AGS26/1687

P0366: Post spinal surgery syndrome in patients with pre-existing neurological co-morbidities: a 5-year-old retrospective study of a single center

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Introduction: Post spinal surgery syndrome (PSSS), formerly known as failed back surgery syndrome, is a complex condition characterized by persistent pain and neurological symptoms after spinal surgery. With the ageing population and the continuously increasing incidence of neurological disorders, the patients with neurological co-morbidities have become a special sub-group of neurosurgical patients prone to post-operative complications. The aim of this study is to estimate the prevalence of PSSS in this specific patient sub-group and to identify possible prognostic factors. **Material-Methods:** This is a 5-year retrospective review of our department's database (01/2020-01/2025). 1564 patients that underwent elective spinal surgery at our department were included in the study. The patients' sample was furthermore separated into two sub-groups: a group of 572 patients with pre-existing neurological co-morbidities (stroke, multiple sclerosis, spinal cord injury, dementia etc.) (Group A) and a group of 992 patients with no known pre-existing neurological history (Group B). The existence of PSSS was determined at the 1-month, 3-months and 6-months post-operative follow-up. **Results:** The overall PSSS prevalence was estimated at 13.6% (213 patients). 122 of the PSSS patients belonged to Group A, estimating the prevalence of PSSS of this sub-group at 21.3% (versus a 9.2% prevalence of Group B). Most common symptoms were persistent neuropathic pain and numbness. The most common predisposing factors were smoking, age over 63, the use of instrumentation and pre-existing spinal cord injury. **Conclusion:** PSSS is a worldwide complication that can affect the patients' quality of life, especially in a population susceptible to further neurological deterioration such as patients with pre-existing neurological disorders. The careful patients' selection, the meticulous pre-surgical planning and the elimination of predisposing factors such as smoking are advised to possibly improve the outcomes.

ID: AGS26/1690

P0367: Post-operative calcification of cauda equina: a case report of a rare neurosurgical entity

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Introduction: The calcification of the cauda equina refers to the deposition of calcium in the nerve roots below the conus medullaris. It can lead to neurological deficits and even cauda equina syndrome. It is a very rare condition, and its prevalence is difficult to be estimated. The aim of this study is to showcase this uncommon cause of cauda equina syndrome and to highlight the importance of a prompt diagnosis. **Case presentation:** A 70-year-old male patient presented to the neurosurgical department due to paraparesis, sensory deficits and erectile dysfunction. His symptomatology started 6 years ago after a failed lumbar spinal fusion surgery, followed by post-operative infection and removal of the instrumentation. His symptoms worsened gradually. His clinical examination showed paresis of bilateral quadriceps (3/5) and 4-/5 of the rest of muscle groups of the lower extremities, severe sensory deficits, erectile dysfunction and incontinence, hyporeflexia of the lower extremities and lumbar pain. A CT and MRI of the lumbar region were performed revealing calcification of the cauda equina at L5 up to S2 level. Surgical decompression was performed with mild improvement of his neurological status. **Discussion:** The pathogenesis of the calcification of cauda equina is unclear. It is believed to be secondary to acute trauma and surgical scarring and the subsequent local lesions. Calcified cauda equina has been reported post-traumatically, post-operatively, in association with spinal tumors and spinal infections. The literature is very scarce and there is no indicated treatment. Decompression and removal of the ossifications when possible have been reported with various results. **Conclusion:** The calcified cauda equina is a very uncommon condition that, in many cases, needs surgical treatment. Due to its rarity, there is a need for further study of the pathophysiology of this entity.

ID: AGS26/1692

P0368: Does fat matter? Comparison of adjacent level paraspinal musculatures in patients who undergo extension fusion with those that do not in the lumbar spine

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Introduction: Fat infiltration of the paraspinal muscles reflect muscle atrophy and degeneration and has been known to lead to dysfunction of the low back. However, it is unclear if fat infiltration affects spinal surgical outcomes. This study aims to determine if post-operative degeneration of the paraspinal musculature is associated with the need for a subsequent extension of fusion in the lumbar spine. **Material and Methods:** This study was conducted as a retrospective cohort study of adult patients who underwent primary multi-level lumbar fusion that included the sacrum with or without further extension of fusion and had pre-operative and post-operative MRI scans conducted. Fat infiltration of the paraspinal muscles was measured at the superior adjacent segment level using the Goutallier T1W, T2W and Four Grade Fat classification. Patients were divided into extension of fusion (EOF) and non-extension of fusion (NOF) groups. **Results:** Of the 88 patients included in the study, 41 underwent extension of fusion. The age of the extension of fusion group was 11% higher than the NoF group ($p < 0.05$). The level of paraspinal fat infiltration in the adjacent segment following lumbar fusion as measured by the Goutallier T1W, Goutallier T2W and Four Grade Fat Classification was more severe in the MRI of patients in the EOF group compared to patients in the NOF group. **Conclusion:** Patients who required an extension of fusion following initial surgery had a higher level of fat infiltration in the paraspinal musculature of the adjacent segment level compared to patients who did not require extension. Therefore, we posit that muscle loss should be considered as one of the risks for adjacent segment disease and extension of fusion, necessitating the need for paraspinal muscle therapy post fusion.

ID: AGS26/1716

P0369: 'Rebound phenomenon' - A cause of early cage back-out in transforaminal lumbar interbody fusion surgery: insights from case series of 1545 patients

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Introduction: Factors like elderly age, low body mass index, placement of undersized cages, bony endplate damage and improper cage placement are several risk factors for cage back-out following TLIF surgeries. Despite this, lacunae remains regarding the other factors contributing to cage migration. We aim to assess the various possible causative factors of cage retropulsion and the management strategies to be utilized for cage back-out following open transforaminal lumbar interbody fusion(TLIF) surgery in degenerative lumbar spine pathology. **Materials and Methods:** We performed a retrospective analysis of prospectively collected data from patients who underwent TLIF surgery for degenerative disc disease with stenosis or instability between 2011 and 2024. We identified patients who presented with cage back-out and analysed the characteristics of these patients to elucidate the possible causes of cage retropulsion. **Results:** Among 1545 patients who underwent TLIF surgery, 16 patients (1%) experienced cage back-out. This included 11 single-level fusions and five two-level fusions, predominantly at the L4-L5 level. Eight patients had early cage back-out within 3 months, while four had back-out after 1 year. Eleven cases involved posterior migration, one case each for postero-lateral and anterolateral migration, respectively. Twelve patients were managed conservatively, whereas four required revision surgery. We identified inadequate disc space preparation and "rebound phenomenon" as significant risk factors for early back-out, necessitating revision for optimal outcomes. Late back-out may benefit from conservative management due to the potential for partial union, with surgery reserved for refractory cases or those with neurological symptoms. **Conclusions:** Cage migration is a recognized and severe complication in TLIF surgery, potentially impacting patient outcomes. Our study found that intraoperative rebound phenomenon and inadequate discectomy or endplate preparation were significant risk factors for cage migration. Surgeons should consider these factors and patient-specific variables to optimize clinical outcomes in TLIF patients.

ID: AGS26/1719

P0370: Radiographic measures of central obesity predict mechanical complications following posterior spinal fusion

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Introduction: Body mass index (BMI) is widely used to assess obesity in surgical patients; however, it fails to differentiate between fat and lean mass or account for fat distribution. In spine surgery, recent studies have investigated other radiographic markers to better capture central adiposity, which can more directly influence postoperative complications than BMI alone. This study investigates the predictive value of radiographically derived abdominal circumference (AC) and abdominal circumference to pelvis circumference (ACPC) ratio for adverse outcomes in orthopedic surgery. **Material and Methods:** A retrospective cohort analysis was conducted on adults who underwent posterior spinal fusion between January 2022 and December 2023, and had computed tomography imaging and two-year follow-up data. AC and ACPC ratio were calculated using axial cross-sections at the L3 vertebral level. Postoperative complications were assessed, including 90-day wound-related events and 2-year mechanical complications (proximal junctional kyphosis [PJK], adjacent segment disease, instrumentation failure, and revision surgery). Receiver operating characteristic curve analyses were performed to evaluate the predictive performance of these measures. **Results:** Among 100 patients (mean age 64.6 ± 11.9 years; 64.0% female), wound-related complications occurred in 13.0%, and mechanical complications were observed in up to 12.1% of patients. BMI significantly predicted wound-related complications (AUC = 0.669, $p = 0.017$). In contrast, AC and ACPC ratio significantly predicted PJK (AUC = 0.776 and 0.765, respectively; $p = 0.004$), adjacent segment disease (AUC = 0.745 and 0.717, respectively; $p \leq 0.012$), and revision surgery (AUC = 0.809 and 0.810, respectively; $p \leq 0.002$). Optimal cutoff values associated with elevated revision risk were 118.3cm for abdominal circumference and 1.4 for the ACPC ratio. **Conclusion:** Radiographically-derived measures of central obesity, particularly AC and ACPC ratio, outperform BMI in predicting several mechanical complications following spinal fusion. These findings support the integration of CT-based adiposity assessments into preoperative planning, and more prospective studies are needed to better stratify surgical risk and improve postoperative outcomes

ID: AGS26/1743
P0371: Pain tolerance perceptions and postoperative opioid use in lumbar fusion: physician estimates outperform patient self-assessment

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Introduction: The opioid crisis in the United States has prompted reevaluation of postoperative pain management strategies, particularly in spine surgery where patients often present with chronic pain. Predicting which patients will have high opioid needs or severe postoperative pain remains a challenge. This study evaluated the relationship between patient self-reported pain tolerance, physician assessments, and postoperative outcomes following lumbar fusion. **Material and Methods:** This prospective cohort study included 30 patients undergoing single- or multi-level lumbar spine fusion at a single academic center. Exclusions were age < 18 years and surgery for infection, trauma, or malignancy. Prior to surgery, patients rated their own pain tolerance (0-10) and compared themselves to peers (0-4). Surgeons rated patient pain tolerance (0-10) and estimated postoperative opioid requirements (0-10). Outcomes included hospital length of stay, total opioid consumption, and cumulative pain scores over postoperative days 1-14. Correlations were assessed using Spearman's rank; multivariate regression evaluated demographic and clinical predictors. **Results:** Mean age was 67 ± 13.7 years, 57% were female, and mean BMI was 30.4 ± 6.7. Physicians rated patient pain tolerance significantly lower than patients rated themselves (5.37 ± 2.34 vs. 6.67 ± 2.09; $p = 0.027$). Neither patient- nor physician-reported pain tolerance predicted opioid use, pain scores, or hospital stay. However, physician-estimated opioid needs correlated with actual opioid consumption ($r = 0.484$; $p = 0.008$) and cumulative pain scores ($r = 0.442$; $p = 0.016$). Patients who rated themselves as having higher pain tolerance than peers had longer hospital stays ($r = 0.356$; $p = 0.047$). No demographic or clinical variables were associated with opioid use or pain scores. **Conclusion:** Patient self-reported pain tolerance did not predict postoperative pain or opioid requirements after lumbar fusion. In contrast, physician-estimated opioid needs correlated with both analgesic use and pain scores, suggesting surgeons may have meaningful insight into postoperative pain trajectories. Incorporating physician judgment into preoperative planning may improve individualized opioid prescribing and optimize pain management strategies**.** This ongoing study will expand the cohort to validate these preliminary findings.

ID: AGS26/1744
P0372: Preoperative GLP-1 receptor agonist use and short term outcomes after lumbar decompression: a matched cohort study

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Introduction: Lumbar decompression is a common surgical intervention for symptomatic spinal stenosis and related conditions, aimed at alleviating pain and improving mobility. GLP-1 receptor agonists, known for their glucose-lowering, weight-reducing, and anti-inflammatory properties, are increasingly

prescribed to patients who may also undergo surgery. However, their potential impact on surgical outcomes remains underexplored. This study investigates the association between GLP-1 receptor agonist use and surgical outcomes following lumbar decompression, focusing on short-term complications (45-day and 90-day outcomes). **Material and Methods:** Utilizing the TriNetX database spanning 101 healthcare organizations, we conducted a retrospective cohort analysis. Patients undergoing lumbar decompression (identified by CPT codes) between 2014 and 2023 were stratified into GLP-1 users and matched controls through propensity score matching (1:1). Matching controlled for demographics and comorbidities, including diabetes, hypertension, and chronic kidney disease. Outcome assessments focused on short-term complications at 45 and 90 days, including medical complications (sepsis, renal failure, MI, readmission) and mechanical complications (reoperation, wound disruption). Statistical analyses included risk ratios, risk differences, and p-values. **Results:** 7,002 patients were included in the study; 3,501 GLP-1 users and matched controls. Baseline characteristics were well-balanced between matched cohorts. At 45 days, GLP-1 users exhibited a lower rate of sepsis compared to controls (0.9% vs 1.5%; RR = 0.566, p = 0.011) and renal failure (2.5% vs 3.3%; RR = 0.748, p = 0.038). At 90 days, GLP-1 users had decreased risks of sepsis (1.1% vs 2.1%; RR = 0.541, p = 0.001), renal failure (3.1% vs 4.4%; RR = 0.712, p = 0.006), myocardial infarction (0.6% vs 1.0%; RR = 0.583, p = 0.046), and hospital readmissions (9.8% vs 11.3%; RR = 0.868, p = 0.043). **Conclusion:** Our findings suggest that preoperative GLP-1 receptor agonist use in lumbar decompression patients is associated with a reduced risk of several short-term medical complications. The decreased rates of sepsis, renal failure, myocardial infarction, and hospital readmissions suggest potential perioperative benefits. These results warrant further investigation into the broader impact of GLP-1 RAs on surgical outcomes and may inform perioperative management strategies for patients on these medications undergoing lumbar decompression.

ID: AGS26/1765
P0373: Correlation between lumbar disc herniation and facet joint inflammation: a comprehensive MRI-based cohort study of 303 patients

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Introduction: Low back pain (LBP) is a leading cause of disability worldwide, often arising from complex interactions within the spinal three-joint complex. Lumbar disc herniation (LDH) and facet joint (FJ) inflammation are common pain generators that frequently present with overlapping symptoms, complicating diagnosis and management. Although both entities have been extensively studied, the correlation between LDH severity and FJ inflammation remains poorly defined. This study aimed to investigate the relationship between LDH severity and FJ inflammatory changes using a large MRI-based cohort. **Material and Methods:** A retrospective cohort of 303 patients (161 females, 142 males; mean age 45.5 ± 12.3 years) who underwent lumbar MRI for LBP between 2023 and 2024 was analyzed. LDH severity was graded using the Michigan State University (MSU) classification, which stratifies herniations by size and location. FJ inflammation was scored on a 0-3 scale incorporating joint effusion, bone marrow edema, and soft tissue edema. Two blinded radiologists independently evaluated all images. Level and side of LDH and FJ inflammation were recorded. Patients were stratified into two age groups: < 40 years (n = 140; age range 20-39) and ≥ 40 years (n = 163; age range 40-79) for subgroup analyses. Correlation analyses were performed using Spearman's rho. **Results:** The most frequently affected levels were L4-L5 (44.6%) and L5-S1 (41.2%). LDH severity demonstrated a significant positive correlation with FJ inflammation score ($\rho = 0.314$, $p < 0.001$) and with the side of FJ inflammation ($\rho = 0.276$, $p < 0.001$). FJ inflammation score was strongly correlated with the side of inflammation ($\rho = 0.945$, $p < 0.001$). Edema was most frequently ipsilateral to the herniated disc, consistent with the observed correlation between mechanical compression and local inflammatory response. Age group analysis revealed no significant differences in LDH or FJ scores; however, weak negative correlations were observed between age and herniation level ($\rho = -0.180$, $p = 0.002$) as well as age and side of herniation ($\rho = -0.120$, $p = 0.036$). **Conclusion:** This study demonstrates that higher LDH severity is associated with greater ipsilateral FJ inflammation, supporting the hypothesis of biomechanical and inflammatory interaction between these structures. The findings highlight the importance of considering concomitant FJ pathology in patients with LDH to improve diagnostic accuracy and guide individualized management strategies for LBP.

ID: AGS26/1843
P0374: Exploring lumbar-hip muscle interactions with MRI-based quantification

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Introduction: Hip and spine disorders commonly coexist and negatively affect patient function and surgical outcomes. While degeneration of paraspinal muscles has been extensively studied, considerably less is known about hip musculature and its contribution to spinal pathology. Currently, no standardized terminology exists to describe hip muscle quality. Establishing such a framework is clinically relevant, given the role of periarticular muscles not only in hip arthroplasty, and degenerative joint disease but also in spinal alignment and postoperative recovery. We hypothesized that hip muscle degeneration reflects region-specific and compensatory adaptations within the hip-spine axis, rather than a generalized systemic sarcopenic process. To evaluate this, we examined correlations between lumbar and hip muscle composition using MRI-based quantitative techniques, adapting established methods from paraspinal to hip musculature. **Material and Methods:** This retrospective study included patients who underwent spinal fusion at a single tertiary orthopedic center between 2017 and 2023. Institutional Review Board approval was obtained. Patients were eligible if both lumbar and pelvic MRI scans were available within one year preoperatively. Exclusion criteria included previous fusion, total hip arthroplasty, or inadequate imaging quality. Muscle quality was assessed using lumbar T2-weighted and hip proton density-weighted axial MRI. At L4, psoas, multifidus, and erector spinae were segmented. At the greater trochanter level, six hip muscles (gluteus minimus, medius, maximus, tensor fasciae latae, sartorius, rectus femoris) were analyzed. Measurements included cross-sectional area (CSA), functional CSA (fCSA), and fatty infiltration (FI). Bilateral values were summed. Spearman's correlations were applied, with multiple comparisons adjusted via the Benjamini-Hochberg procedure. **Results:** Of 143 screened patients, 31 met inclusion criteria (71% female; mean age 63.5 ± 10.0 years; BMI 25.9 ± 4.6). Moderate correlations were observed between lumbar and hip muscle degeneration. Erector spinae FI correlated negatively with sartorius FI ($\rho = -0.508$, $p = 0.005$) and rectus femoris FI ($\rho = -0.483$, $p = 0.008$). Multifidus FI was inversely related to tensor fasciae latae FI ($\rho = -0.396$, $p = 0.019$). In contrast, positive correlations were found between erector spinae and multifidus fCSA and gluteus minimus FI ($\rho = 0.626$, $p < 0.05$). However, after correction for multiple testing, none of these associations remained statistically significant. **Conclusion:** While no associations remained statistically significant after adjustment, directional trends suggest that lumbar and hip muscle degeneration may be interdependent rather than parallel. Negative correlations between paraspinal and hip FI may reflect compensatory recruitment, whereas positive associations between lumbar fCSA and hip FI point to regional load redistribution. These findings support the emerging concept of Hip-Specific Sarcopenia, emphasizing region-specific adaptations rather than generalized sarcopenia. Adapting MRI-based methods from paraspinal to hip musculature proved feasible and underscores the need for a standardized vocabulary to define hip muscle health. Future studies with larger cohorts should establish normative reference values, integrate alignment and gait analyses, and expand phenotyping across the hip-knee-spine axis. Such a framework may improve individualized surgical and rehabilitation strategies for patients with concurrent hip and spine disorders.

ID: AGS26/1876
P0375: Reconsideration of hyperintensity zones - Classification, distribution and their association with MRI phenotypes - A retrospective study

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Introduction: Hyperintensity zone (HIZ) are characterized as focal T2-weighted hyperintensities in the posterior annulus of the disc. Lumbar HIZ is related to a concordant pain response on discography and it is a significant Magnetic resonance imaging (MRI) biomarker for the diagnosis of low back pain. Symptomatic HIZs are associated with a signal intensity of ≥ 50% of the cerebrospinal fluid (CSF). Histologically these zones are either due to presence of vascularized granulation tissue and resulting oedema or due to Mucoid fluids containing fat. There are two distinct types of HIZ's one, Traditional T2-hyperintense and T1-hypointense known as "single-HIZ", which indicate annular disruption and painful in presentation, two, T1- and T2-intense called "dual-HIZ" related to calcified or ossified tissue and non-painful in nature. Currently no standardized classification system for researchers to classify morphological/topographical traits of HIZ and most descriptions are based solely upon T2 weighted MRI. Coupling of T2W, T1W and FLASH MRI sequences useful to elaborate upon various HIZ phenotypes, and its correlation to endplate changes, which helps to shed light upon their clinical relevance and decision-making. Purpose of study is to find out distribution and specific patterns of HIZ. **Methods:** Ninety-five subjects presenting with HIZ in MRI were included in this study (58 male, 37 females; mean age 31 ± 10.30 years). The demographic profile of the eligible patients will be noted in a proforma including age, sex, BMI, and occupation. The MRI showing hyperintensity zones noted based on location as anterior, posterior, superior or inferior end plate, intra-protrusion, marginal. Level of involvement and whether involved in disease segment, end plate changes, Type based on MRI sequence documented. Any correlation in above parameters were statistically analysed. **Results:** The prevalence of HIZ in the overall lumbar spine were 47.3% and commonly found at L4/5 (32.5%) and L5/S1 (47.0%). T2W high -intensity type of HIZ was most prevalent (71.8%), followed by T1W low intensity (6.8%). Of all discs, round types were most

prevalent (37.7%) followed by rim type (10.6%). At all affected levels, there was a significant association between HIZ and disc degeneration, disc bulge/protrusion and Modic type II ($p < 0.01$). Posterior HIZ and T2W high-intensity type of HIZ were significantly associate with disc bulge/protrusion and disc degeneration ($p < 0.01$). **Conclusion:** This study will bring out the advantage of coupling T1, T2 & FLASH weighted sequence which poorly discussed in the literature. Specific HIZ sub-phenotypes were found in specific MRI degenerative changes. The study data will influence the decisions in standardising the consideration of HIZ in fusion of lumbar levels.

ID: AGS26/1899
P0376: Outcomes of single and multilevel direct lumbar interbody fusion (DLIF) in a single Australian tertiary centre over 10 years

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Introduction: DLIF is a well-established surgical intervention for managing degenerative diseases of the lumbar spine. This approach is increasingly preferred due to its ability to insert large interbody cages while avoiding injury to critical blood vessels, minimising muscle disruption, and requiring only a small incision. Despite its growing popularity, long-term outcomes and effectiveness remain underexplored in the literature. This study aims to address this gap by presenting the outcomes of patients who underwent single-level and multilevel DLIF at a tertiary centre in Tasmania over the past 10 years. **Method:** This is a retrospective cohort study that includes all adult elective DLIF cases done from July 2014 to September 2024 at the Royal Hobart Hospital by a single neurosurgeon. Demographic data (age, gender, BMI), comorbidities(smoking status, diabetes), operative details(number of levels fused, indication and the use of self-locking mechanism), and outcomes were extracted from clinical records. Radiographical fusion status was determined by reviewing XRs or CTs of the lumbar spine that were taken at least 6 months after the operation. Early (< 30 days) and late (> 30 days) post-operative complications were recorded. Fisher's exact test was used to calculate the odds ratio (OR) for fusion according to smoking, diabetes and single- vs multilevel surgery. Logistic regression was attempted to assess the independent predictors of the fusion. Confidence intervals (95% CI) for proportions were calculated using Wald methods. **Result:** The mean age of the cohort was 63.7 years, with a mean BMI of 28.7. The majority of the patients were female (71.4%). Smokers and patients with diabetes were present in 28.6% and 20% of the cohort. Single-level procedures accounted for 30% of the cases, with the remainder undergoing multilevel DLIFs. Overall, fusion was achieved in 91.4% of the patients. Fusion rates in non-smokers are higher than in smokers (93% vs. 86%), but the difference is not statistically significant (OR 0.26, $p = 0.48$). The fusion rates for single-level vs. multilevel DLIFs did not show any significant difference. Logistic regression did not identify any independent predictors of fusion rates. Early complications (< 30 days) occurred in 20% of the cohort and are most commonly wound infection. 10% of the cohort developed late complications (> 30 days) such as an instrumental complication. Smoking status and level of operation did not cause any significant difference in complication rate. Also, the fusion rates and complication rates of self-locking vs non-self-locking groups did not have statistically significant differences. **Conclusion:** DLIF remains a promising option for managing degenerative lumbar spine disease in Tasmania, as demonstrated by high radiographic fusion rates and complication rates consistent with global data. While no independent risk factors for fusion success were identified due to sample size limitations, the results highlight the procedure's overall effectiveness. Given these limitations, further studies with larger sample sizes are needed to identify potential risk factors for fusion and post-operative complications, helping to optimise patient selection and improve DLIF outcomes.

ID: AGS26/1917
P0377: Elevated lumbar subcutaneous fat tissue thickness and Schmorl's nodes in patients with total hip arthroplasty

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Introduction: Total hip arthroplasty (THA) is a standard treatment for advanced hip osteoarthritis, and patients requiring THA often present with coexisting degenerative changes in the lumbar spine. The interdependence of hip and spine pathology (sometimes described as a hip-spine syndrome) suggests that altered biomechanics or shared risk factors (e.g. obesity) could link these conditions. However, it remains unclear whether individuals with THA exhibit distinct lumbar degenerative features compared to those without THA. This study aimed to compare lumbar spine degenerative changes and tissue characteristics between THA patients and matched controls without THA. **Material and Methods:** We retrospectively compared 131 patients with THA to 128 age- and sex-matched individuals without THA. All subjects had lumbosacral spine magnetic resonance imaging (MRI)

available for analysis. MRI scans were assessed for subcutaneous fat tissue thickness at each intervertebral level from L1-L2 through L5-S1, the presence of Schmorl's nodes at these levels, Modic changes, intervertebral disc degeneration grades, and paraspinal muscle fatty infiltration scores (multifidus, erector spinae, and psoas muscles). Group differences were analyzed using appropriate statistical tests (non-parametric tests for continuous variables; chi-square/Fisher's exact tests for categorical variables). Multiple comparisons across levels were adjusted with a false discovery rate correction. **Results:** The THA and control groups were similar in age and sex distribution. Patients with THA demonstrated significantly greater subcutaneous fat tissue thickness at all lumbar levels compared to controls (mean thickness range 22.7-39.0 mm in THA patients vs 9.07-24.1 mm in controls across L1-S1; adjusted $p < 0.001$ at each level). Schmorl's nodes were also more prevalent in the THA group, with significantly higher rates of Schmorl's nodes at the L1-2, L2-3, L3-4, L4-5 and L5-S1 levels in THA patients than in controls (all adjusted $p < 0.05$). By contrast, there were no statistically significant differences between groups in the presence of Modic changes at any lumbar level, the grades of intervertebral disc degeneration, or the paraspinal muscle fatty infiltration scores. **Conclusion:** THA patients exhibited greater lumbar subcutaneous fat tissue thickness and more Schmorl's nodes than matched controls, with no differences in Modic changes, disc degeneration, or paraspinal muscle fatty infiltration. These associations may reflect shared systemic factors (adiposity/metabolic dysregulation, reduced bone quality) or long-standing spinopelvic/gait adaptations that increase endplate loading. Recognizing these differences may help inform comprehensive management of spine health in patients undergoing hip arthroplasty.

ID: AGS26/2141
P0378: Surgical management of symptomatic Bertolotti syndrome: operative experience and clinical follow-up of three patients

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Introduction: Bertolotti syndrome (BS) is an uncommon but clinically relevant cause of chronic low back pain, associated with a lumbosacral transitional vertebra (LTV) in which the transverse process of L5 articulates with the sacrum or ilium. Diagnosis requires correlation of clinical and radiological findings, and is confirmed by selective injection of local anesthetic with corticosteroids into the transitional joint. For patients refractory to conservative treatment, surgical resection of the symptomatic mega-transverse process has been described as a therapeutic option. **Objective:** To report a series of three patients with Castellvi type IIa BS managed surgically with resection of the symptomatic transverse process, including operative details and clinical outcomes. **Methods:** All patients presented with symptomatic BS, confirmed by diagnostic injection and absence of significant disc degeneration or adjacent osteoarthritis. Resection of the symptomatic transverse process was performed via a Wiltse-type approach, with intraoperative navigation in two cases. Surgical complications, pain relief, functional outcomes, and return to baseline activities were evaluated with a minimum follow-up of six months. **Results:** No intraoperative or postoperative complications occurred. All three patients experienced complete pain resolution, functional recovery, and return to previous activities, with no recurrence during follow-up. **Discussion and Conclusion:** Our findings support surgical resection as an effective treatment for carefully selected patients with symptomatic BS, particularly in the absence of disc degeneration, adjacent osteoarthritis, or Castellvi type III fusion. Proper case selection and use of intraoperative navigation enable precise resection with low morbidity. Larger prospective studies with long-term follow-up are warranted to further define the role of surgery in BS management.

ID: AGS26/2213
P0379: Pelvic morphotype influence on surgical outcomes of TLIF vs PLF in degenerative spondylolisthesis: toward a personalized approach

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Introduction: Spinopelvic parameters-namely pelvic incidence (PI), pelvic tilt (PT), and sacral slope (SS)-play a critical role in sagittal balance and influence surgical strategy in degenerative spondylolisthesis. Pelvic morphotype, defined by the dynamic relationship among these parameters (anteverted vs retroverted pelvis), may affect outcomes depending on the fusion technique employed. This study investigates whether pelvic morphotype correlates with differential outcomes following transforaminal lumbar interbody fusion (TLIF) versus postero-lateral fusion (PLF). **Material and Methods:** A retrospective analysis was conducted on patients operated for single-level degenerative spondylolisthesis (L4-L5 or L5-S1) between 2017and 2023. Patients were stratified by surgical technique (TLIF vs PLF) and preoperative pelvic morphotype (anteverted: $PI < 45°$, $SS > 35°$, $PT < 15°$; retroverted: $PI > 60°$, $SS < 30°$, $PT > 20°$). Clinical outcomes

were assessed using Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) scores at 12 months postoperatively. Radiological parameters included segmental lordosis gain and fusion rate. Multivariate regression was used to adjust for potential confounders. **Results:** A total of 70 patients (36 TLIF, 34 PLF) were included. In the retroverted subgroup, TLIF demonstrated superior outcomes compared to PLF in terms of ODI improvement (-18.7 vs -17points, $p < 0.0001$), segmental lordosis restoration (+3.2° vs +00°, $p < 0.001$), and fusion rate (91.7% vs 85.3%, $p < 0.05$). In anteverted morphotypes, clinical and radiological outcomes did not significantly differ between techniques. Higher preoperative PT was a strong predictor of improved sagittal alignment with TLIF ($\beta = 52.2$, $p < 0.01$). **Conclusion:** Pelvic morphotype significantly influences the biomechanical and clinical outcomes of fusion techniques in degenerative spondylolisthesis. TLIF provides greater sagittal correction and clinical benefit in patients with a retroverted pelvis. These findings support a morphotype-driven surgical planning paradigm to optimize technique selection and long-term outcomes.

ID: AGS26/2223
P0380: Degenerative spondylolisthesis grade 1: is fixation necessary?

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Introduction: Degenerative spondylolisthesis is a common condition in the elderly, often presenting with chronic low back pain, with or without radiculopathy. The therapeutic approach, especially the indication for spinal fixation in stage 1, remains debated. This study aims to evaluate the necessity of fixation in such cases. **Material and Methods:** We conducted a retrospective comparative study on patients operated for grade 1 degenerative spondylolisthesis between 2017 and 2022. Outcomes were assessed using the Visual Analog Scale (VAS) for pain, the Oswestry Disability Index (ODI) for function, and postoperative complications at 6 and 18 months. **Results:** A total of 27 patients (mean age: 64.6 years; mean follow-up: 2.6 years) were included. Isolated low back pain was present in 14.8% of cases, while 85.2% had associated radicular symptoms. Patients were divided into two groups: Group A ($n = 18$) underwent spinal fixation. Group B ($n = 9$) underwent decompression only. At 18 months, both groups showed significant clinical improvement. VAS scores improved from 7.05 to 2.88 (Group A) and from 7.55 to 3.55 (Group B) ($p = 0.82$). ODI scores improved from 18.38 to 7.83 (Group A) and from 17.88 to 8.00 (Group B) ($p = 0.71$). There was no statistically significant difference between the groups. Symptom recurrence was higher in Group B (22.2%) than in Group A (16.6%), but this difference was also not significant ($p = 1$). **Conclusion:** While fixation in grade 1 degenerative spondylolisthesis may offer better functional outcomes and a lower recurrence rate, the differences are not statistically significant. A tailored approach based on patient-specific factors remains crucial. Further prospective studies are needed to clarify the optimal indications for fixation in this setting.

ID: AGS26/2316
P0381: Utility of the L1 pelvic angle (L1PA) for assessment of sagittal alignment of the lumbar spine following short segment fusion: comparison to segmental measures

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Introduction: The Lumbar Pelvic Angle (L1PA) was introduced as a convenient intraoperative and postoperative measure of sagittal alignment. However, the utility of L1PA for short segment lumbar fusions remains incompletely understood. This study investigates the relationship between L1PA and segmental parameters of spinal alignment for short segment lumbar fusions. **Material and Methods:** This retrospective analysis was conducted on adult patients with degenerative conditions undergoing primary spinal fusion surgery between L4 and S1. Patients with < 5° change in L1PA from pre- to postoperative measurements were stratified into two groups: those (1) achieving > 35° of regional lordosis at L4-S1 postoperatively and (2) those with > 5% change in Lumbar Distribution Index (LDI). Spinopelvic parameters were compared between preoperative and postoperative measurements. **Results:** The study cohort included 539 patients, of which 360 (66.8%) had an L1PA change less than < 5° pre- to postoperatively. Patients in both Group 1 and 2 had significant increases in the L5-S1 segmental angle (both $p < 0.001$) without a significant change at the L4-L5 segment. In Group 2, there was a significant increase in PI-LL mismatch ($p < 0.001$). In both groups there was a significant increase in L4-S1 lordosis, a relaxation in L1-L4 lordosis (both $p < 0.001$), and no significant change in total LL. **Conclusion:** This investigation assessed L1PA in over 500 patients undergoing lumbar fusion between L4 and S1 and found that despite value to the measure, important changes to spinal shape and segmental alignment may occur even in the face of Δ L1PA < 5°. As such, L1PA serves as a potentially useful adjunct to clinical assessment and radiographic measurement

in lumbar degenerative fusion but should not serve as a standalone measurement.

ID: AGS26/2320
P0382: Effect of transforaminal lumbar interbody cage position for patients with coronal disc asymmetry

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Introduction: Transforaminal lumbar interbody fusion (TLIF) can maintain intervertebral height and lordosis while providing disc space bony fusion. Despite its strengths, the standard placement of TLIF cages in the center of the intervertebral disc has been found to lead to worse radiological outcomes in patients with greater severity of coronal imbalance. The aim of this study is to investigate the effect of a lateralized TLIF placement, in the lateral third of the disc space, as a method to achieve coronal plane correction. **Material and Methods:** Adults undergoing TLIF at a large academic institution were identified. Segmental, L1-S1 cobb angle, and L1-S1 lordosis was measured at baseline and on follow up. Cage placement was classified as lateralized (placement of cage in the central third of disc space) or standard (placement in the lateral third of disc space) by assessing AP radiographs at 6-weeks. Multivariate linear regression was used to investigate the association between lateralized vs standard lumbar cage placement and postoperative cobb angle correction, to perform sensitivity analysis on patients who received single level TLIF at L4-L5, to investigate the effect of cage placement on L4-L5 cobb angle and L1-S1 cobb angle. Additionally, the association between symmetry of cage placement and correction of L1-S1 lordosis was assessed. Effect of symmetric vs asymmetric cage placement on incidence of cage subsidence and rate of pseudoarthrosis was evaluated using chi-square analysis. **Results:** 501 patients with single-level lumbar fusion were included with mean age 61.2 years, mean CCI 2.69, and 55.0% female. Preoperatively, mean L1-S1 cobb angle was 4.4°, and postoperative cobb angle was 3.8°. Preoperative mean L1-S1 lordosis was 49.46°, and postoperative lordosis had a mean of 48.9°. In this cohort, 108 (21.6%) patients received lateralized cages. Multivariable linear regression model controlling for age, gender, BMI, and CCI revealed that lateralized cage placement was associated with greater correction of L1-S1 Cobb angle (3.93° vs 3.15°, p = 0.014). Assessment of cobb angle correction only in patients fused at L4-L5 showed a correlation between lateralized cage placement and increased postoperative L1-S1 Cobb angle correction (3.77° vs 2.75°, p = 0.025). Assessment of association between cage placement location and L4-L5 Cobb angle correction showed that lateralized cage placement was associated with increased cobb angle correction (2.8° vs 2.08°, p = 0.033). Assessment of lordosis correction showed no significant association with cage location (- 0.99° in the lateralized group vs. - 0.73° in the standard group, p = 0.819). Chi square analysis of cage placement and incidence of subsidence in L4-L5 fusion patients found a higher rate of subsidence in lateralized placed cages (9.5% asymmetric vs 2.1% symmetric, p = 0.05). There was no statistically significant difference in the rate of pseudoarthrosis between groups (5.2% lateralized vs 5.3% standard; p = 0.98). **Conclusion:** Lateralized TLIF cage placement may provide greater coronal plane correction in patients with segmental disc asymmetry when compared to standard cage placement and appears to be achieved without compromising sagittal correction. These results may assist with optimized cage placement in patients with asymmetric lumbar disc collapse.

ID: AGS26/2329
P0383: Radiographic and clinical outcomes following L5-S1 anterior lumbar interbody fusion: the ALIF learning curve

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Introduction: Over the course of their careers, spine surgeons refine patient selection, surgical planning, and intraoperative workflow. Radiographically, they may also achieve greater disc height and segmental lordosis correction, improving global sagittal alignment. However, whether this is the case in degenerative lumbar disc disease patients undergoing L5-S1 anterior lumbar interbody fusion (ALIF) has not previously been studied. **Material and Methods:** Adult patients who underwent L5-S1 ALIF with or without posterior fixation for degenerative disc disease between June 2017 and December 2024 by a single surgeon were included. Patients were stratified into Early (from licensing to December 2020), Middle (January 2021 to December 2022), and Recent (January 2023 to December 2024). Demographics, radiographic alignment, in-hospital outcomes, and 2-year complication and reoperation rates were compared by career stage.

Multivariate logistic and linear regression adjusted for age, sex, BMI, comorbidities, prior fusion, and posterior instrumentation was conducted to assess the effect of continuous surgeon experience. **Results:** A total of 203 ALIFs were performed (mean age 57.6 years, 50.7% female, mean Charlson Comorbidity Index 2.1). Recent cases showed greater PT reduction (Early = 0.9°, Middle = -1.5°, Recent = -2.2°, p = 0.039), improved PI-LL mismatch correction (-0.4°, -4.8°, -5.4°, p = 0.007), higher L5-S1 lordotic correction (6.7°, 8.4°, 11.4°, p = 0.003), lower blood loss (21.9 mL, 13.8 mL, 10.0mL, p = 0.006), shorter OR time (107.4 min, 86.6 min, 75.2 min, p < 0.001), and fewer mechanical complications (39.3% vs 13.7%, p < 0.001) and reoperations (10.7% vs 2.1%, p = 0.023). Regression showed that each additional year of experience predicted improved alignment, lower blood loss and OR time, and reduced odds of complications (OR = 0.54, p < 0.001) and reoperations (OR = 0.49, p = 0.015). **Conclusion:** Surgeon experience was associated with improved sagittal alignment, in-hospital outcomes, and reduced odds of complication and reoperation following L5-S1 ALIF.

ID: AGS26/2332
P0384: Cage subsidence after L4-L5 TLIF: effect of overcorrecting segmental lordosis

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Introduction: Degenerative changes in the lumbar spine can contribute to loss of segmental and regional lordosis, which may be associated with low back pain, radiculopathy, fatigue, and muscle imbalances from postural instability. Proper restoration of lordotic curvature is a primary goal of surgical intervention through fusion approaches such as transforaminal lumbar interbody fusion (TLIF). This study evaluates the impact of lordotic correction achieved by TLIF on postoperative radiographic and clinical outcomes. **Material and Methods:** Adults who underwent TLIF at the L4-L5 level were identified. L4-L5 lordosis and disc heights were measured at baseline and at the 6-week, 1-year, and 2-year follow-ups. Cage subsidence was defined as loss of disc height of 2mm or more. Association between surgical lordotic correction and postoperative loss of disc height was evaluated using linear regression analysis. Association between changes in L4-L5 lordosis angles and presence of radiographic postoperative cage subsidence at each timepoint was evaluated using repeated-measures ANOVA. Impact of preoperative lordosis angle and degree of surgical lordotic correction on postoperative subsidence was evaluated using binary logistic regression. **Results:** In total, 142 patients with 2-year follow-up were included with a mean age of 60.0 years, mean CCI of 2.5, and 63.3% of female sex. Preoperatively, mean L4-L5 lordosis was 13.1° and mean L4-L5 disc height was 10.9 mm. Postoperatively, mean L4-L5 lordosis was 14.9° and mean L4-L5 disc height was 13.4 mm at 6 weeks, 14.2° and 12.7 mm at 1 year, and 13.6° and 11.9 mm at 2 years. In this cohort, 39 (27%) patients developed cage subsidence. Multivariable linear regression model controlling for age, BMI, and sex revealed that greater L4-L5 lordosis restoration was associated with greater disc height loss at 1 year (β = 0.091, p < 0.001). Repeated-measures ANOVA showed a visit-dependent correlation between L4-L5 lordotic changes and the presence of radiographic subsidence (p < 0.001). Mean preoperative L4-L5 lordosis was 12.7° in subsided patients and 13.4° in non-subsided patients. Non-subsided patients showed stable or slightly increased L4-L5 lordosis after surgery (6-week = 14.0°, 1-year = 15.2°, 2-year = 14.9°), while subsided patients showed notable postoperative loss of lordosis (6-week = 15.9°, 1-year = 13.1°, 2-year = 12.4°). Binary logistic regression showed that preoperative lordosis angle was not correlated with the development of postoperative subsidence ((p = 0.279) but degree of surgical lordotic correction was correlated (p = 0.012). **Conclusion:** Overcorrection of segmental lumbar during L4-L5 TLIF predisposes patients to disc height loss and cage subsidence. Further investigation is warranted to determine how long-term alignment may be optimized during interbody fusion procedures.

ID: AGS26/2347
P0385: Neuromodulation for Postoperative Low Back Pain After Lumbar Spine Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials with Trial Sequential Analysis and Meta-Regression

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Introduction: Acute and chronic postoperative low back pain are frequent complications after lumbar spine surgery, contributing to long-term disability and increased analgesic use. Neuromodulation techniques-both invasive and non-invasive-have emerged as promising non-pharmacological interventions. However, current evidence remains fragmented. This systematic review and meta-analysis aimed to evaluate the effectiveness and safety of neuromodulation in managing acute and chronic postoperative low back pain. **Materials and Methods:** We systematically searched PubMed, Scopus, and Cochrane databases up to 30 June 2025 for randomized controlled trials comparing neuromodulation to sham modulation in patients with postoperative low back pain following lumbar spine surgery. Primary outcomes included pain intensity reduction, analgesic consumption, functional disability, and adverse effects. Standardized mean differences (SMDs) with 95% confidence intervals (CIs) for continuous outcomes were calculated using a frequentist random-effects model. Proportions and 95% CIs for binary outcomes, including adverse events and sex distribution, were computed using the Freeman-Tukey double arcsine transformation to stabilize variance. Heterogeneity was assessed using the I^2 statistic and Cochran's Q test. **Results:** Twelve RCTs involving 413 patients (mean age 53 years; 55% female) were included, with 207 (50%) receiving neuromodulation. In the pooled analysis, neuromodulation significantly reduced pain intensity (SMD -0.82; 95% CI [-1.13, -0.50]; $p < 0.00001$; $I^2 = 53\%$) and analgesic consumption (SMD -0.91; 95% CI [-1.63, -0.20]; $p = 0.01$; $I^2 = 81\%$) compared to sham. No significant difference was found in functional disability (SMD -0.31; 95% CI [-0.85, 0.24]; $p = 0.28$; $I^2 = 44\%$). The pooled female proportion was 55% (95% CI [42.99, 66.95]; $I^2 = 73\%$), and the prevalence of adverse effects was 30.99% (95% CI [11.97, 53.80]; $I^2 = 77\%$), with higher rates observed in patients with chronic pain. **Conclusion:** This meta-analysis demonstrates that neuromodulation significantly reduces postoperative pain and opioid consumption after lumbar spine surgery, although it does not improve functional disability. Given the growing need for non-pharmacological pain management strategies, neuromodulation represents a promising evidence-based adjunct in postoperative care. Future high-quality RCTs should refine optimal protocols and evaluate long-term functional outcomes.

Keywords: neuromodulation, postoperative low back pain, FBSS, lumbar spine surgery

ID: AGS26/2378
P0386: Clinical outcomes after emergency surgical decompression for cauda equina syndrome (CES): is obesity a determining factor?

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Background: An elevated body mass index (BMI) has been shown as an associated risk factor for the spinal emergency Cauda Equina Syndrome (CES). However not much evidence exists for association between outcome of CES surgery and obesity. High BMI is linked to higher complications from lumbar spine surgery, and clinical outcomes can be affected by these adverse events. Our retrospective cohort study compared patient related outcome measures (PROMs) between obese (BMI > 30 kg/m2) and non-obese patients after surgical decompression for CES. **Methods:** Review of 32 consecutive patients undergoing surgery for CES in a single spinal unit between October 2021 and May 2024 were included. Baseline demographics, length of stay and perioperative complication data were collected from the National Health Service (NHS) Hospital Episode Statistics (HES) data. The British Spine Registry (BSR) provided prospective PROMs data including both EQ-5D and ODI scores. SPSS 29 was used to analyse data with significance accepted at $p < 0.05$. **Results:** 19 Female:13 Male patients were included with a median age of 61.5 (29-83) years. 13 (41%) patients were obese (8F:5M). Obese patients presenting with CES were younger than non-obese patients ($p = 0.027$). Multiple medical comorbidities correlated with advancing age ($p = 0.03$) in our study group. Significant residual post-operative pain presented in 13 (41%) patients and was associated with younger age ($p = 0.018$) but not obesity. At 6-month follow-up, the mean EQ-5D and ODI in the obese were worse than the non-obese, but not statistically significant ($p = 0.61$ and $p = 0.61$ respectively). There

was no significant difference in 30-day complication rates ($p = 0.54$) or operative length ($p = 0.59$) in the obese vs non-obese groups. **Conclusions:** Obese patients presenting with CES at a younger age tended to have reduced length of stays, but poorer clinical outcomes as observed by higher residual ODI and lower EQ-5D scores at both 6-months and 1 year when compared to non-obese patients. Complication rates or length of operation do not significantly differ between obese and non-obese patients. Surgeons and patients can utilise these findings in shared decision-making process and determining realistic expectations of surgical outcomes in CES.

ID: AGS26/2406

P0387: Association of GLP-1 receptor agonist use with risk of lumbar degenerative disease and spine surgery in patients with type 2 diabetes

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Introduction: This study aimed to evaluate whether treatment with glucagon-like peptide-1 receptor agonists (GLP-1 RAs) is associated with a reduced risk of lumbar degenerative disease (LDD) and lumbar spine surgery in patients with type 2 diabetes mellitus (T2DM). **Materials and Methods:** Data were obtained from the TriNetX Global Collaborative Network. Adult patients with T2DM who initiated GLP-1 RA therapy were matched 1:1 with non-users based on demographics, comorbidities, and concomitant medication use. Patients with pre-existing LDD or prior lumbar spine surgery were excluded. The primary outcome was the incidence of LDD, and the secondary outcome was lumbar spine surgery. Outcomes were assessed at 3- and 5-year intervals. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. **Results:** A total of 196,435 matched pairs were analyzed. At 3 years, GLP-1 RA users had a lower incidence of LDD compared with non-users (11.9% vs. 13.3%; OR 0.89, 95% CI 0.87-0.91). At 5 years, the difference was more pronounced (14.6% vs. 18.7%; OR 0.74, 95% CI 0.73-0.74). Lumbar spine surgery rates were similar at 3 years (0.4% in both groups; OR 1.03, 95% CI 0.93-1.14), but significantly lower among GLP-1 RA users at 5 years (0.5% vs. 0.6%; OR 0.86, 95% CI 0.78-0.92). **Conclusions:** Use of GLP-1 RAs was associated with a reduced long-term risk of developing LDD and requiring lumbar spine surgery in patients with T2DM. These findings suggest that GLP-1 RAs may have potential as disease-modifying agents for spinal health.

ID: AGS26/2415

P0388: Frailty Index as a predictor of outcomes in lumbar fusion surgery

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Introduction: Frailty is increasingly recognized as a predictor of poor surgical outcomes, yet its impact in elective lumbar fusion remains underexplored. This study evaluates frailty index as a determinant of perioperative risk and long-term recovery in lumbar fusion patients. **Material and Methods:** We retrospectively reviewed 126 patients undergoing posterior lumbar fusion (2022-2025). Frailty index was calculated using a 40-item deficit accumulation model. Outcomes included perioperative complications, length of stay, and postoperative ODI and SF-36 scores. Subgroup analysis stratified patients as robust, pre-frail, and frail. **Results:** Frailty strongly correlated with complications (frail: 38% vs robust: 12%, $p < 0.001$) and prolonged hospital stay (mean 9 vs 5 days, $p = 0.002$). At 1 year, robust patients achieved greater ODI and SF-36 improvements ($p < 0.01$). Pre-frail patients demonstrated intermediate outcomes, highlighting a gradient effect. Frailty remained an independent predictor after multivariate adjustment. **Conclusion:** Frailty index is a valuable predictor of outcomes in lumbar fusion surgery. Routine frailty screening can enhance risk stratification and guide perioperative optimization, improving recovery trajectories in vulnerable patients.

ID: AGS26/2429

P0389: Bone resorption around the annular closure deviceduring a postoperative follow-up of 8 years

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Study Design: Retrospective analysis of prospectively collected data. **Objective:** To identify the characteristics of bone resorption around the ACD. **Summary of Background Data:** ACD implantation is considered to be an effective means of preventing reherniation after microdiscectomy; however, there is an issue: bone may resorb around the ACD. The causes of vertebral bone resorption remain unexplored; no cases have been assessed the dynamics of changes in bone resorption around the ACD and it characteristics. **Methods:** 133 patients underwent ACD implantation after microdiscectomy, 61 of them were followed up for 8 years after surgery (Oswestry, VAS). Lumbar CT scans helped characterize the bone resorption area around the ACD. **Results:** The median of follow-

up was 85 [74; 93] months (from 73 to 105 months). The prevalence of bone resorption around the ACD was up to 63.5%, mainly around the polymer mesh of the ACD (70.0%). The resorbed bone volume increased with time and reached its maximum of 5.2 cm^3 (12% of the vertebral body volume) once a sclerotic rim developed around the bone resorption area. No differences in VAS pain intensity or in Oswestry Disability Index were found between patients with and without resorption ($p > 0.05$). The volume of the intervertebral disc before surgery is a predictor of bone resorption (OR = 0.79, p = 0.009): if it is less than 13.2 cm^3, the risk of bone resorption significantly increases ($p < 0.05$). **Conclusion:** ACD implantation is an effective way to reduce reherniation rates after microdiscectomy. The majority of patients (up to 63.5%) with implanted the ACD have vertebral bone resorption around it. The bone resorption area around the ACD mesh increases with time to up to 12% of the vertebral body volume - with no clinical symptoms or signs, though. The formation of a sclerotic rim prevents the bone resorption area from further growth. If the volume of the intervertebral disc before surgery is less than 13.2 cm^3, the risk of bone resorption significantly increases.

ID: AGS26/2431
P0390: The predictive factors for resorptionof lumbar disc herniation

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Purpose of the study: The aim of this study is to determine the term and identify the predictors of resorption of herniated lumbar disc herniation. **Material and methods:** This study is retrospective and is devoted to the study of two groups of patients - group I (herniated disc resorption), and group II - absence of resorption. All patients underwent MRI of the lumbar spine at the onset of first symptoms. A second study was conducted during the second visit, and based on MRI results, patients were divided into two groups. According to MRI findings, the following parameters were assessed: the degree of intervertebral disc degeneration according to Pfirmann, the degree of arthrosis of facet joints according to Grogan, type of disc herniation, degree of migration of hernial material according to Komori, Modic changes, state of closure plates according to Rajasekaran, presence of retrolisthesis and presence of dynamic resorption of herniated fragment. The Syngo.via workstation was used to measure the volume of the herniated fragment. On each section where a hernia was visible, it was traced in the sagittal plane. Then, the Syngo software isolated the hernia and calculated its volume. Resorption of a disc herniation was considered to be a decrease in its volume by more than 50% of the initial value, as well as mandatory relief of radicular pain syndrome. Identification of predictors for resorption was performed by building logistic regression models. Single-factor models were used to identify individual predictors associated with the target event. ROC analysis revealed maximum threshold values for continuous indicators according to the Youden's index. **Results:** The first group, in which spontaneous resorption was observed, included 141 patients. The second group, where no resorption occurred (group II), consisted of 93 participants. Statistically significant differences were found in several parameters: the average age of the patients in the second group was two years younger, the interval between MRIs was on average two months longer, and there were more hernias in the second group than in the first group. Gender, body mass index (BMI), retrolisthesis, and smoking habits did not differ significantly between the groups. Regarding the level of herniation, there were more cases at the L5-S1 level in group II. This, we believe, is associated with the higher incidence of hernias at this level. Using logistic regression models, we identified hernia size, Komori type of herniation, BMI, and Modic changes as significant factors in resorption. The volume of the herniated disc is more than 1.1 cm^3, and the lack of Modic changes of type II and type III, as determined by Komori, and a BMI below 30.24, increase the chances of herniated disc resorption. **Conclusion:** The average time for the resorption of a herniated lumbar disc is 5.5 months. Factors that predict the resorption of the hernia include type II and III according Komori classification (correspond to sequestered herniation). Other factors include the absence of Modic changes, a volume of disc herniation larger than 1.1 cm^3, and a body mass index (BMI) less than 30.24

Key words: lumbar disc herniation, resorption of the disc herniation.

ID: AGS26/2454
P0391: Lumbar fusion vs lumbar disc replacement for degenerative disc disease: spin bias in comparative systematic reviews and meta-analyses

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Introduction: Lumbar fusion (LF) has been historically recognized as the standard operative treatment for degenerative disc disease (DDD). However, lumbar disc replacement (LDR) has emerged as a promising alternative to LF. Systematic reviews and meta-analyses provide evidence-based insight to determine which procedure should be selected. One factor potentially undermining the credibility of systematic reviews and meta-analyses is spin bias, in which reporting of

results is distorted, intentionally or unintentionally, to favor one intervention over the other. This may mislead clinicians to prioritize interventions based on misconstrued results. This study aims to assess the presence and amount of spin bias in systematic reviews and meta-analyses comparing the outcomes of LF and LDR and find potential predictors of spin bias. **Material and Methods:** This study adhered to the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) guidelines. A search query using keywords was performed using PubMed, EMBASE, and Web of Science databases. Articles were first screened by title and abstract, and selected articles subsequently underwent full-text screening. Each step was performed by two independent authors. Each included study was assessed for the nine most severe types of spin bias as defined by Yavchitz et al in 2016. Each article was assessed using A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR-2) criteria for methodological quality categorizing each study as critically low, low, moderate, or high. Logistic and Poisson regression modeling were used to determine whether AMSTAR-2 rating, journal impact factor, or citations per year were predictive of the presence or number of types of spin. **Results:** 1,180 studies were imported for screening: 438 duplicates were removed, 742 studies were screened, and 22 met inclusion criteria. 8 (36.4%) studies were found to have at least one type of spin bias. Upon AMSTAR-2 assessment, 1 study was rated high, 5 were rated low, and 16 were rated critically low. The average impact factor of the publishing journal was 2.47, ranging from 0.71 to 3.7. The average citations per year was 4.53, ranging from 1.18 to 15.9. Binomial regression found that AMSTAR-2 rating above critically low (OR: 0.805, $p = 0.85$), impact factor (OR: 1.45, $p = 0.58$), and citations per year (OR: 0.765, $p = 0.212$) were not predictive of spin presence. Poisson regression found that AMSTAR-2 rating above critically low (IRR: 0.66, $p = 0.60$), impact factor (IRR: 1.36, $p = 0.50$), and citations per year (IRR: 0.84, $p = 0.21$) were not predictive of the number of types of spin present. **Conclusion:** Spin bias was identified in 36.4% of the systematic reviews and meta-analyses comparing LF and LDR for DDD. Spin bias must be combated to ensure spine surgeons are receiving accurate interpretations of evidence to guide clinical practice. The integrity of literature would likely benefit from publishing journals implementing systems to recognize and combat spin bias when reviewing articles for publication.

ID: AGS26/2551
P0392: Evaluating PLIF with cage and bone graft for degenerative spondylolisthesis: insights into clinical and radiological findings

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Introduction: Posterior lumbar interbody fusion (PLIF) is an effective and standard surgical procedure for patients with Lumbar canal stenosis & spondylolisthesis. The surgery involves a posterior approach to remove a damaged intervertebral disc, decompress neural structures, and facilitate a fusion between adjacent vertebrae. Modern PLIF technique involves the use of interbody cages, most commonly constructed from titanium that are strategically inserted into the disc space previously occupied by the damaged disc. Although the efficacy and outcomes of PLIF using interbody cages have been extensively reported in developed countries, there is a scarcity of published data from Bangladesh, where spine surgery is an evolving subspecialty. **Materials and Methods:** A prospective interventional study was conducted among 28 patients in the department of Orthopedic Surgery at Dhaka Medical College Hospital (DMCH) from January 2022 to December 2022. All the data were analyzed statistically by using Statistical Package for Social Science (SPSS). Results are presented as percentages and mean ± standard deviation (SD). A p-value of less than 0.05 was considered for statistical significance. **Result:** The study population had a mean age of about 51 years, with a female-to-male ratio of 1.6:1. Single-level involvement was identified in 60.72% of cases. At the final follow-up, a significant reduction in pain scores was observed. The mean Visual Analog Scale (VAS) score for back pain decreased from 6.55 ± 0.66 to 2.29 ± 0.46, and for leg pain from 6.59 ± 0.65 to 1.21 ± 0.42. Similarly, the mean Oswestry Disability Index (ODI) score improved markedly, declining from 56.71 ± 3.09 to 15.82 ± 3.46. Superficial wound infection was observed in only two cases (7.14%) as a perioperative complication. Radiological evaluation demonstrated a Grade-I fusion rate of 89.28%. Based on the Modified Macnab criteria, overall functional outcomes were rated as excellent in 89.29% of patients. **Conclusion:** Posterior lumbar interbody fusion (PLIF) with cages and bone graft is a highly effective treatment for degenerative lumbar canal stenosis, providing excellent functional and neurological recovery and high rates of solid arthrodesis, though results may be limited by purposive sampling, short follow-up, and lack of advanced operative facilities.

Keywords: Lumbar canal stenosis, Spondylolisthesis, PLIF, Interbody fusion.

ID: AGS26/2553
P0393: Machine learning approach for pelvic incidence-dependent clustering of sagittal spinal alignment in asymptomatic middle-aged and elderly adults

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Introduction: Restoration of sagittal alignment is the key to preventing mechanical complications and achieving good clinical outcomes in ASD surgery. However, high variations in the

reported incidence of mechanical complications and clinical outcomes under current ASD realignment strategies have severely impeded the decision-making process for the optimal surgical plan. This study aimed to refine the sagittal morphological classification of the spine in asymptomatic middle-aged and elderly adult populations using the unsupervised machine learning (ML) techniques and, by leveraging these findings, to propose and validate a surgical correction reference for adult spinal deformity (ASD) patients across different morphological subtypes. **Methods:** This study cross-sectionally enrolled asymptomatic middle-aged and elderly Chinese adults. Sagittal spinal morphology clusters and pelvic incidence-based correction criteria for ASD realignment surgery were derived from whole spine radiographs using unsupervised ML algorithms. To externally validate the realignment strategy identified in asymptomatic adults, a consecutive cohort of ASD patients with sagittal deformity who underwent realignment surgery was examined for postoperative mechanical complications, unplanned reoperation, unplanned readmission, and clinical outcomes during follow-up. **Results:** A total of 635 asymptomatic adults were enrolled for morphological stratification, and 103 ASD patients with sagittal deformity were included for validation. The unsupervised ML algorithm successfully stratified spinal morphology into four clusters. The pelvic incidence-based surgical correction criteria computed by the regression algorithm demonstrated plausible clinical relevance, evidenced by the significantly lower incidence of postoperative mechanical complications, unplanned reoperation, unplanned readmission, and superior patient-reported outcomes in the restored group (conforming to the correction criteria) during follow-up. **Conclusion:** In this study, unsupervised ML algorithm effectively partitioned asymptomatic sagittal spinal morphology into four distinct clusters. Using the pelvic incidence-based proportional correction criteria, ASD patients can anticipate a reduced incidence of mechanical complications and improved clinical outcomes following spinal realignment surgery.

ID: AGS26/2555
P0394: Longitudinal changes in Psoas-Vertebral Index and its association with timing of adjacent segment disease following lumbar fusion surgery: a pilot study

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Introduction: Adjacent segment disease (ASD) is a common long-term complication after lumbar fusion, contributing to pain, disability, and revision surgery. Established risk factors include age, sagittal malalignment, fusion length, and pre-existing adjacent-level degeneration. Recently, sarcopenia-characterized by reduced muscle mass and quality-has emerged as a potential risk factor. In spine surgery, the psoas-vertebral index (PVI) provides a reproducible MRI-based surrogate for regional sarcopenia. Prior studies suggest that patients with lower baseline psoas size or greater paraspinal fatty infiltration are more likely to develop ASD. However, most literature has focused on cross-sectional or baseline muscle measurements. There is limited evidence on whether longitudinal changes in muscle mass influence the timing of ASD onset. If progressive muscle decline accelerates ASD development, targeted rehabilitation to preserve paraspinal and core muscle mass may represent a modifiable strategy to reduce this complication. **Material and Methods:** We retrospectively analysed 20 patients who underwent surgery for ASD after prior lumbar fusion between 2013 and 2023. PVI was measured on axial MRI at the L4 level before the index fusion and at the time of ASD diagnosis. Three variables were examined: baseline PVI, PVI at ASD presentation, and change in PVI between these time points. Baseline and ASD PVI values were compared, and all three variables were correlated with time from index fusion to ASD development. **Results:** The mean age of the cohort was 76.5 ± 7.6 years, with 14 females (70%). The mean time to ASD was 105 ± 59.9 months. Mean baseline PVI, PVI at ASD, and change in PVI were 1.49 ± 0.54, 1.36 ± 0.44, and -0.13 ± 0.29, respectively. No significant difference was observed between baseline PVI and PVI at ASD ($p = 0.068$). Baseline PVI showed no significant correlation with time to ASD ($\rho = 0.136$), and change in PVI similarly demonstrated no association ($\rho = 0.747$). **Conclusion:** In this pilot cohort, neither baseline PVI nor longitudinal change in PVI correlated with the timing of ASD onset. While the reduction in PVI following index fusion surgery did not reach statistical significance ($p = 0.068$), the effect size suggests a possible association. To our knowledge, this is among the first studies to examine longitudinal muscle changes in relation to ASD progression. Although no significant associations were identified, the study is limited by its small sample size and potential type II error. Larger cohorts or propensity-matched comparative studies including patients without ASD are needed to determine whether accelerated muscle loss predisposes to earlier ASD. If confirmed, these findings would support greater emphasis on peri-operative rehabilitation and muscle-preserving strategies as a means of reducing ASD risk after lumbar fusion.

ID: AGS26/2558
P0395: Outcome of chemonucleolysis with condoliase for the treatment of recurrent lumbar disc herniation

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Introduction: Condoliase, a chondroitin sulfate ABC endolyase, was approved in 2018 in Japan as a novel, minimally

invasive treatment for lumbar disc herniation. It is considered an intermediate option between conservative care and surgical discectomy. By degrading glycosaminoglycans within the nucleus pulposus, intradiscal injection decreases intradiscal pressure, thereby reducing nerve root compression and alleviating pain. Previous clinical studies in primary lumbar disc herniation have demonstrated favorable safety and efficacy, with symptom improvement reported in approximately 80% of patients. In contrast, treatment options for recurrent lumbar disc herniation following surgery remain limited. Revision discectomy is technically more challenging due to epidural scarring and adhesions, and extensive bone removal is sometimes required, leading to spinal instability and necessitating fusion procedures. Given these limitations, less invasive alternatives such as condoliase injection may represent an attractive option. However, evidence regarding its clinical effectiveness in the postoperative recurrent setting is scarce. The present study aimed to investigate the short-term outcomes of intradiscal condoliase injection for patients with recurrent lumbar disc herniation after prior surgery. **Material and Methods:** From March 2021 to February 2025, 11 patients (8 males, 3 females; mean age 49.8 years) with recurrent lumbar disc herniation after previous discectomy underwent intradiscal injection of condoliase at our institution. The treated levels were L2/3 in 1 case, L4/5 in 4 cases, and L5/S1 in 6 cases. All patients had persistent radicular symptoms refractory to conservative treatment. Clinical outcomes were evaluated using the Numerical Rating Scale (NRS) for leg and low back pain at baseline, 2 weeks, 1 month, and 3 months post-injection. Treatment efficacy was defined as ≥ 50% reduction in leg pain NRS compared with baseline. MRI was performed to assess disc degeneration using the Pfirrmann classification. **Results:** The mean leg pain NRS improved significantly from 6.6 at baseline to 3.5 at 2 weeks, 3.1 at 1 month, and 1.9 at 3 months. Six patients (54.5%) achieved ≥ 50% improvement at both 2 weeks and 1 month, and 9 patients (81.8%) at 3 months. Low back pain NRS also decreased from 6.1 at baseline to 3.1, 3.5, and 2.3 at the respective time points. Two patient (18.2%) demonstrated insufficient improvement and subsequently required surgical intervention. MRI follow-up revealed progression of disc degeneration by at least one Pfirrmann grade in 5 patients. No severe adverse events or neurological complications were observed. **Conclusion:** Intradiscal condoliase injection demonstrated meaningful short-term efficacy for recurrent lumbar disc herniation after prior surgery, providing rapid and sustained symptom relief in the majority of patients. Its minimally invasive nature allows avoidance of technically demanding revision discectomy or fusion surgery in selected cases. Although disc degeneration progression was noted in some patients, no major safety concerns emerged. **Clinical relevance:** Condoliase may represent a valuable therapeutic option for recurrent lumbar disc herniation, especially in patients at risk of surgical morbidity. Broader, multicenter prospective studies with longer follow-up are warranted to further validate efficacy and clarify the long-term structural consequences.

ID: AGS26/2562
P0396: Correlation between preoperative slip angle and postoperative functional outcomes in lumbar spondylolisthesis

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Introduction: Lumbar spondylolisthesis remains one of the most common degenerative spinal pathologies requiring surgical treatment. Preoperative radiological parameters, including slip angle, disc height, and foraminal dimensions, may influence postoperative functional recovery. This study aimed to evaluate the correlation between preoperative slip angle and postoperative clinical outcomes following lumbar fusion surgery. **Materials and Methods:** A retrospective analysis was conducted on 82 patients operated for lumbar spondylolisthesis between 2022-2025. Preoperative radiological measurements included slip angle, disc height, and foraminal area assessed on MRI and plain radiographs. Postoperative functional outcomes were evaluated using the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) scores at 6 and 12 months. Correlation analysis was performed between radiological parameters and functional outcomes. **Results:** Patients with lower preoperative slip angles (< 15°) demonstrated significantly better improvement in ODI scores ($p = 0.021$) compared to those with higher slip angles. Reduction in slip angle correlated positively with postoperative foraminal area restoration ($r = 0.48$, $p < 0.05$). Disc height restoration was not found to be an independent predictor of clinical improvement. **Conclusion:** Preoperative slip angle is a significant predictor of postoperative functional outcomes in lumbar spondylolisthesis. Patients with lower preoperative slip angles achieved superior recovery, suggesting that radiological evaluation should be integrated into surgical decision-making.

ID: AGS26/2574
P0397: Efficacy of indirect neural decompression achieved during lumbar fusion: a 227-level analysis

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Introduction: Indirect decompression via interbody distraction during lumbar fusion is widely utilized to treat central canal and foraminal stenosis without direct posterior

decompression. While clinical adoption is increasing, quantitative radiographic and MRI evidence of its effectiveness remains limited. **Materials and Methods:** A retrospective review of 148 patient (227 levels) who underwent lumbar fusion from 2018-2023 was performed. Sub-analyses included single-level cases (n = 100) and patients presenting with lumbar radiculopathy or claudication (n = 87; 137 levels). Pre- and postoperative MRI were graded for central (Guen 2011), paracentral (Bartynsky 2003), and foraminal stenosis (Lee 2009). Grades 0-1 were considered low-grade, and grades 2-3 were high-grade. Radiographic parameters included posterior disc height, segmental lordosis, and global lordosis. Operative records and follow-up identified revision procedures and need for subsequent direct decompression. Paired comparisons were performed with significant set at $p < 0.05$. **Results:** Indirect decompression resulted statistically significant improvements in MRI stenosis scores: mean central stenosis improved by 1.24 ± 1.06 points ($p < 0.001$); right and left paracentral stenosis improved by 1.4-1.7 points ($p < 0.001$); and foraminal stenosis improved bilaterally ($p \leq 0.002$). Posterior disc height increased by $+4.97 \pm 1.96$ mm ($p < 0.001$). Segmental lordosis increased by $+2.8°$ ($p < 0.001$), while global lordosis decreased slightly by $-2.43°$ ($p = 0.010$). Clinical durability was reflected by low reoperation rates: 11 total returns to the OR, with only 3 same-level revisions and 2 subsequent direct decompressions. Findings were consistent in both single-level and radiculopathy-only cohorts. **Conclusions:** Lumbar interbody fusion with indirect decompression significantly reduces MRI stenosis scores and restores posterior disc height, with low revision and direct decompression rates. These results support indirect decompression as an effective treatment strategy for lumbar stenosis in appropriately selected patients. Prospective studies with long-term clinical outcomes are warranted to further validate these findings.

ID: AGS26/2576
P0398: Outcome of transforaminal endoscopic lumbar discectomy in treatment of recurrent disc herniation

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Introduction: Recurrent herniation remains a major concern due to the risks of scarring and disc degeneration, which can worsen outcomes after standard posterior surgery. TELD offers the advantage of bypassing scarred areas and can be done under local anesthesia, though it requires considerable surgical expertise to learn. **Material and Methods:** This prospective cohort study included 20 consecutive patients who underwent transformational endoscopic discectomy for recurrent lumbar disc herniation after a previous discectomy. Twenty patients with mostly radicular issues had transforaminal endoscopic lumbar discectomy (TELD) for a recurring herniated disc between January 2021 and November 2023. 50.4 years old was the average age. The female/male ratio was 4/16 (20%/80%). **Results:** At the 2-year follow-up, 95% of patients reported that the procedure had a good or very good outcome. Five percent rated the outcome as fair, and none reported a poor or negative experience. On the VAS scale (1-10), the average improvement in leg pain was 6-7 points, and the average improvement in back pain was about 6 points. 65% of the patients reported feeling completely regenerated, 30% reported feeling somewhat restricted in their functional capacity, 5% reported feeling notably constrained, and 0% reported feeling unchanged or worse, based on the McNab criterion. There was one instance of nerve root irritation among the 5% total complication rate. Neither infection nor discitis were reported. **Conclusion:** With few side effects and a high patient satisfaction rate, TELD appears to be a successful treatment for recurrent disc herniation.

Keywords: Endoscopic discectomy, Lumbar disc herniation, McNab criteria, Recurrent herniation, Transforaminal approach

ID: AGS26/2602
P0399: Development of simple predictive scoring system for clinical outcome after lumbar spinal fusion using prospective study

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Introduction: Lumbar fusion surgery is widely performed for various lumbar disorders, but accurately predicting postoperative clinical outcomes (COs) remains difficult due to the complexity of influencing factors. Although several predictive tools exist, such as FIRRST, Modified Frailty Index and other scores, such scores are complex and have significant limitations in practical clinical application. This study aims to develop a scoring system that can predict the prognosis after lumbar fusion surgery using simple clinical information. **Material and Methods:** This study retrospectively analyzed the records of 600 patients over 18years old who underwent lumbar fusion surgery (L2-S1) between January 2010 and December 2023. Patients with ≥ 5 levels fused, thoracolumbar junction surgeries, infection, tumor, metastatic disease, incomplete records, or prior lumbar surgery were excluded. Clinical data including age, sex, BMI, BMD, comorbidities, fusion levels, and functional status were collected. Outcomes were measured using the Oswestry Disability Index (ODI)

recovery rate, with > 40% improvement defined as clinically successful. Based on this data, a simple predicting scoring system was developed. Its accuracy was prospectively validated in a cohort of 50 patients from January to June 2025 at Bundang Jeseung Hospital. **Results:** After univariate analysis of 600 retrospective cohorts, women, age, BMD, fusion level, preoperative symptoms, ambulation, DM, cerebrovascular disease, chronic kidney disease, American Society of Anesthesiologist classification were significant. The rate of successful clinical outcomes among lumbar fusion patients was 63.3%. After multivariate regression analysis, significant outcome predictors included age, BMD, fusion level, preoperative ambulation, and ASA grade. Simple scoring system was made of 5 key factors. The simple predictive scoring model demonstrated accuracy of 72%, sensitivity of 76%, and specificity of 57% in identifying patients who achieved favorable outcomes. **Conclusion:** Predicting clinical outcomes after lumbar fusion remains challenging due to diverse, often unquantifiable patient characteristics. Nonetheless, this simple scoring system using 5 key factors offers acceptable predictive accuracy and could enhance patient counseling and management for lumbar fusion surgery

ID: AGS26/2617
P0400: Association between facet tropism and adjacent-level disease: proposal of a novel classification system

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Introduction: The Zygapophyseal or facet joint is synovial, diarthrodial and paired in each vertebral level. This joint lies between the articular processes of two adjacent vertebrae. Due to its unique orientation, the facet joint plays a major role in axial loading and provides stability for each vertebral level by limiting the rotation and flexion. More than 50% of the elderly develop degenerative changes, which may lead to instability and foraminal stenosis. Several authors studied the facet joint and facet tropism, and they found that they are associated with the degenerative changes in the lumbar spine, disc herniation and spondylolisthesis. Facet orientation refers to the angle of the facets in the transverse plane relative to the sagittal plane. While the facet tropism refers to asymmetry of the facet joints with respect to each other in the sagittal plane. Furthermore, due to the influence of the joint orientation and tropism on the biomechanics of the vertebral segment, it can be one of the risk factors that is associated with the adjacent level disease (ALD). ALD refers to the pathologic changes and deterioration of the disc or facet joint adjacent to a fusion segment with or without clinical symptoms after a spinal fusion surgery. The aim of the study is to find out the association between the facet tropism and adjacent level disease, and propose a novel classification system. **Material and Methods:** Patients having undergone posterior lumbar decompression and fusion and diagnosed with adjacent level disease between January 2014 - January 2024 with a follow-up of at least one year will be identified in the HMG Spinal Surgical Database. Exclusion criteria are < 18 years, tumors, trauma, and deformity. Analysis will be performed with the Corel Viewer, and spreadsheet software such as Microsoft Excel, and statistical software (e.g. Stata). Qualitative variables will be presented as frequency (n) and percentages. Quantitative variables will be given as mean ± standard deviation (STD). The association between the categorical variables will be analyzed by using a Pearson's Chi-square. The statistical tests for continuous outcome variables will be analyzed by the t-test. We will propose a novel classification of facet tropism that stratifies patients by degree of asymmetry linked to high risk of adjacent-level disease, and assess its inter- and intra-observer reliability. **Results:** The study is ongoing, and final results are not yet available. **Conclusion:** Completion is expected soon, and the study will provide a novel facet tropism classification linked to adjacent-level disease risk.

ID: AGS26/2638
P0401: Multifidus muscle volume reduction and endurance impairment following rigid lumbar fixation: pilot study

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Introduction: The long-term effects of surgical techniques for lumbar degenerative pathologies on paraspinal muscle function remain controversial. This pilot study aimed to compare multifidus muscle volume, trunk muscle endurance, and surface electromyography (sEMG) findings following rigid pedicle screw-rod fixation and non-instrumented surgery. **Material and Methods:** A total of 20 patients who had undergone lumbar surgery between 2019 and 2020 with at least 5 years of follow-up were randomly selected: 10 with rigid fixation (ISG) and 10 with non-instrumented surgery (NISG). Multifidus muscle volumes were calculated using standardized MRI-based measurements. Trunk endurance was assessed with standardized core endurance tests, and paraspinal muscle activity was examined with sEMG. **Results:** The mean multifidus muscle volume was 23.08 ± 4.29 cm^3 in the ISG and 26.09 ± 3.41 cm^3 in the NISG, with a statistically significant difference between groups ($p < 0.05$, Cohen's $d = 0.77$). In addition, the ISG demonstrated reduced trunk endurance, lower activation capacity, and higher resting activity

in sEMG recordings compared with the NISG ($p < 0.05$). Importantly, a positive relationship was observed between multifidus muscle volume and trunk endurance ($r = 0.387$, $p < 0.05$). **Conclusion:** Pilot data suggest that rigid fixation not only reduces multifidus muscle volume compared to non-instrumented surgery but also negatively impacts endurance and alters sEMG activity patterns. The observed association between muscle volume reduction and decreased endurance highlights the potential influence of surgical technique on long-term muscle function. These findings emphasize the importance of muscle-preserving surgical approaches and structured postoperative rehabilitation. Ongoing studies with larger samples are expected to confirm and expand upon these preliminary results.

ID: AGS26/2679
P0402: Impact of facet joint degeneration on radiological outcomes after OLIF surgery

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Introduction: Oblique lateral interbody fusion (OLIF) is widely utilized in the treatment of degenerative lumbar conditions, as its minimally invasive approach facilitates the restoration of disc angle and height. However, severe facet joint degeneration may cause posterior ankylosis, limiting segmental mobility and hindering the insertion of larger interbody cages. Nevertheless, few studies have investigated the relationship between the degree of facet degeneration and radiological outcomes following OLIF. Therefore, the present study aimed to evaluate the impact of facet joint degeneration on radiological outcomes following OLIF in patients with degenerative lumbar spine disease. **Material and Methods:** We retrospectively analyzed 292 patients (442 disc levels) who underwent OLIF for degenerative lumbar disease with at least 1 year of follow-up. Patients were categorized into four groups according to the severity of facet joint degeneration. Radiological outcomes including changes in disc angle, presence of endplate injury, cage subsidence, and fusion rate were compared across groups. **Results:** There were no significant differences in demographic characteristics (except diagnosis), cage angle or height, or operated levels among the four groups. Although differences in disc angle were observed at final follow-up, the amount of disc angle change was not significantly different. The incidence of endplate injury was significantly higher in groups with severe facet degeneration ($p = 0.024$). However, there were no statistically significant differences in cage subsidence or fusion rate between groups. **Conclusion:** OLIF demonstrated favorable radiological outcomes irrespective of the degree of facet joint degeneration. However, severe facet degeneration may increase the risk of endplate injury during cage insertion; thus, careful attention is warranted during disc space distraction and endplate preparation in such cases.

ID: AGS26/2698
P0403: Radiological features and postoperative outcomes in patients of degenerative lumbar scoliosis with pelvic obliquity: the application of an novel classification

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Introduction: Degenerative lumbar scoliosis (DLS) is a prevalent spinal condition in the elderly, with an incidence of approximately 2%-68 %. Pelvic obliquity (PO), a sign of coronal imbalance, is frequently observed in patients. PO can cause joint deterioration and aberrant gait, which can have a significant negative impact on the patient's quality of life. Systematic studies and reports on the radiographic characteristics of DLS patients with PO and the outcome of PO following orthopedic surgery are still lacking. The radiological characteristics of DLS patients with PO were collated in this study, and we found that there are two types of patients with PO depending on the orientation of the pelvic iliac spine on the higher side. As each subtype of PO has distinct clinical traits, each subtype should be treated using a different surgical strategy. The objectives of the study are to propose a novel classification of preoperative PO in DLS patients and discuss how this PO classifications could guide scoliosis corrective surgery. **Material and Methods:** Patients with PO (POA $\geq 3°$) were divided into type I ($n = 48$) and type II patients ($n = 42$). The higher iliac spine of the pelvis was congruent with the direction of the C7 plumb line(C7PL) offset in Type I, whereas in Type II, the higher iliac spine was opposite to the direction of the C7PL offset. A comparative analysis was performed between pre- and postoperative radiological parameters and patient-reported outcomes of various patient's types. **Results:** 90 patients (31%) had PO, of whom 48 were type I and 42 were type II. Compared to patients who had persistent postoperative PO, type I patients who recovered from PO had lower Apical vertebral translation (AVT) (13.27 vs. 20.34, $p = 0.025$), while type II recovered patients had lower postoperative Sacral Obliquity Angle (SOA) (1.62 vs. 3.89, $p = 0.015$). The percentage of

intraoperative fixation to the sacrum was lower in type II patients with follow-up-recurrent-PO (15.8% vs. 60%, p = 0.014). **Conclusion:** Patients can be categorized into type I and II based on the classification of PO that we proposed and should adopt different surgical strategies accordingly. Intraoperative SOA correction and fixation to the sacrum in Type II patients are crucial for restoring long-term pelvic balance while improvement in Cobb angle and AVT during surgery are more important for correcting Type I PO.

ID: AGS26/2714
P0404: Global sagittal imbalance in degenerative spine disease: identification of key predictors and a novel scoring tool

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Introduction: Degenerative spine disease is increasingly recognized as a significant contributor to chronic disability. Global sagittal malalignment is a key biomechanical parameter influencing clinical outcomes. However, full-length standing radiographs are not always feasible in routine practice, particularly in resource-constrained settings. Beyond cost and accessibility, a greater challenge lies in anticipating which patients are at risk. Identifying reliable clinical and regional radiographic predictors of sagittal imbalance can enable early recognition, improve surgical planning, and support the development of pragmatic diagnostic tools. **Material and Methods:** In this cross-sectional analytical study, 200 adult patients with degenerative cervical and/or lumbar spine disease were prospectively evaluated. Clinical variables, comorbidities, and regional radiographic parameters were recorded. Global sagittal alignment was assessed using whole-spine standing lateral radiographs, with C2 and C7 sagittal vertical axis (SVA) as primary metrics. Multivariate logistic regression identified independent predictors, which were incorporated into a scoring system. **Results:** Global sagittal malalignment was observed in 22.5% (C2 SVA) and 17.5% (C7 SVA) of patients. Significant predictors included age, parity > 2 in females, hypertension, diabetes mellitus, cervical myelopathy, lumbar spondylolisthesis, high T1 slope, increased cSVA, high pelvic tilt and incidence, and reduced lumbar lordosis. A clinically applicable scoring system was derived using these predictors, demonstrating good discriminatory ability. **Conclusion:** Global sagittal malalignment is common in degenerative spine disease and can be anticipated using a combination of clinical and regional radiological parameters. The proposed scoring system offers a simple and effective tool to identify at-risk patients in routine practice, particularly where access to whole-spine imaging is limited.

ID: AGS26/2719
P0405: Outcome of unilateral biportal endoscopy in treatment of degenerative spinal canal stenosis associated with scoliosis

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Introduction: Unilateral biportal endoscopic (UBE) as a minimally invasive (MI) approach can be used to treat degenerative lumbar canal stenosis (DLCS) that associated with degenerative scoliosis. Beside the advantages of minimal invasive approach such as small wound, less postoperative pain and short hospital stay; UBE technique do not affect posterior structures which have important rule in maintaining spinal stability. **Patient and Methods:** This is prospective cohort study of 12 patients with degenerative lumbar canal stenosis (DLCS) associated with degenerative scoliosis treated between October 2023 and April 2025 using UBE technique. They were 8 males and 4 females with an average age of 62.5. **Results:** At the end of follow up, the mean VAS for low back pain was improved from 5.3 ± 3.0 to 1.8 ± 1.0 and the VAS for leg symptoms was improved from 8.2 ± 2.1to 1.2 ± 0.9. The mean ODI score was significantly improved from 57.6 ± 17.9 to 15.8 ± 12.6, respectively. Modified Macnab criteria were excellent in 7 patients (58.3%), good in 3 (25%), fair in 2 (16.3%). The average hospital stay was 3.6 ± 2.4 days. Complications included no dural tears, 1 transient motor weakness, 1 inadequate decompression, and 1 epidural hematoma. **Conclusions:** UBE techniques allow effective and safe decompression for DLCS that associated with scoliosis. The soft tissue and facet joint destruction are minimal so we can avoid spinal fusion and preserve the segmental stability.
Keywords: Minimally invasive surgery, biportal endoscopic spine surgery, lumbar canal stenosis, scoliosis

ID: AGS26/2737
P0406: Comparison of canal diameter and foraminal height changes after short- and long-segment fixation in lumbar spinal stenosis

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Introduction: Surgical fixation strategies for lumbar spinal stenosis vary between short-segment and long-segment stabilization. The choice of method may directly impact postoperative canal diameter and foraminal height, which are crucial for decompression efficacy. This study aimed to compare radiological outcomes between short- and long-

segment fixation techniques. **Materials and Methods:** A total of 96 patients with degenerative lumbar spinal stenosis operated between 2022-2025 were included. Patients were divided into two groups: short-segment fixation (n = 52) and long-segment fixation (n = 44). Radiological parameters including canal diameter, foraminal height, and segmental lordosis were measured preoperatively and postoperatively using CT and MRI scans. **Results:** Both groups showed significant postoperative improvement in canal diameter ($p < 0.001$). Long-segment fixation resulted in greater increases in canal diameter (mean +28%) compared to short-segment fixation (+19%). Foraminal height restoration was superior in the short-segment group (mean +15% vs. +9%, $p = 0.037$). Segmental lordosis correction was significantly better in the long-segment group. **Conclusion:** While long-segment fixation provides superior canal diameter restoration and sagittal alignment, short-segment fixation offers better foraminal height preservation. Surgical planning should be tailored according to the predominant pathology and the patient's sagittal balance requirements.

ID: AGS26/2751
P0407: Sacroiliac pain after lumbosacral arthrodesis

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Introduction: Sacroiliac pain syndrome (SIPS) of biomechanical etiology constitutes a frequent complication following lumbosacral arthrodesis (LSA), resulting from the transfer of mechanical stress to the adjacent sacroiliac joint. This iatrogenic pathology represents a major cause of persistent or recurrent low back pain in the post-surgical spinal population. Diagnosis relies on a clinical-radiological approach combining specific provocation tests and dedicated imaging. The objective of this study was to analyze the incidence, clinical characteristics, and evolution of SIPS in patients who underwent lumbosacral arthrodesis. **Material and Methods:** This was a retrospective single-center study conducted at the Principal Military Teaching Hospital of Tunis, including 27 patients (January 2017 - December 2024) who developed SIPS after lumbosacral arthrodesis with a minimum follow-up of 2 years. The population comprised 6 men and 21 women with a mean age of 59 years (27-88 years). Medical history revealed an average of 3 prior lumbar interventions per patient (1-7). The diagnosis of SIPS was established based on clinical criteria (positive provocation tests) and radiological criteria (degenerative changes of the sacroiliac joint). Evaluation criteria included lumbar and radicular pain intensity (NRS 0-10), functional scores (Oswestry Disability Index, Short Form-12), and analysis of predictive factors for SIPS occurrence. **Results:** The incidence of SIPS following lumbosacral arthrodesis was significant in our cohort. Lumbar pain presented a mean intensity of 8.4 (7-10) and radicular pain of 5.1 (2-10). The Oswestry score revealed severe functional disability with a mean of 69.4 (52-86). Symptom onset occurred on average 18 months after initial surgery. Factors associated with SIPS occurrence included arthrodesis extension to the sacrum, advanced age, and history of multiple surgeries. Bilateral localization of sacroiliac pain was observed in 55.6% of patients (15/27). **Conclusion:** Sacroiliac pain syndrome constitutes a frequent and disabling biomechanical complication following lumbosacral arthrodesis. This study emphasizes the importance of differential diagnosis of persistent post-surgical low back pain and the necessity for appropriate clinical surveillance of this at-risk population.

ID: AGS26/2768
P0408: Patients receiving GLP-1 agonists have reduced odds of pseudoarthrosis following lumbar decompression and fusion

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Introduction: In the past two decades, the frequency of lumbar spine decompression and fusion surgeries has risen exponentially. This increase has coincided with a rise in postoperative complications, notably pseudoarthrosis-a failure in spinal fusion manifesting as recurring pain and mechanical instability. The association between glucagon-like peptide-1 (GLP-1) agonist use and complications following lumbar decompression and fusion has yet to be explored. The goal of this study is to examine the association between GLP-1 agonist usage and the incidence of pseudoarthrosis, adjacent segment disease, revision surgery, and other perioperative complications following lumbar decompression and fusion surgery. **Material and Methods:** TriNetX, a global health research network, was queried from 2004-2024 for patients undergoing open lumbar fusion using a posterior/transforaminal (CPT 22633, 22630, 22612), anterior (CPT 22558), or lateral approach (CPT 22533) with a decompression lumbar laminectomy or laminotomy (CPT 63047, 63030) and who had documented GLP-1 agonist usage within 1-year post-operation. Analysis included chi-squared tests with a control cohort propensity score matched for age, sex, race, smoking, diabetes, BMI, and uremia who did not have postoperative GLP-1 agonist usage. Outcomes of interest were

DVT, emergency department (ED) visits, inpatient hospitalization, opioid abuse, PE, sepsis, surgical site infection, wound complications within 90 days, adjacent segment disease, implant failure, pseudoarthrosis, and revision within 2 years. Subgroup analysis based on surgical approach was conducted. **Results:** A total of 1,266 patients who received GLP-1 were compared to propensity matched controls. After matching, patients were 62.7 ± 10 years old, 39% male, 70% white, 85% diabetic, and 67% obese. GLP-1 agonist use within 1-year post-operation was significantly associated with reduced odds of ED visits (OR 0.78, CI 0.62-0.97), inpatient hospitalization (OR 0.29, CI 0.24-0.34), sepsis (OR 0.49, CI 0.27-0.89), post-operative SSI (OR 0.42, CI 0.27-0.65), wound complications (OR 0.50, CI 0.33-0.77) within 90 days, and pseudoarthrosis (OR 0.46, CI 0.38-0.56) within 2 years post-operation. In the posterior approach subcohort, GLP-1 agonist use was significantly associated with reduced odds of ED visits (OR 0.78, CI 0.62-0.98), inpatient hospitalization (OR 0.27, CI 0.23-0.32), post-operative SSI (OR 0.43, CI 0.27-0.66), wound complications (OR 0.60, CI 0.39-0.93) within 90 days, and pseudoarthrosis (OR 0.51, CI 0.42-0.62) within 2 years post-operation. In the anterior approach subcohort, GLP-1 agonist use was significantly associated with reduced odds of inpatient hospitalization (OR 0.30, CI 0.17-0.53) within 90 days post-operation. The study population was insufficient to assess lateral approaches independently. **Conclusion:** Lumbar decompression and fusion surgery patients prescribed GLP-1 agonists in the post-operative period experienced lower rates of pseudoarthrosis, postoperative infections, and overall hospitalizations compared to those who did not receive GLP-1 agonists. GLP-1 agonists may offer a therapeutic benefit in improving outcomes in this patient population, and further prospective research is needed to validate these findings and investigate the underlying mechanisms.

ID: AGS26/2775

P0409: Long-term reoperation rates after minimally invasive lumbar decompression versus open laminectomy: a national claims database analysis

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Introduction: Surgical intervention is typically reserved for patients with lumbar spinal stenosis or disc herniation who fail conservative management. Two common surgical options are minimally invasive lumbar decompression (MILD) and open laminectomy. MILD offers shorter recovery, reduced hospital stays, less blood loss, and lower perioperative pain, whereas open laminectomy is more invasive and carries greater postoperative risks. However, the long-term durability of MILD relative to open laminectomy remains unclear, as prior studies are often limited by small sample sizes and short follow-up. This study compares longitudinal reoperation rates between MILD and open laminectomy using a nationally representative, high-powered database. **Material and Methods:** This retrospective cohort study was conducted using the PearlDiver Mariner database to identify patients who underwent lumbar decompression between 2010 and 2022. Cohorts were defined by CPT codes: MILD (0275T) and open laminectomy (63030, 63047). The first decompression claim was designated as the index procedure within the study window. The primary outcome was reoperation, defined as repeat decompression (0275T, 63030, 63047), assessed at 0-90 days, 90 days-1 year, 1-2 years, 2-5 years, and cumulatively through 1, 2, and 5 years. Covariates included demographics, insurance type, service location, and comorbidities. Cohorts were compared using chi-square tests. Propensity-score bucket matching was performed to adjust for baseline differences. Analyses were conducted in R within PearlDiver, with significance set at $p < 0.05$. **Results:** A total of 13,698 MILD patients and 1,169,645 open laminectomy patients were identified. Within the unmatched cohort, MILD patients were older (70.9 ± 9.9 vs 58.9 ± 14.3 years, $p < 0.001$), had greater comorbidity burden, including COPD (34.8% vs 25.8%) and hypertension (89.2% vs 75.6%), and more often underwent surgery in ambulatory centers (98.3% vs 58.3%). Reoperation was higher after MILD compared to open laminectomy: 0-90 days (1.8% vs 1.5%), 90 days-1 year (4.2% vs 1.9%), 1-2 years (2.2% vs 1.4%), and 2-5 years (2.1% vs 2.0%) (all $p < 0.001$). Cumulative reoperation rates after MILD and open laminectomy were 5.9% vs 3.4% at 1 year, 8.0% vs 4.8% at 2 years, and 10.0% vs 6.7% at 5 years (all $p < 0.001$). After 1:1 propensity-score matching, 13,698 balanced pairs were analyzed. Reoperation rates remained higher for MILD compared to open laminectomy: 0-90 days (1.8% vs 1.1%), 90 days-1 year (4.1% vs 1.9%), 1-2 years (2.1% vs 1.3%), and 2-5 years (2.0% vs 1.5%) (all $p < 0.05$). Cumulative reoperation rates after MILD and open laminectomy were 5.9% vs 3.0% at 1 year, 8.0% vs 4.3% at 2 years, and 10.0% vs 5.8% at 5 years (all $p < 0.001$). **Conclusion:** In this large retrospective cohort, MILD was associated with consistently higher reoperation rates than open laminectomy through 5 years. While MILD offers perioperative advantages, these must be weighed against its reduced long-term durability. This study utilized a large, nationally representative cohort with extended follow-up, enabling robust comparison of long-term outcomes. Future prospective trials incorporating patient-reported outcomes

are needed to clarify long-term effectiveness and refine patient selection.

ID: AGS26/2792

P0410: Comparative outcomes of awake spine surgery under spinal versus general anesthesia in patients over 80 years old with spinal lumbar stenosis: a pilot study

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Introduction: When it comes to spine surgery, traditionally it is performed under general anesthesia. There has been much controversy about awake surgery in recent years, but it has not yet become mainstream in many countries. Awake spine surgeries found in the literature includes laminectomies and discectomies, anterior cervical discectomy and fusions (ACDF), lumbar fusions, and dorsal column (DC) stimulator placement. The aim of this study was to compare the early postoperative outcomes of elderly patients undergoing awake spine surgery with those undergoing surgery under general anesthesia. **Material and Methods:** This is a retrospective matched case-controlled study conducted in tertiary care institution, where awake spine surgery is performed for the first time. Ten patients over 80 years old with lumbar spinal stenosis were matched by age, sex, spinal stenosis grade (it is used Schizas grade system) and type of surgical procedure. **Results:** In case group the average time of postoperative recovery and hospital stay is statistically significant shorter. There were none intraoperative complications in case group, nor postoperative delirium. Postoperative pain were better regulated with fewer medications (average VAS score was lower) in case group. **Conclusion:** In our pilot study we have shown that awake spine surgery is more safer method for elderly patients than surgery under general anesthesia, with lower rate of postoperative complications and lower use of postoperative pain drugs.

ID: AGS26/2808

P0411: Predictive value of preoperative nutritional risk index for screw loosening after lumbar interbody fusion in elderly patients with lumbar spine diseases

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Introduction: Pedicle screw loosening is one of the common complications in elderly patients undergoing transforaminal lumbar interbody fusion (TLIF) for lumbar spine disease. Malnutrition, prevalent among elderly patients, has been shown to be associated with increased complications. The Geriatric Nutritional Risk Index (GNRI) serves as a simple indicator of nutritional status. However, the relationship between malnutrition, particularly GNRI, and pedicle screw loosening has not been adequately investigated. This study aims to investigate the relationship between GNRI and pedicle screw loosening following TLIF to guide the perioperative nutritional management of patients and prevent postoperative complications. **Material and Methods:** A retrospective review was conducted on clinical data from patients who underwent single-level TLIF between 2014 and 2022. Data collection encompassed patient demographics, preoperative laboratory parameters, surgery-related data, perioperative radiographic data, and patient-reported outcomes were comprehensively documented. All patients were followed up for a minimum of 12 months. The relationship between GNRI and pedicle screw loosening was evaluated by univariate and multivariate Cox regression analysis, restricted cubic spline (RCS) analysis, receiver operating characteristic (ROC) analysis, and Kaplan-Meier survival analysis. **Results:** A total of 426 patients were included in the study. The rate of pedicle screw loosening rate was 16.4% at a minimum follow-up of 12 months. Patients with pedicle screw loosening exhibited significantly lower GNRI (89.0 ± 8.0 vs. 99.2 ± 9.3, $p < 0.001$) and volumetric bone mineral density measured by quantitative computed tomography (QCT-vBMD) (84.2 [interquartile range (IQR) 79.6-92.2] vs. 104.0 [IQR 88.2-126.0] mg/cm3, $p < 0.001$) compared to those in the non-loosening group. Multivariate Cox regression analysis identified sex (hazard ratio [HR] 1.433, 95% confidence interval [CI] 0.714-2.876, $p = 0.027$), age (HR 1.062, 95% CI 1.014-1.113, $p = 0.012$), GNRI (HR 0.841, 95% CI 0.711-0.994, $p = 0.043$), and QCT-vBMD (HR 0.982, 95% CI 0.967-0.997, $p = 0.019$) as independent risk factors for screw loosening. RCS analysis showed that GNRI was negatively correlated with screw loosening ($p < 0.0001$). The area under the curve (AUC) for the GNRI in predicting pedicle screw loosening was 0.794, with a cut-off value of 95.590 (sensitivity, 85.7%; specificity 65.2%). Kaplan-Meier survival analysis identified that the lower-level GNRI group exhibited a higher cumulative incidence of screw loosening (log-rank test, $p < 0.0001$). **Conclusion:** The GNRI was an independent risk factor for postoperative screw loosening in elderly patients undergoing TLIF for lumbar spine disease. Preoperative GNRI may potentially serve as a valuable tool in predicting postoperative screw loosening in elderly patients undergoing TLIF.

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P0412: Lumbar plexus intraoperative neuromonitoring during lateral interbody fusion: preliminary findings

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Introduction: Intraoperative neuromonitoring (IONM) is an online technique that evaluates the integrity of neural pathways in real time. Selecting appropriate modalities to maximize patient safety while maintaining surgical workflow remains a challenge. The transpsoas lateral lumbar interbody fusion (LLIF) technique is an effective alternative to traditional anterior and posterior approaches. We report our preliminary findings using a multimodal IONM protocol specifically focused on lumbar plexus monitoring during LLIF. **Material and Methods:** Monitoring included saphenous nerve somatosensory evoked potentials (snSSEP), motor evoked potentials (MEP), and electromyography (EMG) with psoas, quadriceps, and tibialis anterior recordings. Transpsoas lumbar plexus mapping was performed with monopolar stimulation (500 μs, biphasic pulse) applied through the dilator to the ipsilateral anterior iliac fossa, using at least three stimuli at 180° angles. The minimum current eliciting a compound muscle action potential (CMAP) was recorded. **Results:** Seven patients (4 female; median age 57 years) underwent LLIF at L3-L4 (n = 3) or L4-L5 (n = 4). Median psoas retraction time was 18 minutes. Lumbar plexus mapping was feasible in all patients, with a median threshold of 12 mA. In one case, quadriceps CMAP was obtained at 5 mA, leading to revision of the approach. In another case, CMAPs were consistently obtained between 5-6 mA and the LLIF was aborted. Monitoring findings included: one transient EMG denervation episode (200 ms) during fusion, one 40% MEP amplitude decrease in psoas, and one 30% snSSEP amplitude decrease after psoas retraction. None of these changes correlated with permanent postoperative neurological deficits. **Conclusion:** Multimodal IONM with MEPs, SSEPs, and EMG appears valuable in reducing neurologic risk during LLIF. The minimum safe threshold for transpsoas lumbar plexus mapping remains uncertain and requires further investigation.

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P0413: Patient-reported outcomes measures in degenerative lumbar spondylolisthesis surgery: a systematic review

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Introduction: Multiple studies proved effectiveness of surgery in treating degenerative spondylolisthesis (DSL) symptoms. However, a great deal of heterogeneity exists in the patient reported outcomes (PROMs) utilized in these published studies, underscoring the need for a better understanding of the selection and implementation of appropriate PROMs. This is the first systematic literature review to analyze the usage of different PROMs in published studies reporting on the diverse types of surgical management of DLS. **Material and Methods:** PubMed and 5 other databases were searched through January 1st, 2025, for studies published in

2000 or later in English language. Data from included articles including publication year, first author, study country, study design, registry used if any, number of total and male cases, number of level(s) operated, type(s) of surgical intervention, number of cases per intervention, and PROM used for each reported intervention were analyzed. The primary outcome of interest was finding the commonly used PROMs as well as investigating the trends of PROMs utilization in relation to other collected data variables. **Results:** 170 studies from 24 countries where 30 different PROMs (either alone or more commonly in combination) were utilized to evaluate outcome of 29 different surgical interventions combinations were performed on 23,575 patients have been analyzed. Oswestry Disability Index (ODI) was the most common PROM utilized in 74% (n = 126), then numerical rating scale (NRS) / Visual analogue scale (VAS) for back pain in 72% (n = 123), followed by NRS/VAS for leg pain in 56% (n = 96). The short-form 36 (SF-36) was the most used generic non-spine-specific PROM in 25% (n = 43). PROMs utilization increased over time ($p < 0.001$), from 24 PROMs utilized in 14 studies (2000-2005) up to 218 PROMs in 63 studies (2016-2020). Singapore & Switzerland showed the highest utilization rate of almost 4 PROMs per article. Studies describing endoscopic approach (3.9 PROMs/study) and pedicle screw fixation with fusion (3.7 PROMs/study) had significantly higher PROM usage per study ($p < 0.001$). NRS/VAS back pain was more commonly used in retrospective studies (81%, 60/74) while ODI was the most used in prospective studies (78%, 75/96). In studies reporting on surgeries for 1 (n = 94) or 2 (n = 37) spinal levels, NRS/VAS back pain was the most used in 77% (n = 102). In studies reporting on 3 or more levels, ODI was the most used PROM, 77% (n = 14). Seven different spine registries were used in 31 articles where the most used PROMs were NRS/VAS for back pain and NRS/VAS for leg pain (n = 6), followed by ODI (n = 5), and EQ-5D (n = 4) with an average of 5 different PROMs used per registry. **Conclusion:** There inconsistency and heterogeneity in the utilization of PROMs as an outcome evaluation tool after surgical interventions for the management of DSL which jeopardizes the objective comparison of interventions. A study evaluating the clinimetric properties of the commonly used PROMs identified in this systematic review is warranted to understand their relevance to DSL and aid in reaching a consensus on the most appropriate one.

ID: AGS26/2918
P0414: Effects on segmental lumbar sagittal alignment after anterior hyperlordotic reconstruction of the lumbarsacral spine

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Introduction: Hyperlordotic ALIF aims to restore lumbar sagittal alignment, but its impact on segmental correction, normative alignment targets, and clinical outcomes remains under investigation. **Materials and Methods:** We retrospectively analyzed 28 patients undergoing L4-L5 and/or L5-S1 ALIF with hyperlordotic cages. Radiographic measurements (lordosis angles, Baastrup grades, Roussouly type) and clinical outcomes (VAS, ODI) were assessed pre-op and at 12 months. Mixed-effects models (frequentist and Bayesian) evaluated the influence of cage lordosis (CageLL) on segmental alignment. Alignment was compared to published normative L4-S1 targets. **Results:** Significant segmental lordosis changes occurred post-op, with CageLL modulating the distribution between L4-L5 and L5-S1. Each degree of CageLL increased L5-S1 lordosis (+2.1°) and reduced L4-L5 correction (-1.25°). All patients fused; 28.6 % developed ASD. Pain and function improved markedly (ΔVAS = 7.0; ΔODI = 28.3), with > 90% responder rates. Normative L4-S1 target deviation did not predict outcomes. Roussouly-type change was associated with L5-S1 correction. Diabetes modestly reduced pain relief; other comorbidities had no clear effect. **Conclusions:** Hyperlordotic ALIF effectively restores segmental alignment and improves clinical outcomes. Cage angle influences segmental correction distribution but not overall patient benefit. Normative targets may have limited predictive value; individualized alignment goals are essential.

ID: AGS26/2960
P0415: Low rate of hardware failure and revision surgery in patients treated with lateral lumbar interbody fusion and unilateral pedicle screw rod fixation

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Introduction: Lateral lumbar interbody fusion (LLIF) is increasingly used for degenerative lumbar disease. Bilateral pedicle screw fixation (BPSF) provides rigid stabilization but may increase operative time, blood loss, and costs. Unilateral pedicle screw fixation (UPSF) has been proposed as a less invasive alternative, though evidence in LLIF remains limited. To assess radiographic and clinical outcomes of LLIF with UPSF, including fusion, subsidence, migration, and revision surgery rates. **Material and Methods:** This multicenter

retrospective study included consecutive adults undergoing one- or two-level LLIF with UPSF for degenerative lumbar conditions. Demographics, surgical details, and radiographic follow-up ≥ 6 months were reviewed. Fusion was defined as absence of lucency, hardware failure, or motion on flexion-extension radiographs. **Results:** A total of 216 patients (129 females, 87 males; mean age 63.8 ± 10.9 years) were analyzed. Twenty-four (11.1%) were smokers and 52 (24.1%) had prior lumbar surgery. Single-level LLIF was performed in 153 patients (70.8%), most commonly at L4-L5 (76.5%). Mean follow-up was 24.8 months. Fusion was achieved in 196 patients (90.7%). Subsidence occurred in 11 (5.1%), with three requiring reoperation. Migration was observed in five (2.3%), one requiring revision. Pseudoarthrosis developed in eight (3.7%), with one revision. Adjacent segment degeneration was noted in eight (3.7%), with five reoperations. Overall reoperation rate for cage-related or hardware failure was 1.9%. **Conclusion:** LLIF with UPSF achieved high fusion rates and low reoperation rates, with acceptable subsidence and migration. This technique appears safe and effective in selected patients, representing a less invasive and potentially more cost-effective alternative to BPSF.

ID: AGS26/3016
P0416: Single- vs double-level ALIF (L4-L5-S1): comparison of complications and clinical-radiological outcomes

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Introduction: The anterior lumbar interbody fusion (ALIF) is an increasingly adopted technique in degenerative spine surgery, both as a primary and revision procedure. However, comparative data on complications and clinical-radiological outcomes in patients undergoing single-level (L5-S1 or L4-L5) vs. double-level (L4-S1) ALIF are still limited. The primary aim of this study was to assess the incidence of intra- and perioperative complications in patients treated with ALIF L4-L5-S1, comparing the different groups according to the treated level(s). Secondary objectives included the analysis of clinical and radiological outcomes at ≥ 6 months of follow-up. **Materials and Methods:** A single-center retrospective analysis was conducted on 470 patients who underwent ALIF between 2013 and 2025. Patients were divided into three groups: ALIF L5-S1 (n = 280), ALIF L4-L5 (n = 100), ALIF L4-S1 (n = 90). Patients treated with anterior-only or combined anterior-posterior approaches were included, provided that posterior fusion did not extend above L2. Exclusion criteria were age <18 years, stabilizations above L2, or incomplete clinical-radiological data. Collected data included clinical (VAS, ODI, RMDQ), radiological (pelvic parameters, lumbar lordosis, disc height), and intraoperative variables (complications, blood loss, operative time, ICU requirement). **Results:** No statistically significant differences were observed in the incidence of intra- and perioperative complications among the three groups. Operative times were longer in the double-level groups, but without a significant increase in morbidity. Postoperative radiological parameters showed comparable improvements across groups, with a good recovery of segmental lordosis and disc height. Clinical outcomes (VAS, ODI, RMDQ) demonstrated significant improvement compared with baseline in all groups, with no clinically relevant differences among them. **Conclusions:** In our center, double-level ALIF is not associated with a substantial increase in complications compared to single-level procedures. The anterior approach proves to be an effective and safe strategy for the treatment of lumbar degenerative disease, even in complex or revision cases, ensuring favorable clinical and radiological outcomes.

ID: AGS26/3035
P0417: MRI-based L1 vertebral bone quality scores predict cage subsidence following transforaminal lumbar interbody fusion similar to L1 CT Hounsfield units

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Introduction: Cage subsidence is one of the most common complications after transforaminal lumbar interbody fusion (TLIF) and correlates with inferior bone quality. Studies have reported L1 vertebral bone quality score (VBQ) based on MRI to be a promising alternative to evaluating preoperative bone quality. However, to the knowledge of the authors, no study has examined the correlation between L1 VBQ scores and cage subsidence after TLIF. The purpose of the study was (1) to assess the interrelation between the L1 VBQ score and cage subsidence after TLIF; and (2) to compare L1 VBQ and L1 CT Hounsfield Unit (HU) values in predicting cage subsidence after TLIF. **Material and Methods:** We reviewed patients who had undergone TLIF at one institution between 2012 to 2021. Cage subsidence was measured using postoperative lumbar CT based on cage protrusion through the endplates at more than 2 mm. The L1 VBQ score was calculated by dividing mean L1 signal intensity (SI) by mean SI of the cerebrospinal fluid (CSF) at L1. The L1 HU value representing bone mineral density (BMD) was measured using computed tomography. We then performed Student's t -test for

independent samples and logistic regression analyses for statistical analysis. We also conducted receiver operating characteristic (ROC) analysis to assess the predictive ability of the L1 VBQ score and L1 CT HU. **Results:** Of 233 participants, cage subsidence was observed in 41 patients (17.6%). Comparison between the characteristics of patients between the group with subsidence and the group without subsidence revealed significant differences in the age, VBQ score, and L1 CT HU. Multivariate logistic regression showed that higher L1 VBQ score (OR = 2.499, 95% CI: 1.205-5.180, p = 0.014) and lower L1 CT HU (OR = 0.960, 95% CI: 0.933-0.987, p = 0.005) were associated with an increased rate of cage subsidence. Area under the curve (AUC) analysis of the L1 VBQ score returned 0.735 (95% CI: 0.620-0.850) and the suitable threshold was 3.424 (sensitivity: 82.9%, specificity: 70.7%). The AUC of L1 CT HU was 0.747 (95% CI: 0.642-0.852) and the suitable threshold was 136.5 (sensitivity: 85.4%, specificity: 56.1%). **Conclusion:** The present study demonstrates that L1 VBQ score and L1 CT HU are reliable predictors with similar performance for cage subsidence after TLIF.

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P0418: MRI-based endplate bone quality scores outperform vertebral bone quality scores in predicting adjacent segment disease following transforaminal lumbar interbody fusion

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Introduction: Adjacent-segment disease (ASD) complicates up to one-third of single-level TLIFs and drives 10 % of revisions; low bone mineral density (BMD) is the principal modifiable risk factor. While DEXA and QCT are reference standards, they are under-used because of degenerative overestimation, extra radiation and limited access. MRI-based vertebral bone quality (VBQ) correlates with DEXA and predicts ASD, yet site-specific BMD may be more informative. We therefore compared the novel endplate bone quality (EBQ) score-quantifying subchondral fat infiltration at the adjacent segment-with global VBQ to determine whether EBQ is the stronger independent predictor of ASD after single-level TLIF. **Material and Methods:** A single-center retrospective analysis was conducted of patients undergoing single-level TLIF for degenerative spinal disease from 2014 to 2020. Demographic, surgery, and radiographic data were collected. Logistic regression was used to identify independent risk factors for ASD. Furthermore, a receiver operating curve (ROC) analysis was conducted to evaluate the predictive efficacy of the EBQ score and VBQ score. **Results:** The rate of ASD was 16.4% at a minimum 24-month follow-up. Significant risk factors for ASD were higher VBQ score (OR = 3.418, 95%CI: 1.297-9.008, p = 0.013), higher EBQ score (OR = 2.469, 95%CI: 1.085-5.621, p = 0.031), and higher adjacent segment Pfirrmann grade (OR = 2.866, 95%CI: 1.765-4.653, p < 0.001). The diagnostic accuracy of VBQ and EBQ for distinguishing ASD were 0.806 (95%CI: 0.728-0.883) and 0.835 (95%CI: 0.757-0.912). The optimal threshold of VBQ scores was 2.926 (sensitivity: 90.6%, specificity: 62.0%) and of EBQ was 3.511 (sensitivity: 90.6%, specificity: 71.8%). **Conclusion:** Higher VBQ and EBQ scores are both independent risk factors of ASD after single-segment TLIF surgery, and EBQ scores perform better in predicting ASD. When EBQ > 3.511, there is a considerable risk of ASD.

ID: AGS26/3043
P0419: Prediction of adjacent segment disease after transforaminal lumbar interbody fusion: a predictive model combining multiple radiology variables

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Introduction: Adjacent-segment disease (ASD) develops in 15-37 % of TLIF patients and prompts revision in 11%; low bone mineral density (BMD), pedicle-screw position, paraspinal-fat infiltration and other radiological traits have been individually implicated, yet single-factor models lack clinical power. We therefore fused site-specific MRI metrics-modified vertebral bone quality (MVBQ) and endplate bone quality (EBQ)-with demographic and technical variables to build and validate a practical nomogram that quantifies individual ASD risk after single-level TLIF. **Material and Methods:** This study included patients undergoing single-level TLIF at our center from 2014 to 2020. Basic information and radiology parameters of patients were collected. The least absolute shrinkage and selection operator (LASSO) method was used to select risk factors and a nomogram was established. The receiver operating characteristic (ROC) curve was used to assess predictive accuracy of ASD by single hazard variables and the joint predictive model. **Results:** 228 patients were included in this study and 46 patients (20.2%) developed ASD. Patients with ASD had higher PS tip-VE distance (p = 0.023), higher adjacent segment disk Pfirrmann grade (p<0.001), lower TCSA (p = 0.037), lower FCSA (p = 0.037), higher FI (p<0.001), higher VBQ scores (p<0.001), higher MVBQ scores (p<0.001), and higher EBQ scores (p<0.001). After LASSO regression analysis, six potential risk factors were selected. The ROC analyze showed the joint predictive model had excellent predictive

accuracy (AUC = 0.95, 95%CI: 0.920-0.980, higher than the AUC of single risk factors. **Conclusion:** Pfirrmann grade, FCSA, FI, PS tip-VE distance, MVBQ scores and EBQ scores are all risk factors of ASD. The joint prediction model developed based on the above risk factors has excellent predictive accuracy for ASD, which is a promising tool for clinical application.

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P0420: Simplified S1 vertebral bone quality score predicts screw loosening in patients with lumbar spondylolisthesis

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Introduction: Transforaminal lumbar interbody fusion (TLIF) for spondylolisthesis is frequently complicated by S1-pedicle-screw loosening (up to 41 %), especially in patients with low bone mineral density (BMD). While dual-energy X-ray absorptiometry can mis-classify BMD in degenerative spines and quantitative CT (QCT) is rarely available, MRI-based vertebral bone quality (VBQ) scores are emerging alternatives. We compared the traditional L1-4 VBQ score with a newly proposed single-level S1 VBQ score against QCT to determine which better predicts S1 screw loosening after single-level TLIF. **Material and Methods:** We reviewed 165 patients undergoing single-segment TLIF for lumbar spondylolisthesis at our center from 2012 to 2021. Demographic and radiographic data were collected. To determine the independent factors affecting pedicle screw loosening, univariate analysis and multivariate logistic regression were conducted. Receiver operating characteristic analysis was carried out to assess the predictive ability. **Results:** 16.3% of patients experienced screw loosening at a minimum of 24 months of follow-up. Statistically significant differences in the 2 groups were observed in surgery level (L5-S1), traditional VBQ, S1 VBQ, and QCT values. QCT values, traditional VBQ score, and the S1 VBQ score were independent risk factors for screw loosening. The receiver operating characteristic analysis showed that area under the curve (AUC) of QCT was 0.839 (95% confidence interval [CI]: 0.771-0.907) and the cut-off value was 119 (sensitivity: 85.2% and specificity: 76.8%); AUC of VBQ scores was 0.787 (95% CI: 0.699-0.875) and the cut-off value was 3.585 (sensitivity: 88.9% and specificity: 69.6%), while AUC of S1 VBQ score was 0.823 (95% CI: 0.739-0.908) and the cut-off value was 3.72 (sensitivity: 81.5% and specificity: 76.8%). **Conclusion:** The elevated S1 VBQ score was identified as an independent risk factor for screw loosening and exhibits greater predictive capability compared to the traditional VBQ score in forecasting screw loosening following TLIF for lumbar spondylolisthesis.

ID: AGS26/3050
P0421: Correlation of Modic changes with interventional procedures in lumbar spine pain

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Introduction: Low back pain (LBP) represents a major public health concern, being a principal driver of occupational absenteeism and a significant factor in diminishing patients' quality of life. The anatomical complexity of the lumbar spine (LS) often complicates the precise determination of the pain source. Furthermore, the intricate neural innervation patterns mean that nociception originating from a single intervertebral segment can easily manifest as pain referred to adjacent cranial or caudal segments. **Materials and Methods:** This retrospective analysis included 70 patients who underwent invasive interventional procedures for chronic low back pain over a one-year period. The interventions comprised either Radiofrequency Ablation (RFA) or Epidural Steroid Injection (ESI). The primary objective was to investigate the correlation between the presence of Modic changes (M1 and M2), as determined by Magnetic Resonance Imaging (MRI), and the indication for these invasive procedures. Specifically, we aimed to compare the prevalence of Modic changes in the patient subset receiving ESI versus the subset receiving RFA. **Results:** In the Epidural Steroid Injection (ESI) group, 30 patients presented with Modic 1 (M1) and/or Modic 2 (M2) changes, while 12 patients showed no evidence of Modic changes. Within the ESI group, M1 changes were observed to be more prevalent than M2 changes. Conversely, in the Radiofrequency Ablation (RFA) group, 18 patients exhibited M1 and/or M2 Modic changes, and 10 patients had no Modic changes. Interestingly, the RFA group demonstrated a higher frequency of M2 changes compared to M1 changes. **Conclusion:** The findings indicate a correlation between the presence of Modic changes and the severity of patient back symptoms leading to the need for invasive treatment. Patients who presented with Modic changes were more frequently treated with interventional procedures (ESI or RFA) than those without. Given the differential prevalence of M1 and M2 changes between the ESI and RFA groups, further

comprehensive studies are warranted to explore additional factors that correlate with specific Modic change subtypes and their prognostic value regarding treatment response.

ID: AGS26/3096
P0422: Short term outcome analysis of the first 35 cases of interlaminar lumbar decompression using uniportal endoscopy

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Introduction: Uni-portal endoscopic interlaminar lumbar decompression is increasingly adopted for lumbar disc herniation and canal stenosis. However, outcome data during the early learning curve with at least one-year follow-up remain limited. This study evaluates the clinical and radiological outcomes of the first 35 consecutive cases performed over a one-year period, providing practical insights for new endoscopic surgeons. **Material and Method:** Between July 2023 and June 2024, 35 patients (23 lumbar disc herniation, 12 lumbar canal stenosis) underwent uni-portal endoscopic interlaminar decompression. Demographics, operative time, complications, and clinical outcomes were prospectively recorded. Pain was assessed using the Visual Analog Scale (VAS) for leg and back pain, and functional outcomes were evaluated using the Oswestry Disability Index (ODI). Minimum follow-up was 12 months (mean 13.6 ± 1.2 months). **Results:** The mean age was 49.6 ± 11.2 years (20 males, 15 females). The mean operative time for the first 10 cases was 180 ± 22 minutes, which decreased to 108 ± 15 minutes in the subsequent 25 cases, reflecting a steep learning curve. At one-year follow-up, mean VAS scores for leg pain improved from 7.8 ± 0.9 preoperatively to 2.0 ± 0.8, while back pain improved from 6.2 ± 1.1 to 2.3 ± 0.9 ($p < 0.001$ for both). ODI scores improved from 58.4 ± 7.6% to 18.9 ± 5.4% ($p < 0.001$). Dysesthesia occurred in 7 patients (20%), all transient and resolving within 6-8 weeks. One patient (2.8%) with a broad-based herniation required revision due to incomplete decompression. No neurological deterioration, dural tears, infections, or hematomas were observed. The mean hospital stay was 1.3 ± 0.6 days, and return to routine activities occurred at 3.8 ± 1.2 weeks. Clinical improvements were maintained at one-year follow-up. **Conclusion:** Uni-portal endoscopic interlaminar lumbar decompression provides significant and durable pain relief with functional improvement at one year, even during the initial learning curve. Operative efficiency improves rapidly, supporting the safety, efficacy, and reproducibility of this minimally invasive technique for both lumbar disc herniation and canal stenosis.

Keywords: Uni-portal endoscopy; Interlaminar lumbar decompression; Lumbar disc herniation; Lumbar canal stenosis; Learning curve; Minimally invasive spine surgery

ID: AGS26/3152
P0423: A spontaneous anterior fusion of lumbar spine after posterolateral lumbar fusion with pedicle screw-plate system

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Introduction: Lumbar posterolateral fusion (PLF) with Pedicle Screw-Plate (PSP) fixation without interbody fusion found spontaneous anterior fusion (SAF). No study has reported the SAF of lumbar spine in patients who underwent PLF. This study reports the rate of SAF of lumbar spine after PLF with PSP system compared with the rate of SAF after PLF with pedicle screw-rod (PSR) system. **Material and Methods:** Retrospective reviews of charts and radiographs were performed in 111 patients who underwent PLF with PSP system and PSR system for treatment of degenerative lumbar spine. Demographic data, diagnosis, Myerding grading, level of fusion, Pfirmann grading, disc height, pedicle screw depth, follow up time and SAF were compared between PSP and PSR groups. **Results:** Fifty-five patients in the PSP group and 56 patients in the PSR group were included with similar baseline characteristics. There were more degenerative spondylolisthesis patients in the PSP group compared with patients in the PSR group. However, there was no significant difference of Pfirmann grading in both groups. Fifteen patients (27.3%) in the PSP group developed SAF while no patient in the PSR group had SAF. When patients in the PSP group were analyzed, the mean follow-up time in patients with SAF was significantly longer than the no SAF group. **Conclusion:** This study has reported SAF of lumbar spine in patients who underwent PLF with the PSP system. The SAF increasingly occurred with longer follow-up time. In this study, no SAF was found in patients who underwent PLF with the PSR system.

ID: AGS26/3171
P0424: Pelvic incidence-lumbar lordosis mismatch correction in lumbar fusion: a systematic review and meta-analysis

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Introduction: Sagittal balance is a critical goal in lumbar fusion surgery, with mismatch between pelvic incidence and lumbar lordosis (PI-LL) shown to correlate with disability and clinical outcomes. A PI-LL mismatch of ≤ 10° is widely considered optimal, yet the comparative benefits of achieving full correction (≤ 10°) versus partial correction (> 10°) remain unclear. This study aimed to systematically review and synthesize available evidence on clinical, radiographic, and patient-reported outcomes associated with full versus partial PI-LL correction in adults undergoing lumbar fusion for degenerative disease. **Material and Methods:** A systematic search of MEDLINE, Cochrane, Scopus, Embase, and Web of Science was performed to identify studies stratifying postoperative PI-LL and reporting patient-reported and/or radiographic outcomes. Study designs included fixed threshold comparisons (≤ 10° vs > 10°), three-group classifications, and age-adjusted targets. Patient-reported outcomes were predominantly assessed using the Oswestry Disability Index (ODI) and visual analog scale (VAS) for pain. Meta-analyses were performed where sufficient data were available. Pooled mean differences (MD) and odds ratios (OR) with 95% confidence intervals (CI) were calculated using random-effects models. Heterogeneity was assessed using the I^2 statistic. Statistical significance was set at $p = 0.05$. **Results:** Twenty-two studies involving 2994 patients met inclusion criteria. Full correction (PI-LL ≤ 10°) was associated with better ODI scores in 43% of studies and worse in 7%, while VAS pain scores improved in 56% of studies with no reported worsening. Pooled analysis of eight studies demonstrated no significant difference in the mean change in VAS low back pain between full and partial correction (MD [full-partial] -2.8, 95% CI -12.3 to 6.7; $I^2 = 88\%$). However, full correction was associated with significantly lower odds of adjacent segment disease in seven studies (OR 0.23, 95% CI 0.07-0.81, $p = 0.028$). **Conclusion:** Achieving postoperative PI-LL within 10° in lumbar fusion for degenerative disease is associated with improved patient-reported outcomes and reduced risk of adjacent segment disease. Nonetheless, heterogeneous exposure definitions and retrospective designs limit the certainty of available evidence.

ID: AGS26/3172
P0425: Decompression alone or with fusion: do outcomes really differ in lumbar spinal stenosis?

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Introduction: Degenerative lumbar spinal stenosis (DLSS) is a frequent cause of pain and disability in the aging population. The role of adjunctive fusion with instrumentation in addition to decompression remains debated. To compare functional and perioperative outcomes of decompression alone versus decompression with transpedicular screw fixation in patients with DLSS. **Materials and Methods:** A retrospective observational study was conducted at a Level I trauma center in Pakistan between March 2020 and June 2025. Patients with radiologically confirmed spinal trauma were included. Data collected included age, sex, mechanism of injury, anatomical site, neurological status (ASIA scale), associated injuries, management strategy, ICU admission, length of stay (LOS), and outcomes. Logistic regression was applied to identify independent predictors of mortality. This retrospective study included 95 patients treated at the Department of Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore, between January 2022 and December 2022. Patients were divided into two groups: decompression alone (n = 37, 38.9%) and decompression with fixation (n = 58, 61.1%). Outcomes were assessed using the Swiss Spinal Stenosis (SSS) score, Oswestry Disability Index (ODI), and Visual Analogue Scale (VAS) for back and leg pain at baseline, 6 months, 1 year, and 2 years. Operative time, blood loss, hospital stay, and complications were also recorded. **Results:** Both groups showed significant improvement in SSS, ODI, and VAS scores at 2 years ($p < 0.001$). No meaningful difference in long-term functional outcomes was observed between groups ($p > 0.05$). The fixation group had longer mean operative time, greater blood loss, and longer hospital stay (6.3 vs 4.5 days). Complication and reoperation rates were similar. Radiological analysis showed solid fusion in fixation cases and no significant postoperative instability in the decompression-alone cohort. **Conclusion:** Decompression alone and decompression with fixation provide comparable functional improvement. Decompression alone offers the benefits of shorter surgery, less blood loss, and faster recovery, while fixation may be reserved for patients with instability or multilevel disease.

ID: AGS26/3224
P0426: OLIF with antero lateral stabilisation in degenerative disorders of lumbar spine - Is posterior surgery necessary?

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Introduction: Indirect neurological decompression in form of increased foraminal opening and central canal opening has

been the central concept in lateral surgeries of spine. These minimal invasive procedure also preserve both the ALL and PLL providing efficient reduction of vertebral body through ligamentotaxis. **Purpose:** To assess clinical and radiological outcomes of oblique lumbar Inter body fusion technique in single stage single anterior approach with anterolateral screw without going posterior (OLIF-AL). **Material and Methods:** Observational type study of 3 years duration. Inclusion criteria: 1. Degenerative spinal diseases. 2. Failed conservative management for over 2 months. 3. Revision surgery following failed posterior surgery. Exclusion criteria: 1. L5-S1 level involvement. 2. Higher iliac crest. 3. More than 2 level involvement. 4. Presence of congenital deformities. Clinical assessment was done using Numeric Rating scale score (NRS) and Oswestry disability Index score. Operating time and blood loss was also monitored. Radiological assessment of disc height, foraminal height and foraminal area on standing lateral radiography. Segmental lordotic angle. Fusion status analysed using modified Birdwell fusion criteria. **Results:** 55 patients in our study Mean age was 54.5 yrs. Mean preoperative NRS score for back pain and leg pain was 4.6 and 5.9 will was reduced to 2.3 and 1.8 respectively at final follow up. ODI score decreased from 48.8% to 24.0%. In Radiological outcome Birdwell fusion criteria at 1 yr and final follow up was 70% and 90%. Disc height increased from mean of 8.6 mm to 13.4 mm. Average increase in foraminal area was 30%. Segmental lordotic angle increased from mean of 10.1 degree to 15.2 degree. We observed about 30% in operation time and significant reduction in blood loss. Complication in 3 patients, which was approach related injury to psoas muscle (hip flexor weakness) which improved completely over the period of 3 months. **Conclusion:** Single stage single anterior approach OLIF for degenerative lumbar diseases showed favourable clinical and radiological outcome. It helps avoids various complications of second procedure in standard OLIF. Overall OLIF with anterolateral screw is safer faster and efficient.

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P0427: Posterolumbar interbody fusion with laminoplasty in the treatment of lumbar isthmic spondylolisthesis. A prospective clinical study

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Introduction: The technique for surgical treatment of isthmic spondylolisthesis (ISL) is still controversial. Different opinions have been expressed by various authors on timing, type of surgery, type of grafts that are used as well as on whether reduction should be applied or not and the value of reduction. In light of these data we describe our technique in the treatment of ISL and its outcomes. **Material and Methods:** we examined 70 consecutive patients that had been operated in our clinic due to ISL. The patients have been assessed clinically and radiologically. The same posterior surgical technique was used in all patients (interbody fusion using bone substitute and cage, reduction of the olisthesis and reinsertion of the lamina). **Surgical Technique:** In prone position, after exposure of the spine posteriorly and transpedicular screw fixation of the affected segment, the lamina of the affected level was removed en-bloc through the facet joint and site of lysis on both sides. Decompression of the nerve roots on both sides followed by discectomy and preparation of the endplates for bone substitute and cage was performed. Partial reduction of the olisthesis could be achieved through the discectomy and additional reduction through the application of lordotic rods. Finally, after preparation of the lamina and removal of the cartilage on the joint surfaces the lamina was placed and fixed through small screws 2.7mm to the facet joint on both sides. **Results:** The mean age of the 44 females and 26 males was 53.2 years (18-78). Main complaint at the time of presentation was low back pain (mean VAS 5.9/10) in 59 patients with mean duration of 11.9 months. Leg pain was found in 57 cases; L5 radicular pain in 46 of them. Four patients had foot weakness due to foraminal disc herniation. Olisthesis grade I was seen in 36 patients, grade II in 24 and grade III in 10 cases. The technique was performed in 57 patients for L5/S1, in 10 patients for 4/5, in 3 patients for L4-S1. Fusion of adjacent degenerative level was done in 11 cases. Mean operative time was 182 min. with a blood loss of 630 ml. complete reposition could be obtained in 60 patients. Three patients had dural tears intraoperatively, one patient had foot weakness postop. that improved completely within one week. Out of 2 Patients with superficial wound infections one needed revision surgery. Solid fusion was found in 65 patients at the last FU. Three patients developed symptomatic screw loosening of L5 which had to be re-operated. VAS reduced to 3/10 before discharge and to 1.2 at the last FU (mean of 20.5 months). **Conclusion:** Removal of the lamina facilitates decompression of the nerve roots and enables reduction of Olisthesis. The use of bone substitute prevents donor site complications. The laminoplasty preserves the osseous structures of the posterior column and prevents scar formation. It also facilitates performing the revision surgeries.

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P0428: Power-drill fluoroscopy-controlled freehand vs. navigation-assisted pedicle screw placement: a propensity score-matched retrospective cohort study

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Introduction: Precision in spinal instrumentation is critical in preventing neurological injury and hardware failure. While freehand (FH) and navigation-assisted (NA) techniques are well-studied, power drill-assisted methods remain underreported. This study compares the accuracy of power-drill fluoroscopy-controlled FH (PFH) versus power-drill fluoroscopy NA-assisted pedicle screw placement. **Material and Methods:** This propensity score-matched retrospective cohort study evaluated PFH versus NA pedicle screw insertion in degenerative thoracolumbar spinal pathologies. Only patients with postoperative CT scan were included. Pediatric, cervical, and non-degenerative cases were excluded. Matching was based on demographic variables. Accuracy was assessed and dichotomized using CT-based Gertzbein-Robbins classification (A+B = satisfactory, C-E = unsatisfactory), comparing complication rates and surgical parameters. A generalized linear mixed model was utilized for within-patient clustering to estimate accuracy determinants. **Results:** Among 1,102 screened cases, 528 had follow-up CT imaging. A total of 49 patients (314 screws) in the PFH and 61 patients (262 screws) in the NA were identified. Thirty-five patients per group have been matched in the final analysis (224 vs. 154 screws). PFH demonstrated significantly higher rates of satisfactory screw placement (GRS A + B: 98.1% vs. 94.3% pre-matching; 98.2% vs. 93.5% post-matching; $p = 0.02$) and a 66.7% lower likelihood of revision surgery at 12-month follow-up (5.71% vs. 17.14%, $p = 0.26$). Radiation dose ($mGy \cdot cm^2$) was 65% lower in PFH compared to NA ($8,378.43 \pm 5,302.08$ vs. $23,793.02 \pm 13,161.81$, $p < 0.0001$). Pedicle screws were found to be longer in the PFH group (5.08 ± 0.54 vs. 4.9 ± 0.44; $p < 0.001$), while osteoporosis was associated with lower screw accuracy (OR 0.43, 95%CI 0.2-0.92; $p = 0.02$). **Conclusion:** PFH pedicle screw placement demonstrates higher overall accuracy compared to NA-assisted techniques with less radiation exposure in our cohort. PFH seems to be a viable, effective alternative to NA with reduced dependency on advanced imaging systems.

ID: AGS26/3265
P0429: Predictive factors of recurent lumbar disc herniation

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Introduction: Lumbar disc herniation surgery, while generally successful, can be complicated by recurrent disc herniation often requiring reoperation. The causes are multifactorial, potentially involving patient traits, spinal biomechanics, and surgical technique. However, identified risk factors remain inconsistent across studies and populations. This study aimed to evaluate the predictive factors within a specific Tunisian cohort. Identifying these factors is essential for improving surgical outcomes through better patient selection, tailored techniques, and targeted postoperative management. **Material and Methods:** We retrospectively reviewed 120 patients operated for single-level lumbar disc herniation at the Institut Kassab of Orthopedics between 2014 and 2024. Surgical techniques included standard discectomy with laminotomy, microdiscectomy, hemilaminectomy, total laminectomy, and discectomy with posterolateral non-instrumented fusion. Patients were divided into a recurrent group (n = 18, 15%) and a non-recurrent group (n = 102). Demographic variables (age, sex, BMI, smoking, diabetes, occupational factors), clinical parameters (history of trauma, pain characteristics), and radiological features (type of herniation, disc height index, sagittal range of motion, facet orientation/tropism) were analyzed. **Results:** The recurrence rate was 15%. Univariate analysis showed significant associations between recurrence and younger age, male gender, obesity, smoking, diabetes, traumatic events, heavy occupational lifting, transligamentous extrusion type, and surgical technique (total laminectomy vs. microdiscectomy). Radiological predictors included increased disc height index, greater sagittal range of motion, and augmented facet tropism, decreased facet orientation. **Conclusion:** In this Tunisian series, recurrent lumbar disc herniation was associated with both patient-related and biomechanical factors. Attention to modifiable risks such as smoking cessation, weight control, and occupational strain reduction, combined with careful surgical technique, may help decrease recurrence rates. Patients with high-risk profiles require closer follow-up and tailored postoperative rehabilitation.

ID: AGS26/3266

P0430: Is facet orientation the key to success in non surgical treatment of lumbar facet cysts ?

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Introduction: Lumbar facet cysts are a common cause of radiculopathy. Percutaneous facet cyst rupture (PFCR) offers a minimally invasive, cost-effective alternative to surgery. This study evaluates PFCR outcomes in patients with favorable versus unfavorable facet orientations, with emphasis on symptom relief and recurrence. **Methodology:** Sixty-seven patients (32 men, 35 women) with acute radiculopathy (< 3 months) from lumbar facet cysts were included. Patients were grouped by facet orientation: 28 favorable and 39 unfavorable. Exclusion criteria were prior lumbar surgery, chronic symptoms, or other spinal disorders. Follow-up was conducted at 3, 6, and 12 months post-PFCR. Recruitment is ongoing to expand the cohort to 100-150 patients for broader analysis. **Results:** In the favorable orientation group, 27 of 28 patients achieved complete pain relief without recurrence at 12 months; one required surgery. In the unfavorable group, 27 of 39 reported complete initial relief, though 15 developed recurrent back pain. Among the remaining 12, two were lost to follow-up, six underwent surgery for persistent stenotic symptoms, and four had cyst recurrence requiring repeat PFCR. **Conclusion:** PFCR is highly effective in patients with favorable facet orientation, yielding sustained pain relief and minimal recurrence. In those with unfavorable orientation, initial outcomes are encouraging, but recurrence of pain and cyst regrowth are more frequent. Facet orientation appears to be an important predictor of long-term PFCR success. Expansion of the cohort will help refine efficacy and complication profiles.

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P0431: Lumbar interbody fusion for degenerative spondylolisthesis: clinical and radiological outcomes in a Tunisian cohort of 100 patients

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Introduction: Degenerative spondylolisthesis is a frequent cause of low back pain and radiculopathy in elderly patients. Lumbar interbody fusion is widely performed to restore spinal stability, decompress neural elements, and improve functional outcomes. However, data from North African populations remain scarce. This study aimed to evaluate the clinical and radiological results of lumbar interbody fusion for degenerative spondylolisthesis in a Tunisian cohort. **Material and Methods:** We retrospectively reviewed 100 patients (72 women, 28 men) operated between 2010 and 2022 for single- or two-level degenerative spondylolisthesis. The mean age was 59 years (range 42-75). All patients underwent posterior lumbar interbody fusion (PLIF) or transforaminal lumbar interbody fusion (TLIF) with pedicle screw fixation. Clinical outcomes were assessed using the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) for back and leg pain. Radiological fusion was evaluated by CT scan at 12 months. Complications and reoperation rates were recorded. **Results:** At a mean follow-up of 36 months, 85% of patients reported significant improvement in back and leg pain (mean VAS improvement: 5.2 points, $p < 0.001$). ODI scores improved from a mean of 62% preoperatively to 24% at final follow-up. Radiological fusion was achieved in 92% of cases. Early complications occurred in 12 patients (12%), including dural tears (5 cases) and superficial infection (4 cases). Late complications included adjacent segment disease in 6 patients (6%). The reoperation rate was 8%. **Conclusion:** Lumbar interbody fusion provides satisfactory clinical and radiological outcomes for degenerative spondylolisthesis in the Tunisian population. Despite a moderate complication rate, this technique remains a safe and effective option for restoring spinal stability and improving patient quality of life.

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P0432: Incidental durotomy in lumbar surgery: does it really change the outcome?

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Introduction: Incidental durotomy is a common complication of lumbar spine surgery, with reported rates between 1% and 17%. Concerns include cerebrospinal fluid (CSF) leakage, infection, pseudomeningocele, and delayed wound healing, often leading to conservative measures such as bed rest, acetazolamide, or prolonged drains. When the tear is irreparable intraoperatively, management becomes more challenging. However, it remains unclear whether such durotomies truly alter postoperative outcomes when

managed with standardized protocols. This study aimed to assess the clinical impact of irreparable durotomies in lumbar decompression. **Materials and Methods:** One hundred patients undergoing lumbar decompression between 2022 and 2024 were prospectively followed for 12 months. All were managed with a uniform protocol: mobilization within 24 hours, no acetazolamide or head-low positioning, and uncharged drains maintained for up to 72 hours before removal. **Results:** Most patients (78.9%) recovered without headaches or prolonged stays. Complications were limited to wound CSF leakage requiring re-exploration (n = 2), postoperative meningitis (n = 1), delayed wound healing (n = 4), and pseudomeningocele without communication (n = 3). **Conclusions:** Accidental intraoperative durotomies that cannot be primarily repaired do not appear to significantly worsen outcomes when managed with consistent postoperative care. Most patients recovered without prolonged hospitalization, delayed mobilization, or escalated therapy. Although complications such as pseudomeningocele, infection, or wound issues can occur, their incidence remains low and manageable. These findings suggest that with proper protocols, irreparable durotomies should not be considered a major determinant of adverse recovery in lumbar decompression surgery.

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P0433: Reshaping the spine: sacral dome osteotomy for high-grade L5-S1 spondylolisthesis-safety, radiographic correction, and clinical outcomes

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Introduction: High-grade L5-S1 spondylolisthesis (Meyerding Grade III or higher) presents complex challenges in alignment correction, particularly in restoring spinopelvic parameters and achieving safe reduction. Conventional reduction techniques risk neural injury and may inadequately address segmental alignment. Sacral dome osteotomy (SDO) facilitates posterior translation of L5 by resecting the anterior dome of the sacrum, allowing anatomical reduction while preserving neural integrity. This study aims to evaluate the safety, radiographic correction, and clinical outcomes of SDO in the treatment of high-grade L5-S1 spondylolisthesis. **Material and Methods:** A retrospective analysis was performed on patients undergoing SDO and L4-S1 posterior spinal fusion (PSF), with or without lateral interbody fusion (LIF), at a single institution. Demographic, perioperative, and radiographic data were collected. Outcome measures included estimated blood loss (EBL), length of stay (LOS), Visual Analog Scale (VAS) scores, fusion rates, and revision surgery. Pre- and postoperative sagittal parameters were assessed, including lumbar lordosis (LL), L5-S1 and L4-5 segmental lordosis, pelvic tilt (PT), sacral slope (SS), and PI-LL mismatch. **Results:** Five patients met inclusion criteria (mean age 39.2 ± 17 years; BMI 25 ± 6 kg/m^2). Mean EBL was 1280 ± 766 mL; mean LOS was 7 ± 4.5 days. VAS improved from 6.4 ± 2 preoperatively to 0.8 ± 1.3 at final follow-up (mean 815 ± 344 days). LL improved from 72° ± 6.5 to 75° ± 16; PI-LL mismatch decreased from 11° ± 10.6 to 6.5° ± 14. Segmental lordosis at L5-S1 increased from 13.3° ± 9 to 21.3° ± 10, and at L4-5 from 27.2° ± 5 to 28.3° ± 9.5. L4-S1 lordosis improved from 35° ± 13 to 37.5° ± 12.8. PT increased slightly (23.7° ± 4 to 25.9° ± 9), and SS decreased marginally (58.3° ± 6.5 to 56° ± 8). One patient underwent hardware removal at 52 weeks. No cases of pseudoarthrosis, sacral fracture, or permanent neurological deficits were observed. **Conclusion:** SDO offers a safe and effective strategy for achieving bony reduction in high-grade L5-S1 spondylolisthesis. In this small cohort, it enabled substantial radiographic correction and pain relief with minimal complications or need for revision. Larger studies are warranted to validate these findings and define optimal indications.

ID: AGS26/3383
P0434: Bracing and activity restriction after lumbar discectomy. An international survey of AO Spine Members

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Introduction: Bracing after lumbar discectomy surgery is a controversial topic with paucity of related scientific literature. Previous surveys on spine surgeons' preferences were limited both in geographical coverage and number of respondents. Cross sectional observational study. The aim of this study is to fill this gap in literature. **Material and Methods:** An international online survey among AO spine members regarding the postoperative recommendations for bracing, activity restriction, and associated factors, was performed. **Results:** A total of 703 spine surgeons participated in the survey of which 34% recommended postoperative bracing, with half of them reported usage for four weeks. Main influencing variables were respondents from Europe/South Africa region, greater extent of bony decompression, and larger amount of excised disc material. Seventy-nine percent of the respondents recommended postoperative activity restrictions. Prolonged standing, prolonged sitting, and driving were usually restricted for two weeks. Bending, twisting, lifting, and low intensity physical activities were restricted for 3 months, while high intensity physical activities and direct contact sports for 6 months were restricted. **Conclusion:** Despite recent insights into the literature showing a lack of efficacy, one third of a large cohort of international spine surgeons practice bracing after lumbar discectomy for variable duration. A more extensive bony decompression, and a more aggressive disc material debulking seems to significantly influence the surgeons' decision to brace. More high-quality studies are warranted on this topic to reach an evidence-based recommendation.

ID: AGS26/3389

P0435: Lateral lumbar interbody fusion (XLIF) for the management of lumbar pseudarthrosis: technical note and case series results

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Introduction: The number of lumbar fusions performed for degenerative pathology has increased, leading to more revision surgeries, frequently due to pseudarthrosis, defined as the absence of bony consolidation one year after the index surgery. Its incidence ranges from 5% to 35% and is associated with both surgical- and patient-related risk factors. Pseudarthrosis is linked to morbidity, reoperation, and increased costs. The most common clinical presentation is mechanical axial pain, and diagnosis should combine imaging and clinical symptoms. Revision procedures must address both mechanical and biological factors, with possible strategies including interbody fusion and correction of risk factors. Posterior revision surgery poses significant challenges, such as fibrosis, adhesions, potential neurological complications, and high recurrence and failure rates. Lateral approaches, such as extreme lateral lumbar interbody fusion (LLIF), may offer advantages by avoiding prior surgical scars, reducing operative time, blood loss, and enhancing recovery. The main objective is to describe clinical outcomes of patients undergoing revision surgery for lumbar pseudarthrosis using the LLIF approach. **Material and Methods:** A retrospective descriptive study was conducted including patients who underwent revision surgery for lumbar pseudarthrosis using LLIF between July 2019 and July 2024 at Clinica Universidad de los Andes. **Results:** Our case series included 9 patients who underwent exclusive lateral approach for pseudarthrosis management. There were 7 men and 2 women, with a mean age of 67.6 years (range 49-78, SD 10.1) and mean BMI of 27.0 kg/m^2. The mean postoperative interval from the index surgery was 566.9 days. Fusion was achieved in 8 of 9 patients; one patient later required reoperation due to adjacent segment disease. Titanium cages were used in some cases, while the rest were PEEK. The mean operative time was 134 minutes. Mean immediate postoperative VAS was 2.88, decreasing to 1.41 at 24 hours. The mean ODI was 8%. Four cases of left-sided cruralgia and three cases of left

psoas paresis related to the approach were reported; all symptoms were transient, resolving within 5 to 15 days. **Conclusion:** This case series demonstrates short-term results of LLIF as an alternative to traditional posterior revision for lumbar pseudarthrosis. Outcomes suggest that this minimally invasive approach achieves adequate fusion with low complication rates. Further studies with larger cohorts, longer follow-up, and direct comparison with the standard posterior technique are warranted.

ID: AGS26/3390
P0436: Influence of sagittal spinal balance on mid-term functional outcome after discectomy

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Introduction: Discectomy is the reference treatment for lumbar disc herniation resistant to conservative therapy or presenting with neurological signs. However, functional outcomes vary between studies and may depend on several factors, including sagittal balance. The aim of this work was to assess the impact of spinal sagittal alignment on clinical and functional outcomes after discectomy. **Material and Methods:** This retrospective study covered a 6-year period (2015-2021) with a minimum follow-up of 36 months. All patients who underwent lumbar discectomy were included. Collected data comprised demographics and spinopelvic parameters-pelvic incidence, sacral slope, and lumbar lordosis-measured pre- and postoperatively. Postoperative outcomes were evaluated at final follow-up using residual pain on a Visual Analog Scale (VAS) and the Oswestry Disability Index (ODI). **Results:** The series included 65 patients with a mean age of 45.4 years and a sex ratio of 0.7. Thirteen percent of patients had Roussouly type-1 spines, 46% type-2, and 41% type-3 or 4. The mean ODI improved from 30.9 preoperatively to 14.8 at final follow-up. Mean VAS pain scores decreased from 7.1 to 3.87. Outcomes were better in patients with type-1 and type-2 spines, but comparison across Roussouly types showed no statistically significant difference in functional results. **Conclusion:** Sagittal balance did not significantly influence mid-term functional outcomes after lumbar discectomy. Nevertheless, assessing sagittal alignment remains an important step in preoperative evaluation.

ID: AGS26/3392
P0437: Anterior to posterior docking: a feasibility study of lumbar plexus displacement in lateral lumbar interbody fusion

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Introduction: Transpsoas lateral lumbar interbody fusion (LLIF) at L4-5 navigates a constrained safe zone due to anterior migration of the lumbar plexus and the ventral position of the great vessels. This study evaluated whether initial docking at the anterior one-third, followed by gradual posterior advancement under intraoperative neuromonitoring, could displace the plexus posteriorly and expand the anterior corridor without compromising motor function. This study will assess the feasibility of posterior lumbar plexus displacement using anterior-first docking at L4-5. **Material and Methods:** A retrospective review was performed on 74 consecutive patients who underwent prone LLIF at the L4-5 segment with institution accessible pre-operative MRI and post-op CT scans. Preoperative axial T2-weighted MRI were used to localize the left femoral nerve. A horizontal reference line was drawn at the posterior margin of the disc space, just anterior to the spinal canal. From this reference, two perpendicular measurements were obtained: one to the anterior-most point of the disc, defining the anteroposterior (AP) disc diameter, and one to the anterior-most point of the femoral nerve. Nerve position was expressed as a percentage of the total AP disc depth. Postoperative CT scans were reviewed using the same reference line to measure the perpendicular distance to the posterior edge of the implant. Femoral nerve movement was calculated as the absolute difference in millimeters between the preoperative nerve location and the final implant position. **Results:** The mean AP disc diameter was 41.8 ± 4.9 mm. The femoral nerve lay 16.3 ± 5.1 mm from the posterior margin, corresponding to $38.8 \pm 10.8\%$ of disc depth. The posterior edge of the implant measured 8.7 ± 3.7 mm, corresponding to $20.9 \pm 8.7\%$ of disc depth. Femoral nerve movement averaged 7.6 ± 4.6 mm posteriorly. No patient exhibited intraoperative neuromonitoring alerts indicative of neural injury, nor demonstrated $\leq 3/5$ knee extension strength

immediately postoperatively or at the two-week follow-up. **Conclusion:** Final implant position consistently measured posterior to the preoperative femoral nerve location, suggesting transient plexus displacement during surgery. As preoperative MRI was obtained supine, the degree to which this shift reflects prone positioning versus anterior-to-posterior dilator advancement remains uncertain. Nonetheless, the absence of postoperative motor deficits supports the feasibility of this docking strategy to safely expand the anterior corridor at L4-5.

ID: AGS26/3406
P0438: Effect of Body Mass Index on perioperative outcomes in minimally invasive oblique lateral lumbar interbody fusion versus open fusions: a multivariant analysis

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Introduction: Oblique lateral lumbar interbody fusion (OLLIF) is a minimally invasive lumbar surgery. Differences in resource consumption between open spinal surgeries, transformational lumbar interbody fusions (TLIF) and OLLIF, are not documented. We monetize quantifiable differences in resource utilization between the two procedures. A retrospective review of 124 surgeries was performed (OLLIF = 69, TLIF = 55). Standard conversion factors were used and values reported based on the levels (1-4) addressed at surgery. One level surgery time (OLLIF 62.9 vs. TLIF 134.9 minutes) and surgical expense (OLLIF $5,253 vs. TLIF $11,264) were reduced in the OLLIF population. Inpatient costs (OLLIF $5,712 vs. TLIF $9,271) and length of stay (LOS) were also reduced (OLLIF 2.6 vs. TLIF 4.2 days). Per case, reduced resource consumption suggests lower total hospital costs. Reduced surgical time and LOS can result in greater patient throughput per operating room and patient bed for OLLIF patients in hospitals that have resourced constrained environments. **Material and Methods:** We monetize quantifiable differences in resource utilization between the two procedures. A retrospective review of 124 surgeries was performed (OLLIF = 69, TLIF = 55). Standard conversion factors were used and values reported based on the levels (1-4) addressed at surgery. **Results:** One level surgery time (OLLIF 62.9 vs. TLIF 134.9 minutes) and surgical expense (OLLIF $5,253 vs. TLIF $11,264) were reduced in the OLLIF population. Inpatient costs (OLLIF $5,712 vs. TLIF $9,271) and length of stay (LOS) were also reduced (OLLIF 2.6 vs. TLIF 4.2 days). **Conclusion:** Per case, reduced resource consumption suggests lower total hospital costs. Reduced surgical time and LOS can result in greater patient throughput per operating room and patient bed for OLLIF patients in hospitals that have resourced constrained environments.

ID: AGS26/3418
P0439: Multicenter comparative outcomes of endoscopic transforaminal vs interlaminar lumbar discectomy

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Background: Lumbar disc herniation (LDH) is among the most common spinal disorders and a leading indication for surgical intervention in degenerative spine care. Over the past two decades, full-endoscopic spine surgery (FESS) has become a widely adopted minimally invasive alternative, offering precise neural decompression with minimal collateral tissue disruption. Two principal surgical corridors are used: the transforaminal approach (TELD), best suited for foraminal and upper lumbar pathology, and the interlaminar approach (IELD), advantageous at L5/S1 and for central or paracentral herniations. Despite their widespread adoption, prospective comparative evidence between TELD and IELD remains scarce. Leveraging high-frequency, app-based patient-reported outcomes, this multicenter study provides a temporally resolved analysis of recovery trajectories, offering new insight into how procedural geometry influences clinical recovery. **Methods:** In this prospective, multicenter cohort study, 573 patients underwent ambulatory full-endoscopic single-level lumbar discectomy (TELD: n = 351; IELD: n = 222). Perioperative data were documented via a digital health platform (SPINEHealthie). Patient-reported outcome measures (back pain, leg pain, Oswestry Disability Index [ODI]) were collected daily during the first postoperative week and at 2 weeks, 1 month, 3 months, 6 months, and 12 months.

Given baseline imbalances in age, BMI, herniation morphology, and L5/S1 distribution, adjusted linear mixed-effects models were applied to account for these covariates. **Results:** Both TELD and IELD resulted in marked and sustained improvement in pain and disability. IELD was associated with superior early outcomes. Back pain scores were significantly lower from 2 weeks to 6 months (2 weeks: -0.77 [95% CI -1.38 to -0.16], p = 0.014; 3 months: -0.87 [-1.54 to -0.21], p = 0.010; 6 months: -1.27 [-1.98 to -0.56], p < 0.001), converging by 12 months. Leg pain improved more rapidly after IELD, with significant differences from days 1-3 through 6 months (days 1-3: -0.87 [-1.52 to -0.22], p = 0.009; days 4-7: -0.98 [-1.64 to -0.32], p = 0.004; 2 weeks: -1.15 [-1.81 to -0.48], p < 0.001; 6 months: -1.55 [-2.32 to -0.79], p < 0.001), converging by 12 months. ODI trajectories likewise favored IELD in the intermediate phase (2 weeks: -2.50 [-4.91 to -0.10], p = 0.042; 3 months: -4.00 [-6.58 to -1.43], p = 0.002; 6 months: -6.14 [-8.89 to -3.40], p < 0.001), with no significant differences at 12 months. **Conclusions:** Both TELD and IELD are effective, tissue-preserving techniques for lumbar discectomy with durable one-year outcomes. IELD was associated with faster and more pronounced improvements in pain and function, whereas TELD remains valuable particularly for foraminal pathology and non-L5/S1 levels. These findings highlight the importance of anatomy-guided, individualized selection of surgical approach in endoscopic lumbar discectomy.

ID: AGS26/3465

P0440: Association of lumbar spine fusion with increased long-term risk of hip, knee, and ankle arthroplasty: a matched cohort study of adjacent joint degeneration

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Introduction: Spinal fusion surgery is known to alter spinal biomechanics, but its long-term impact on adjacent lower extremity joints remains unclear. We hypothesized that lumbar spinal fusion accelerates degenerative changes in adjacent joints, increasing the risk of hip, knee, and ankle arthroplasty. Spinal fusion surgery is known to alter spinal biomechanics, but its long-term impact on adjacent lower extremity joints remains unclear. We hypothesized that lumbar spinal fusion accelerates degenerative changes in adjacent joints, increasing the risk of hip, knee, and ankle arthroplasty. **Material and Methods:** A retrospective matched cohort study was conducted using a large electronic health record database. Adult patients who underwent lumbar were compared to matched controls without spinal fusion. Matching was performed 1:1 for age, sex, ethnicity, body mass index, and comorbidities including osteoporosis, chronic kidney disease, liver disease, type 2 diabetes, and rheumatoid arthritis. Primary outcomes were rates of total hip arthroplasty, total knee arthroplasty, and ankle arthroplasty over 1-, 3-, and 5-year follow-up periods. Hazard ratios (HR) with 95% confidence intervals (CI) were calculated. Statistical significance was defined as p < 0.05. **Results:** At one year, lumbar fusion patients had significantly higher rates of THA (HR 1.59, 95% CI 1.29-1.95, p < 0.001), while rates of TKA and ankle arthroplasty were not significantly different. At 3 years, the fusion group demonstrated increased risk of both THA (HR 1.83, 95% CI 1.55-2.15, p < 0.001), and TKA (HR 1.28, 95% CI 1.12-1.47, p < 0.001), with no significant difference in ankle arthroplasty. By 5 years, lumbar fusion was associated with elevated risks of THA (HR 1.78, 95% CI 1.54-2.05, p < 0.001), TKA (HR 1.45, 95% CI 1.29-1.63, p < 0.001), and ankle arthroplasty (HR 2.90, 95% CI 1.15-7.29, p = 0.018). **Conclusion:** Lumbar spinal fusion was associated with a significantly increased long-term risk of total hip, knee, and ankle arthroplasty in this cohort, suggesting that the original spinal pathology requiring lumbar fusion or the altered biomechanics post-fusion may contribute to accelerated degeneration in the weight-bearing joints of lower extremities advancing from proximal to distal. These findings may underscore the importance of counseling patients undergoing lumbar fusion on potentially subsequent joint consequences.

ID: AGS26/3474

P0441: Fully endoscopic transforaminal lumbar interbody fusion with an expandable cage to treat grade II L5/S1 isthmic spondylolisthesis: an observational cohort study with more than 5 year follow up

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Introduction: Fully endoscopic transforaminal lumbar interbody fusion (TLIF) surgery potentially offers better endplate preparation (increased fusion rate), less complications and quick recovery, than traditional open or tubular TLIF surgeries. **Material and Methods:** 36 patients with symptomatic grade II L5/S1 isthmic spondylolisthesis were treated with uniportal endoscopic TLIF from January, 2018 through January, 2024. In this consecutive observational cohort study, pre- and postoperative VAS scores of back pain and leg pain, ODI, as well as clinical fusion rate were analyzed at a final follow-up of more than 5 years. **Results:** Intraoperative data and clinical outcomes were analyzed and reported. For all the 36 patients, intra-

operative blood loss was average 63ml. There were no infections or wound complications. All 36 patients had successful reduction of spondylolisthesis and placement of a large size expandable interbody cage. At the final 5-year follow-up, the postoperative VAS scores of back and leg pain, ODI score were all significantly improved comparing with the preoperative scores. Clinical fusion rate was 100%, but 2 patients developed lateral recess and/or foraminal heterotopic ossification which required re-operation. **Conclusion:** Uniportal fully endoscopic TLIF is a new and effective technique with potential advantages of better end plate preparation, safe placement of large interbody fusion device, faster recovery and better fusion rate, hence good post-operative clinical outcome for patients with grade II L5/S1 isthmic spondylolisthesis.

ID: AGS26/1772

P0442: Development and Validation of a Magnetic Resonance Imaging-Based Predictive Model for Recurrence after Simple Nucleotomy in Lumbar Disc Herniation

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Introduction: This study aims to explore the development and validation of a predictive model for postoperative recurrence in patients with lumbar disc herniation (LDH) undergoing simple nucleotomy, based on magnetic resonance imaging (MRI). **Material and Methods:** A retrospective analysis was conducted on clinical and MRI data of LDH patients who underwent simple nucleotomy between January 2017 and December 2023. Multidimensional indicators were extracted, including demographic characteristics, conventional MRI sequence features, enhanced MRI parameters, cartilaginous endplate integrity, and degree of disc degeneration. Least Absolute Shrinkage and Selection Operator (LASSO) regression and multivariate logistic regression analyses were employed to identify independent predictors and develop a combined predictive model. The model's discriminative ability, calibration accuracy, and clinical utility were evaluated using receiver operating characteristic (ROC) curves, calibration curves, and decision curve analysis (DCA). **Results:** The results demonstrate that the predictive model, constructed based on MRI radiomic features combined with clinical risk factors, exhibits high predictive efficacy for postoperative recurrence of LDH. **Conclusion:** For patients after simple nucleotomy in LDH, the MRI-based predictive model can provide valuable support for individualized recurrence risk stratification and clinical decision-making.

Diagnostics

ID: AGS26/153

P0443: Effect of lumbosacral transitional vertebra on bone density in the lumbar spine

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Introduction: This study aimed to compare HU measurements in lumbar vertebrae between patients with LSTV and an age- and sex-matched group without LSTV using existing abdominal CT images. Additionally, lumbar bone mineral density differences of LSTV types according to Castellvi's classification were also assessed. **Material and Methods:** We reviewed all abdominal CT scans of patients in our hospital's PACS between July 2024 and June 2025 to cover a full period of one year. While data were recorded for patients with LSTV in the scans, patients without LSTV were also recorded to create an age- and sex-matched control group. HU values were measured on CT images of the lumbar spine obtained through the PACS software by one experienced radiologist and one experienced spine surgeon separately. The average of these two measurements was used in the study. Vertebral bodies were located in the mid-sagittal images, and an elliptical range of interest (ROI) was placed at the interpedicular section of the selected vertebral body and enlarged as much as possible without touching cortical bone. To achieve meticulous measurement, the cross-sectional area was measured. Since the greatest load distribution is at the lumbosacral junction, after measuring HU at all levels, the ratio of L5 and S1 measurements to the average of L1-4 measurements was calculated to reduce the effect of individual differences of the patients. Measurements of patients with and without LSTV were compared. Results were also evaluated separately based on LSTV type. **Results:** A total of 344 LSTVs (142 female, 202 male) were detected in abdominal CT scans. Castellvi type I was found in 238 studies, type II in 58 studies, type III in 34 studies, and type IV in 14 studies. Age and gender distribution according to LSTV type was not found to be statistically significant. HU values were significantly lower in the LSTV group than in the control group at all levels except L5. The ratio of the L5 measurement to the L1-L4 mean value was higher in the LSTV group, while the ratio of the S1 measurement to the L1-L4 mean value was similar between the groups. When the HU values of LSTV types were

compared, the HU value at the L5 level was found to be higher in patients with type 3 anomaly than in other types ($p = 0.008$). When types 3 and 4, which include anomalies in the form of fusion to the sacrum, were compared with types 1 and 2, it was revealed that the HU value at the L5 level was higher in the fused types ($p = 0.039$) and the S1 value was lower in the fused types ($p = 0.018$). **Conclusion:** This study demonstrated that LSTV abnormality causes a decrease in bone density in the lumbar spine, except at the L5 level. The load distribution due to LSTV caused an increase in bone density at the L5 level compared to the average of the other lumbar vertebrae. Also, types with transverse processes fused to the sacrum resulted in changes in the L5 and S1 levels.

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P0444: Pre-albumin as a predictor of patient reported outcomes following lumber interbody fusion

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Introduction: Lumbar fusion is a common surgical technique indicated for degenerative, deforming, and traumatic pathologies. Low prealbumin level is considered a biomarker of malnutrition and sarcopenia and has been shown to increase the risk of complications after spine surgery. However, studies assessing the impact of prealbumin on patient-reported outcome measures (PROMs) after spine surgery are lacking in orthopedic literature. The purpose of this study is to determine if pre-op prealbumin level is a reliable predictor of patient-reported outcomes following lumbar interbody fusion. **Material and Methods:** Operative information, pre-op prealbumin level, and patient-specific information were collected from electronic medical records. The Oswestry Disability Index (ODI) and PROMIS-10 were collected pre-op, 12 weeks, 6 months, and 1-year post-op. Inclusion criteria consisted of patients undergoing elective 1-2 level open or minimally invasive TLIF/PLIF at a single academic center for degenerative pathology. ROC analysis determined a prealbumin cutoff for achieving established minimal clinically important difference (MCID) values for each PROM. The impact of prealbumin on changes in PROM scores was assessed using univariate and multivariate linear and logistic regression. Mixed effects models were used to evaluate differences in PROMs between groups over time. **Results:** The optimal ROC curve identified a prealbumin cutoff of 20.15 mg/dL for achieving MCID on the ODI at 1 year (Sensitivity 84.2%, Specificity 100%, AUC 0.882). Using a prealbumin cutoff of 20.15, individuals with sarcopenia (< 20.15) were significantly older than individuals without sarcopenia. Prealbumin did not predict changes in PROMs from baseline to any time point postoperatively. Sarcopenia did not impact the odds of achieving MCID for any PROM. All PROMs improved significantly for both groups postoperatively and no significant differences between groups were found. **Conclusion:** Although patients with prealbumin < 20.15 were older than patients with prealbumin > 20.15, both groups had similar clinical improvements over time. Prealbumin may not be a reliable predictor of postoperative PROMs following lumbar interbody fusion.

ID: AGS26/205
P0445: The correlation between scoliosis curvature rigidity and spinal cord abnormalities: a retrospective clinical study

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Introduction: Idiopathic scoliosis (IS), characterized by a lateral spinal curvature exceeding a 10° Cobb angle with vertebra rotation, affects approximately 2-5% of adolescents globally. Despite decades of research, the complex relationship between scoliosis and spinal cord abnormalities continues to challenge our understanding of spinal deformities. While the Cobb angle remains the standard measurement for curve severity, we've observed that curve rigidity the spine's resistance to corrective forces may offer deeper insights, particularly in cases with neural involvement. Our team conducted this retrospective clinical investigation to explore the nuanced association between scoliosis curve rigidity and specific spinal cord abnormalities through a biomechanical lens, comparing results with a control group of scoliosis patients with normal MRI findings. **Material and Methods:** reviewed 50 cases comprehensive data from 12 patients with scoliosis and documented spinal cord abnormalities (Group 1), and a comparison group of 38 patients with scoliosis and normal MRI findings (Group 2). All patients underwent thorough clinical assessment, detailed radiographic evaluation including flexibility measurements, and high-resolution magnetic resonance imaging. We quantified curve rigidity by calculating correction percentages from bending or traction radiographs, defining curves with less than 30% flexibility as significantly rigid. **Results:** analysis revealed tethered cord syndrome as the predominant abnormality in Group 1 (58.3% of cases either isolated or combined), followed closely by thoracic Syringomyelia (50.0%). Less frequently, we encountered Diastematomyelia and grade 3 spondylolisthesis (8.3% each). Progression patterns varied markedly by

abnormality type patients with Diastematomyelia showed strikingly aggressive curve progression (-64.29%), while those with isolated tethered cord demonstrated more modest progression (-27.86%). Pain was remarkably common (66.7% of patients in Group 1) and correlated positively with curve magnitude. When comparing the two groups, we found statistically significant differences in final Cobb angles and correction rates, with Group 1 (spinal cord abnormalities) showing significantly larger final angles and worse correction rates. A significant difference in rigidity distribution was also observed, with all Group 1 patients exhibiting severe rigidity, while Group 2 showed varying degrees of flexibility ranging from flexible to moderate. Pain was more prevalent in Group 1 (66.7%) compared to Group 2 (26.3%). **Conclusion:** These findings lend substantial support to the "asynchronous neuro-osseous growth" theory, wherein a fundamental mismatch between vertebral column and spinal cord growth rates creates a tethering effect that constrains normal vertebral development. This constraint triggers a cascade of biomechanical adaptations rotational lordosis, vertebral rotation around the spinal cord axis, and progressive deformity driven by asymmetric growth plate loading (Hueter-Volkmann principle). Beyond theoretical significance, our work has practical implications for clinical practice, potentially reshaping MRI screening protocols, improving prognostication based on specific neural abnormality patterns, and informing more targeted treatment approaches for adolescent idiopathic scoliosis with neural involvement.

ID: AGS26/208
P0446: 12th rib anomalies and the development of idiopathic scoliosis: a theoretical framework for anatomical and biomechanical mechanisms

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Introduction: Idiopathic scoliosis (IS), defined as a lateral spinal curvature exceeding a Cobb angle of 10 degrees without a clear structural cause, affects 2-5% of adolescents, particularly during periods of rapid growth. The quadratus lumborum (QL) muscle, anchored to the twelfth rib, plays a critical role in stabilizing the lumbar spine. Congenital anomalies of the twelfth rib such as agenesis, hypoplasia, or asymmetry may disrupt QL function, potentially exacerbating IS progression through biomechanical imbalances. This study proposes a theoretical framework linking these anomalies to IS development, integrating anatomical, biomechanical, and genetic perspectives. **Material and Methods:** A systematic review was conducted of studies published between January 2022 and June 2025 across PubMed, Scopus, Web of Science, and Embase. From 420 articles screened using PRISMA guidelines and quality-assessed via the Newcastle-Ottawa Scale, 40 relevant studies were identified. A meta-analysis estimated the prevalence of twelfth rib anomalies in IS patients, with sensitivity analysis to assess result stability. An FEA model, developed using ANSYS 2023 R1, simulated lumbar spine dynamics, incorporating interactions of multiple muscles (QL, psoas major, obliques) and sensitivity analyses for muscle stiffness variations (±20%) and rib length changes (±30%). Anatomical and clinical correlations were reviewed to support the proposed mechanisms. **Results:** The meta-analysis revealed a 12% prevalence of twelfth rib anomalies in IS patients (95% CI: 8-16%) compared to 4% in controls (95% CI: 2-6%), with an odds ratio of 3.2 (95% CI: 2.1-4.8, $p < 0.001$, $I^2 = 40\%$). Sensitivity analysis confirmed result stability (OR = 3.0, 95% CI: 1.9-4.6). FEA simulations demonstrated increased lateral spinal loading (160 N in agenesis, 140 N in hypoplasia, 150 N in asymmetry, compared to 100 N in normal conditions) due to ineffective compensation by adjacent muscles (e.g., psoas major, obliques), elevating vertebral stress by 5-10%. Twelfth rib anomalies reduced QL force by 40% in agenesis and 20-30% in hypoplasia, supporting a "vicious cycle" hypothesis for IS progression. Proposed mechanisms suggest that asymmetric loading, genetic interactions (e.g., BNC2), and disrupted respiratory mechanics contribute to curve exacerbation. **Conclusion:** Twelfth rib anomalies represent a modifiable factor in IS progression by disrupting QL function and increasing lateral spinal loading. Findings from the meta-analysis and FEA modeling support this association, highlighting the need for screening rib anomalies using low-dose CT imaging and targeted physiotherapy. The study recommends longitudinal research and genetic analyses to confirm these mechanisms.

ID: AGS26/209
P0447: Atypical left-sided thoracolumbar scoliosis (Type 3C-L) with T9-T11 apical vertebra: a case study proposing a novel classification framework and tailored therapeutic strategies

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Introduction: Left-sided thoracolumbar scoliosis with an apical vertebra between T9 and T11 is a rare presentation within the Type 3C classification of the Physiotherapeutic Scoliosis-Specific Exercises (PSSE) Schroth Method. Existing classification systems (King, Lenke, Schroth) are predominantly designed for right-sided curves, limiting their applicability to atypical patterns. This study aims to document a rare case, evaluate its alignment with established

classifications, and propose a refined descriptive framework. **Case Presentation:** A 14-year-old female presented with a left-sided thoracolumbar scoliosis (apex at T11, spanning T9 to L2) identified during routine school screening. Radiographic assessment revealed a Cobb angle of 568ز degrees, a coronal imbalance (CSVL-C7PL) of 75 mm, and an Apical Vertebra Transition Angle (AVTA) of 31 degrees. The L3 vertebra tilted toward the convex (right) side, with no structural proximal curve. The curve was classified as Type 3C per PSSE Schroth and A1 per Rigo-Weiss criteria. MRI confirmed the absence of underlying pathologies, and the patient was diagnosed with idiopathic scoliosis, referred for PSSE physiotherapy with bracing considered. **Material and Methods:** A systematic literature review was conducted using PubMed, Scopus, and Web of Science, targeting left-sided thoracolumbar scoliosis, Type 3C patterns, and T9-T11 apex cases (1990-June 2025). The case was analyzed using King, Lenke, and Schroth systems, with a proposed Type 3C-L framework to address taxonomic gaps. Due to the early stage of intervention, follow-up data are not yet available; however, a follow-up evaluation is planned at 6-month intervals over 12 months to assess Cobb angle, coronal imbalance, and quality of life (SRS-22). Therapeutic recommendations were developed based on biomechanical considerations. **Results:** The case aligned with King Type IV and Lenke Type 5C but deviated due to its left-sided direction, revealing limitations in existing classifications. The Schroth Type 3C framework was structurally applicable but required adjustment for the left-sided orientation and T9-T11 apex. Literature review confirmed the rarity of this presentation, with a 16% prevalence of left-sided curves at T11. The Type 3C-L subtype was proposed, incorporating left-sided curve direction, T9-T11 apex, and tailored PSSE exercises with adjusted bracing. **Conclusion:** This case highlights the need for refined classification systems to address atypical scoliosis patterns. The proposed Type 3C-L framework provides a structured approach for documentation and management. Tailored PSSE exercises and adjusted bracing are recommended, supported by a planned prospective cohort study (50 patients, 12 months) to validate the subtype, assess prevalence, and evaluate long-term outcomes. A multidisciplinary approach involving scoliosis specialists, physiotherapists, and Orthotists is emphasized to advance treatment strategies.

ID: AGS26/212
P0448: Apical vertebra translation angle (AVTA) in scoliosis: a theoretical framework for assessing spinal deformity severity and progression, pilot study

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Introduction: Adolescent idiopathic scoliosis (AIS) represents a multifaceted three-dimensional spinal disorder impacting 1-3% of young individuals, marked by lateral curvature surpassing 10 degrees alongside vertebral rotation. Although the Cobb angle serves as the primary diagnostic benchmark, its emphasis on the coronal plane overlooks crucial axial and sagittal dimensions that drive disease advancement. This work introduces the Apical Vertebra Translation Angle (AVTA) as an innovative measure, merging the apical vertebra's translational offset from the central sacral vertical line (CSVL) with the Cobb angle, refined by biomechanical adjustments based on vertebral position. The conceptual model seeks to deliver a more integrated evaluation of deformity intensity, focusing on vertebral stability and degenerative hazards, thereby paving the way for applications in non-invasive interventions like targeted physiotherapy and orthotic support. **Material and Methods:** The investigation employed a conceptual paradigm drawing on simulated parameters from existing scholarship, including apical vertebral translation (AVT) ranging from 4-6 cm, trunk width of 25-30 cm, and Cobb angles between 20-40 degrees. AVTA computation involves two key stages: first, deriving a normalized ratio of AVT to trunk width for scale invariance; second, modulating the Cobb angle via a coefficient (k) reflecting regional biomechanics (0.95 for thoracic, 1.0 for lumbar). Severity tiers are delineated as mild (< 20 degrees), moderate (20-30 degrees), and severe (>30 degrees). A theoretical biomechanical evaluation probed AVTA's effects on spinal loading, complemented by correlation modeling with Cobb angle and axial rotation informed by three-dimensional imaging research. **Results:** Simulated computations yielded a projected severity distribution: 25% mild, 55% moderate, 20% severe, exemplified by AVTA values such as 19 degrees for a 20-degree Cobb angle (mild). Robust associations emerged with the Cobb angle ($r = 0.80$-0.85) and moderate links to vertebral rotation ($r = 0.60$-0.70), with a 11.8-degree threshold forecasting rotatory instability. AVTA exceeding 30 degrees correlated with amplified facet joint loading by 25% and disc compression by 15-20%, heightening risks of degeneration and ligamentous damage, alongside a potential 2.5-fold elevation in chronic complications. Furthermore, elevated AVTA aligned with diminished quality-of-life metrics, notably in pain and self-perception domains. **Conclusion:** AVTA emerges as a pioneering conceptual index that enhances scoliosis appraisal by fusing translational and angular facets across planes, surpassing the Cobb angle in comprehensiveness. It bolsters guidance for conservative therapies and degenerative risk identification, yet necessitates prospective validation to affirm clinical relevance. This framework establishes a basis for advancing diagnostic instruments in scoliosis management.

ID: AGS26/274

P0449: Which vacuum phenomenon is more predictive for future junctional disorders? Intradiscal or intrafacet?

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Introduction: Recent spine studies focused on identifying whether intradiscal vacuum phenomenon (VP) was associated with spinal instability. However, none of them reported a direct association between VP and spinal instability following fusion for degenerative lumbar spine disorders (DSDs), namely junctional disorders. In the present study, we aimed to evaluate whether the VP was predictive for junctional disorders in patients who underwent short-segment lumbar decompression and fusion for DSDs at a tertiary spine center. **Material and Methods:** We retrospectively reviewed prospectively collected database of patients who underwent short-segment decompression and fusion for DSDs. Pre-operative sagittal and axial computed tomography (CT) scans were evaluated in terms of intradiscal and intrafacet VP at all lumbar levels, respectively. Each VP was scored as 1 point. Then, the total VP score was calculated as the sum of intradiscal VP score and intrafacet VP score. Then, we analyzed the possible predictivity of VP for junctional disorders at final follow-ups of the patients operated for short-segment lumbar decompression and fusion. **Results:** Patients with junctional disorders had significantly higher total and intrafacet VP scores compared to those without junctional disorders. Total VP score had an OR of 1.217 ($p = 0.014$) and intrafacet VP score had an OR of 1.465 ($p = 0.008$). The ROC analysis depicted that the cut-offs value for total and intrafacet VP scores to predict junctional disorders following short-segment lumbar decompression and fusion were 1.5 points and 0.5 point, respectively. **Conclusion:** Vacuum phenomenon could be associated with junctional disorders in patients who underwent short-segment lumbar decompression and fusion for DSD. Intrafacet VP was more important than intradiscal VP in predicting junctional disorders. Proper surgical planning including the evaluation of both intrafacet and intradiscal VP at all lumbar levels is crucial to decrease the likelihood of junctional disorders.

ID: AGS26/275

P0450: Erector spinae could be the game changer in surgical decision-making in patients with lumbar spondylolisthesis: a cross-sectional analysis of an age-, sex-, subtype-, level-matched patients with similar spinopelvic parameters received surgical or conservative management

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Introduction: In this study we aimed to identify whether paraspinal muscle morphology could play a role in surgical decision-making in patients with lumbar spondylolisthesis. **Material and Methods:** We conducted a cross-sectional analysis of a prospectively collected database between January 2013 and May 2023. Consecutive women and men, who visited our outpatient clinics with chronic LBP, neurogenic claudication, and had lumbar spine magnetic resonance imaging (MRI) for their complaints were included into the preliminary dataset. We compared the patients who had conservative management (conservative group) or underwent surgery for lumbar spondylolisthesis (surgical group) in terms of intervertebral disc degeneration, end-plate changes, fatty infiltration in the paraspinal muscles and spinopelvic parameters. **Results:** Conservative and surgical groups were similar in terms of severe IVDD and Modic changes at any lumbar level. Surgical group had significantly fattier erector spinae compared to the conservative group. Regression analysis and ROC analysis revealed an OR of 1.088 and a cut-off value of 17 points for fatty infiltration in the erector spinae to predict which patient could undergo surgery for lumbar spondylolisthesis. **Conclusion:** Each 1-point increment in fatty infiltration in the erector spinae at any lumbar level increased the likelihood of surgery by 8%. Lumbar spondylolisthesis patients with fatty infiltration score for erector spinae at or above 17 were more likely to have surgery. We recommend clinicians to focus on improving erector spinae muscles in patients with lumbar spondylolisthesis.

ID: AGS26/326
P0451: Lumbar spine motion analysis - Current concepts

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Introduction: Lower back pain affects 49-80% of the population globally, with degenerative lumbar disc disease representing a significant portion of cases requiring surgical intervention. Accurate assessment of lumbar spine range of motion (ROM) remains critical for clinical outcomes, patient selection, and device evaluation. Current assessment methods vary significantly in accuracy, invasiveness, and clinical applicability. This review synthesizes and consolidates current concepts in lumbar spine motion analysis, evaluating available methodologies for measuring segmental and global lumbar ROM. **Material and Methods:** A comprehensive literature search was conducted on PubMed using the terms "lumbar spine" AND ("motion analysis" OR "motion evaluation" OR "motion assessment"), limited to peer-reviewed English language articles published between 2000-2025. Studies were systematically reviewed and categorized by methodology and clinical application. **Results:** The review identified multiple approaches for lumbar motion analysis, ranging from traditional static radiographic techniques to advanced dynamic assessment methods. Static flexion-extension radiographs remain the clinical standard despite significant inter- and intraobserver variability. Radiostereometric analysis offers high precision with submillimetre accuracy, however does require invasive marker implantation. Dynamic techniques including fluoroscopic kinematic analysis, wearable insertional measurements untis, marker-based and markerless optical motion capture systems provide real-time assessment capabilities with varying degrees of accuracy and clinical feasibility. **Conclusion:** Despite a plethora of motion analysis methods have been proposed, developed and tested over the years, static radiographs remain clinically ubiquitous in the assessment of lumbar spine ROM. No single method universally excels in accuracy, feasibility, and clinical applicability for lumbar motion analysis. These new techniques may potentially offer superior precision and dynamic assessment capabilities. Future research should focus on standardizing imaging protocols and validating emerging technologies against established benchmarks.

ID: AGS26/349
P0452: The impact of 12th rib length on lumber nerve morphology and cranial-caudal symptom shift

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Introduction: Discrepancies between physical and imaging findings complicate accurate level diagnosis in spinal disorders. Anatomical studies suggested that 12th rib length correlates with cranial-caudal shifts of the lumbosacral plexus, but this remains speculative because the plexus has not been visualized in patients. This study investigated whether the conus medullaris and L4 morphology-particularly the branch to the lumbosacral trunk (LST)-could be visualized on MRI, and whether these findings correlate with 12th rib length and cranial-caudal symptom shifts. **Material and Methods:** This was a retrospective observational study on prospectively collected data, combined with cadaveric analysis. We included 160 consecutive patients who underwent surgery for lumbar disc herniation with preoperative coronal MRI between July 2015 and July 2025. Exclusion criteria were cauda equina syndrome, idiopathic scoliosis, double-level herniation, and cranial or caudal migration. MRI and radiographs were used to assess the conus medullaris level, LST branch visibility, and their relationship with 12th rib length and cranial-caudal symptom shifts. The straight-line distance to the conus was measured using the inferior endplate of T12 as a reference line; distances caudal to the line were recorded as positive, cranial as negative. The 12th rib length and conus distance were normalized to height (mm/m) to correct for body size. In the cadaveric study, 25 cadavers were evaluated for relationships among LST thickness, 12th rib length, and plexus deviation. LST thickness was defined as the LST branch/L4 ratio, calculated by dividing branch thickness by L4 root width. **Results:** A total of 127 patients (81 men and 46 women; mean age, 44.8 ± 17.4 years) met the inclusion criteria. A discrepancy between imaging and physical findings was observed in 39 cases (30.7%). Patients with caudally shifted symptoms had a more cranially located conus

medullaris (16.7 ± 8.8 mm vs. 3.7 ± 6.6 mm, $p < 0.001$), shorter 12th ribs (78.4 ± 7.3 mm/m vs. 43.0 ± 22.3 mm/m, $p < 0.001$), and higher MRI visibility of the LST branch (17.6% vs. 77.2%, $p < 0.001$). The conus medullaris level correlated positively with 12th rib length ($r = 0.36$, $p < 0.001$). Cadaveric analysis demonstrated a strong negative correlation between 12th rib length and the LST/L4 ratio ($r = -0.86$, $p < 0.001$). Smaller ratios were consistently associated with caudal plexus shifts ($p < 0.01$). **Conclusion:** The 12th rib length was strongly correlated with positional shifts of the conus medullaris and lumbosacral plexus, explaining cranial-caudal deviations of symptoms. MRI evaluation of L4 morphology, particularly visualization of the LST branch, further reflected these shifts. These findings indicate a close link between bone morphology and neural anatomy. Incorporating 12th rib length and L4 morphology into preoperative assessment may improve diagnostic accuracy, resolve discrepancies between physical and imaging findings, and guide surgical level selection. In conclusion, the 12th rib may serve as a practical, readily available radiographic marker to optimize surgical planning and improve outcomes in patients with lumbar disorders.

ID: AGS26/401

P0453: Intraoperative neuromonitoring (IONM) alerts in severe spinal deformity corrections with baseline neurodeficit - Are they different from those without - results from international multicenter prospective Spinal Deformity Intraoperative Monitoring (SDIM) study

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Introduction: The characteristics of IONM alerts in spinal deformity surgery are different in patients with or without a baseline neurodeficit. Preexisting neurological deficit can be a risk factor in deformity surgery, however detailed analysis of this patient population regarding intraoperative neural monitoring alerts has not been reported earlier. **Material and Methods:** 20 international centers prospectively documented the demographics, radiographic findings, and surgical events of patients undergoing spinal deformity correction (major Cobb > 80°) with EMG, SSEP and MEP monitoring. Detailed neurological examination was performed at baseline, immediately post-op and prior to discharge from hospital. IONM alert was defined as a loss of amplitude of > 50% in SSEP or MEP from baseline or sustained EMG activity that lasts > 10 seconds. Post-hoc analysis of patients with baseline neurologic deficit vs patients with normal neurological status was performed. **Results:** 546 patients were analysed - 477 had no deficit (ND) or an isolated sensory deficit and 69 had motor deficits (D)of which 45 were isolated motor and 24 combined motor and sensory. There was significant difference ($p < 0.001$) in baseline MEPs and SSEPs, which was decreased or absent in 3.1% and 2.1% in ND and 18.8% and 14.1% in D patients. 66 (13.9%) of patients in ND had a total of 90 alerts during surgery, and 12 (17.4%) in D had 15alerts. LEMS score from baseline to postop worsened in 8.4% in ND versus 21.7% in D ($p < 0.01$). Decline in neurological status from baseline to discharge was recorded in 5.9% in ND versus 23.2% in D ($p < 0.001$). Surgical events were identified as potential causes in 68 alerts out of 90 in ND and 10 out of 15 in D ($p = 0.4$) with osteotomy and rod insertion being the most frequent cause in both groups. In D patients, 11 out of 15alerts fully recovered to baseline, 3 did not and 1 recovered only partially. **Conclusion:** Patients with preoperative motor deficits had a higher rate of decreased or absent baseline MEP and SSEP signal and a higher rate of neurological deterioration after surgery. The difference in the rate of alerts was not significant with osteotomy and rod insertion being the most frequent surgical cause of alerts in both groups.

ID: AGS26/541

P0454: Development of a comprehensive treatment algorithm for tandem spinal stenosis - Decision making and surgical strategy

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Introduction: Tandem spinal stenosis (TSS) can present with a constellation of myriad neurological symptoms and signs. Whole spine MRI has improved the diagnosis but does not aid therapeutic decision-making. While most studies have focused

on cervico-lumbar TSS, there is inadequate literature on TSS of other regions. **Material and Methods:** 238 patients surgically treated for TSS with a minimum follow-up of 2 year were studied to develop a clinico-radiological treatment algorithm for TSS. The patients were classified based on the areas of stenosis namely, cervico-lumbar (Type A -186), cervico-thoracic (Type B -11), thoracolumbar (Type C -24), and cervical, thoracic & lumbar (Type D -17). The criteria for diagnosis of TSS were cord compression and T2 signal intensity changes in cervical/ thoracic regions, and/or Schiza's grade ≥ C lumbar canal stenosis (LCS). In the sequence of surgical algorithm, clinical severity was taken as the prime factor followed by cord signal changes. The outcomes were evaluated through Nurick's grade (NG) and ODI. **Results:** Type A cervico-lumbar TSS was divided into four sub-types. Type A1-patients with clinical myelopathy without symptoms of LCS underwent cervical decompression alone (n = 58). NG improved from 3.8 ± 0.98 to 1.74 ± 0.74 ($p < 0.05$). Only 11 (18%) required lumbar decompression later. Patients with LCS (Type A2) without clinical myelopathy underwent lumbar decompression alone (n = 97). Four (4.1%) developed myelopathy during follow-up requiring a cervical surgery. Patients with predominant LCS symptoms with only signs of myelopathy (Type A3, n = 7) underwent lumbar decompression initially but all required cervical surgery within 2 years. Type A4 (n = 24) with both myelopathy and claudication symptoms were treated by combined staged decompressions procedures. Type B (n = 11) had patients with myelopathy due to compression at cervical and thoracic regions. They were sub-divided based on upper limb myelopathy. In patients with both upper and lower limb myelopathy (Type B1, n = 1 1), cervical decompression was done first (n = 6) followed by staged thoracic decompression. The NG improved from 4.6 ± 0.5 to 1.8 ± 0.3 ($p < 0.05$). In patients with predominant lower limb myelopathy (Type B2, n = 5), only thoracic surgery was performed. Only one required cervical surgery later. In Type C thoracic & lumbar TSS (n = 24), 20 were treated by thoracic decompression based on signs of myelopathy. The mean NG improved from 4.1 ± 0.7 to 1.9 ± 0.9 ($p < 0.05$). Six cases required lumbar level surgery later. Type D with stenosis at all three regions presented variedly, and underwent staged decompression (n = 17). **Conclusion:** Based on clinical features of myelopathy and claudication, along with specific diagnostic MRI criteria, the present study comprehensively classified all possible types of TSS. The algorithm provides specific surgical strategies for each subtype, based on a large cohort of patients. More than MRI evidence of stenosis and signal changes, clinical symptoms and signs were helpful in formulating treatment.

ID: AGS26/586

P0455: Validation of MRI-based vertebral bone quality (VBQ) score for opportunistic osteoporosis screening in patients with chronic low back pain: a retrospective comparative study

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Introduction: Opportunistic screening for osteoporosis using available imaging is crucial for early intervention. The MRI-based Vertebral Bone Quality (VBQ) score offers a non-ionizing method to assess bone mineral density (BMD) in patients already undergoing MRI for chronic low back pain (LBP). The objective of this study is to validate the VBQ score against the established standards of CT Hounsfield Units (HU) and DEXA T-scores in a cohort of patients with degenerative LBP. **Material and Methods:** This retrospective study, approved by the institutional ethical review committee, analyzed electronic medical records (EMR) of a tertiary care hospital from January 2020 to December 2024. We included 200 patients with chronic LBP who had undergone lumbar spine MRI, plus either an abdominal/pelvic CT or a DEXA scan within a 6-month period. VBQ scores were calculated from T1-weighted MRIs. Pearson correlation and ROC analysis were used to evaluate the relationship between VBQ, L1 CT HU, and DEXA T-scores. **Results:** A strong negative correlation was found between VBQ scores and both L1 CT HU ($r = -0.72$, $p < 0.001$) and lumbar spine DEXA T-scores ($r = -0.68$, $p < 0.001$). VBQ scores were significantly higher in patients diagnosed with osteoporosis via DEXA (3.48 ± 0.31) compared to those with osteopenia (2.95 ± 0.22) and normal BMD (2.51 ± 0.18) ($p < 0.001$). A VBQ score cut-off of 3.0 demonstrated a sensitivity of 88% and specificity of 92% for identifying osteoporosis (AUC = 0.94). **Conclusion:** The VBQ score is a highly effective, opportunistic tool strongly correlated with both CT and DEXA measures of BMD. Its integration into routine MRI reporting for LBP can significantly improve osteoporosis screening rates, enabling earlier diagnosis and fracture prevention in a high-risk population.

ID: AGS26/606
P0456: MRI based whole spine sagittal parameters are equivalent to standing whole spine radiograph measurements

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Background: The importance of whole spine sagittal balance in several spinal diseases has been extensively studied. The current assessment is based on whole spine radiographs, which involves significant radiation risks, infrastructure and cost. The aim of this study is to evaluate the utility and comparability of sagittal spinal parameters measured in the mid-sagittal MRI of the whole spine. **Methodology:** 53 patients (disc prolapse, n=36, degenerative listhesis, n = 10 and degenerative disc disease, n=7) underwent standing whole spine radiograph and supine whole spine MRI. The T2 mid-sagittal whole spine section and the corresponding coronal T2 image were used to fix the femoral head centre and measure the different sagittal parameters. The parameters measured in both images were the C2 plumbline, C7 plumbline, C0-C2 Cobb angle, C3-C7 lordosis, T5-T12 kyphosis, lumbar lordosis, pelvic incidence, sacral slope and pelvic tilt and the Roussouly classification. The mean and median was calculated and the statistical tools used to compare were independent t-test and Wilcoxon rank sum test. **Results:** The mean age of the study population was 44.2 ± 10.7 years. The male:female ratio was 34:19. There were no significant differences between the whole spine X-ray and the MRI for C2 plumbline ($p = 0.446$), C7 plumbline ($p = 0.536$), pelvic incidence ($p = 0.295$), sacral slope ($p = 0.809$), pelvic tilt ($p = 0.091$), C3-C7 Cobb angle ($p = 0.538$) and lumbar lordosis ($p = 0.125$). There were significant differences between the X-ray and MRI findings of C0-C2 Cobb angle ($p \leq 0.001$) and T5-T12 kyphosis ($p \leq 0.001$). 75.4% patients (n = 40) had the same Roussouly type in both X-ray and MRI. On comparing the agreement for Roussouly type between X-ray and MRI using kappa statistics, agreement was substantial (0.68, 95% CI: 0.53-0.84). **Conclusion:** Supine whole spine MRI sequence can be used as an alternative to standing whole spine radiograph for measuring sagittal spine parameters, and classify the spine based on Roussouly classification. This can avoid radiation exposure and extra imaging cost in a patient. For specific analysis of upper cervical spine and thoracic kyphosis standing radiographs are more accurate.

ID: AGS26/862
P0457: Feasibility and accuracy evaluation of microfluidic chip for rapid detection of drug-resistant genes in tuberculosis clinical isolates

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Introduction: The objective of this study was to assess clinical isolates of Mycobacterium tuberculosis using a microfluidic chip, simultaneously detecting eight drug-resistant genes associated with first- and second-line anti-tuberculosis drugs. These findings were compared with phenotypic drug susceptibility results to evaluate the feasibility and accuracy of the microfluidic chip for diagnosing drug-resistant tuberculosis. Focusing specifically on clinical samples of spinal tuberculosis, the microfluidic chip was employed for species identification of Mycobacterium tuberculosis complex and detection of drug-resistant genes, aiming to offer guidance for personalized chemotherapy regimens. **Material and Methods:** A total of 544 clinical isolates of Mycobacterium tuberculosis with documented drug susceptibility results were gathered from the hospital's strain repository. This cohort comprised 500 drug-resistant strains and 44 susceptible strains. The 544 clinical isolates underwent testing using the microfluidic chip, with results compared against phenotypic drug susceptibility testing to assess the chip's feasibility and accuracy in detecting resistance to eight anti-tuberculosis drugs. Additionally, 136 patients diagnosed with spinal tuberculosis via pathological and radiological assessments were included. Tissue specimens (pus, caseous materials, or granulation tissue) were procured through lesion clearance or CT-guided puncture. These specimens were evenly divided, with one portion undergoing rapid culture using the BACTEC MGIT960 liquid culture system, followed by modified Roche absolute concentration method for drug susceptibility testing on positive samples. The other portion underwent species identification of Mycobacterium tuberculosis complex and detection of mutations associated with resistance to first- and second-line anti-tuberculosis drugs using the microfluidic chip. Phenotypic drug susceptibility testing served as the gold standard to evaluate sensitivity and specificity of the microfluidic chip in detecting clinical samples of spinal tuberculosis. **Results:** Among the 544 clinical isolates of Mycobacterium tuberculosis, there were 197 strains resistant to INH and 303 sensitive strains, 219 strains resistant to RIF and

281 sensitive strains, 97 strains resistant to EMB and 403 sensitive strains, 133 strains resistant to SM and 367 sensitive strains, 82 strains resistant to FQS and 418 sensitive strains, 102 strains resistant to AMK and 398 sensitive strains, 70 strains resistant to KAN and 430 sensitive strains, and 49 strains resistant to CPM and 451 sensitive strains. The sensitivity and specificity of the microfluidic chip for detecting INH resistance were 89.34% and 97.36%, respectively; for RIF resistance, 91.78% and 95.73%; for EMB resistance, 76.29% and 95.29%; for SM resistance, 87.97% and 97.00%; for FQS resistance, 95.12% and 96.65%; for AMK resistance, 88.24% and 97.74%; for KAN resistance, 84.29% and 97.21%; and for CPM resistance, 89.80% and 96.90%, respectively. Using a microfluidic chip, identification of Mycobacterium tuberculosis species was performed on 136 clinical samples of spinal tuberculosis, with a positivity rate of 87.50%. Among culture-positive samples, the sensitivity of Mycobacterium tuberculosis species identification by the microfluidic chip was 95.45%. The sensitivity for samples positive on both smear and culture was 95.80%, while for samples negative on smear but positive on culture, the sensitivity was 31.32%. Regarding isoniazid (INH) resistance detection, the microfluidic chip exhibited a sensitivity of 80.95% and a specificity of 91.04%. For rifampicin (RIF) resistance detection, the sensitivity of the microfluidic chip was 88.24%, with a specificity of 90.74%. The sensitivity for streptomycin (SM) resistance detection was 81.82%, with a specificity of 92.21%. For fluoroquinolones (FQS) resistance detection, the sensitivity was 88.89%, and the specificity was 97.47%. The sensitivity for ethambutol (EMB) resistance detection was 71.43%, with a specificity of 96.30%. Kanamycin (KAN) resistance detection showed a sensitivity of 75.00% and a specificity of 95.24%. Capreomycin (CPM) resistance detection had a sensitivity of 100% and a specificity of 98.84%. The average time required for Mycobacterium tuberculosis species identification and detection of drug-resistant mutations using the microfluidic chip was 6 (range 5-9) hours. **Conclusion:** The application of the chip in detecting Mycobacterium tuberculosis strains demonstrates high sensitivity and specificity in identifying common first- and second-line anti-tuberculosis drug-resistant mutation genes. The process is simple to operate and time-efficient. In the clinical testing of spinal tuberculosis samples, this microfluidic chip exhibits high sensitivity. Compared to traditional chips, it shows higher sensitivity and specificity, particularly in detecting ethambutol (EMB) and fluoroquinolones, thus providing a promising tool for tuberculosis diagnosis and drug resistance surveillance.

ID: AGS26/1064
P0458: Smartphone-based computer vision of finger kinematics for screening in degenerative cervical myelopathy

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Introduction: Degenerative cervical myelopathy (DCM) is a progressive spinal cord disorder that remains frequently underdiagnosed, with diagnostic delays averaging 1-4 years. Current assessments, including the 10-second grip-and-release test, rely on grip counts but are limited in accuracy, particularly in older adults with comorbid hand conditions such as osteoarthritis or peripheral neuropathy. There is a need for objective, scalable, and accessible screening tools. In this study, we evaluated a smartphone-based computer vision tool to quantify finger kinematics during the grip-and-release test, with the goal of improving diagnostic accuracy for DCM and correlating video-derived features with spinal cord compression on MRI. **Materials and Methods:** Smartphone videos were collected from 123 participants: 58 patients with DCM and 65 age-matched controls (healthy individuals and those with non-DCM hand dysfunction). The control group included three subgroups: (1) individuals with impaired hand dexterity due to various other conditions such as arthritis, peripheral neuropathy, or prior hand injury or surgery (n = 18); (2) individuals with symptomatic lumbar stenosis (n = 22); and (3) healthy individuals without hand dysfunction (n = 25). Finger landmarks were extracted using MediaPipe, and 250 kinematic features per finger were computed across both hands. Feature selection was performed using ANOVA ($p < 0.05$) and mutual information scores (> 0.01). A CatBoost classifier was trained on selected features using an 80/20 train-test split with five-fold cross-validation. For comparison, a logistic regression model was trained using grip count alone. Model performance was assessed using AUC, F1-score, sensitivity, and specificity. Linear regression models examined associations between video-derived features and MRI-derived measures of spinal cord compression in 56 DCM participants. **Results:** Mean grip count was significantly lower in the DCM group (7.92 ± 3.27) compared to controls (10.26 ± 3.78; $p < 0.001$). Among control subgroups, the hand dysfunction group averaged 7.09 grips, the lumbar stenosis group averaged 10.65 grips, and healthy controls achieved 12.13 grips. The CatBoost model trained on 66 selected kinematic features achieved superior performance (AUC 0.90, F1-score 0.83, sensitivity 83.3%, specificity 84.7%) compared to the grip

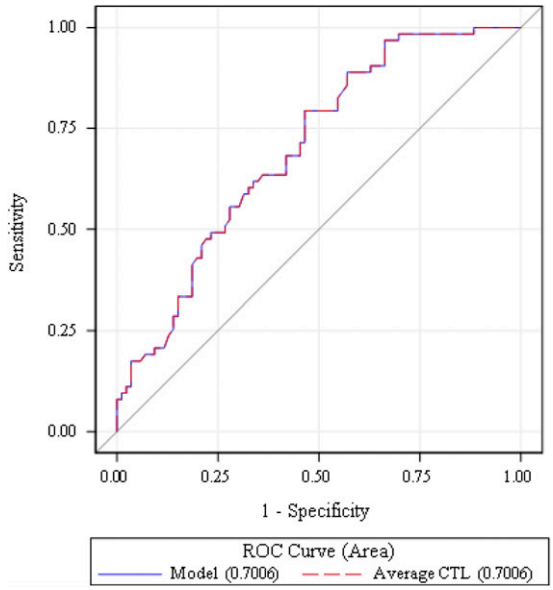
count-only model (AUC 0.69, F1-score 0.67, sensitivity 75.0%, specificity 46.2%). Among the top 20 SHAP features the thumb contributed the most (~34%) followed by the Index and the Middle to classification decisions. Video-derived kinematic features were significantly associated with MRI measures of spinal cord compression, including sagittal diameter (R^2 = 0.45, p = 0.001), transverse diameter (R^2 = 0.43, p = 0.002), compression ratio (R^2 = 0.42, p = 0.003), and maximum spinal cord compression (R^2 = 0.36, p = 0.018). **Conclusion:** A smartphone-based computer vision tool analyzing finger kinematics significantly augments the conventional grip and release test in detecting hand motor impairment specific to DCM. Video-derived features demonstrated strong diagnostic accuracy and were associated with objective measures of spinal cord compression on MRI. Smartphone-based computer vision holds promise as an objective, scalable screening tool for DCM in both clinical and community settings.

ID: AGS26/1079
P0459: Comparative evaluation of DEXA and opportunistic quantitative CT for lumbar spine bone mineral density assessment in patients undergoing thoracolumbar spine surgery

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Introduction: Osteoporosis is one of the most common diseases leading to generalized bone frailty. It is characterized by reduced bone quality and density, which increases susceptibility to fractures. Dual-energy X-ray absorptiometry (DEXA) is the most widely used technique for assessing bone mineral density (BMD). While it is accessible, involves relatively low radiation, and requires minimal operator training, DEXA has important limitations. As it only areal BMD (aBMD), which may fail to capture bone fragility in a significant proportion of patients. Quantitative computed tomography (QCT), in contrast, provides volumetric BMD (vBMD) measurements using standard CT scans. The aim of this study is to evaluate the diagnostic performance of quantitative computed tomography (QCT) in assessing bone mineral density. **Material and Methods:** This retrospective cohort study was conducted at King Abdulaziz Medical City, Riyadh. The study included all patients who underwent thoracolumbar spine fusion surgery between 2018 and 2025 with available preoperative CT and DEXA scans**.** Variables included demographics, clinical data, surgical details, and radiological data. QCT measurements were performed by a single blinded musculoskeletal radiologist. The categorical variables were reported by using frequency and percent. The categorical variables were compared by groups using chi-square/ fisher exact as applicable. The ROC analysis was generated by using logistic regression models. Analyses was conducted by using SAS software, version 9.4. **Results:** In total 160 subjects were recruited, 80 cases and 80 controls. The DEXA T-scores lumbar attenuation was 57% sensitive and 70% specific. The DEXA T-scores hip attenuation was 74% sensitive and 63% specific. The DEXA T-score lumbar screening (n = 149) shows BMD categories as osteoporotic 18(12%), osteopenic 45(30.2%), and normal 86(57.7%). There was a minimal agreement observed (0.21) between DEXA T-scores lumbar and hip compared to average CT scores. **Conclusion:** This study demonstrates that DEXA has limited sensitivity and specificity in detecting osteoporosis, particularly in patients with spinal degeneration. Opportunistic QCT derived from routine CT scans provides a more accurate assessment of lumbar spine BMD and identifies cases of osteoporosis that may be missed by DEXA.



ID: AGS26/1093
P0460: Motor evoked potentials and contact heat evoked potentials in degenerative cervical myelopathy: a retrospective cross-sectional analysis

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Introduction: Degenerative Cervical Myelopathy (DCM) is the leading cause of non-traumatic spinal cord injury. Decompressive surgery is the mainstay for moderate to severe cases of DCM. Diagnosis is currently based upon clinical examination and cervical cord MRI. The diagnostic workup can be complemented by neurophysiological examination to detect spinal cord damage, ruling out differential diagnoses, and monitoring the disease course. Contact heat evoked potentials (CHEPs) are considered a sensitive method for detecting spinal cord conduction deficits in mild DCM, superior to somatosensory evoked potentials (SEPs). Motor evoked potentials (MEPs) facilitate quantification of corticospinal conduction in DCM and to monitor the disease course. However, a comparison between MEPs and CHEPs has not yet been performed and may elaborate upon the complimentary utility of MEPs within the diagnostic workup of DCM. **Material and Methods:** A cross-sectional retrospective analysis of a prospective cohort study in 171 patients with DCM (NCT02170155) was performed. DCM was diagnosed through presence of one clinical sign or symptom of myelopathy and supportive findings on MRI. DCM severity was scored with the modified Japanese Orthopedic Association Scale (mJOA). CHEPs from cervical dermatomes C6, C8, T4 were obtained routinely in all patients, while MEPs of lower, and in one case upper extremity were performed as an additional exam upon individual clinical judgement. The patient record was searched for participants with DCM that were examined with both MEPs and CHEPs within a 30-day interval without surgical intervention or clinical deterioration between the examinations. The grading of MEPs and CHEPs was binarized to either "pathological" or "normal" and a contingency table was created for comparison. **Results:** From the original study cohort of 171 participants, a subset of 29 patients met the criteria for the final analysis. Exclusion criteria comprised of subjects who lacked both MEPs and CHEPs (n = 103), or too of an interval between MEPs and CHEPs (n = 39). The mean mJOA of the subset was 14.8 points as compared to 15.6 in the full cohort. From the subset, 58.6% had spasticity. With regards to neurophysiology, 58.6% (n = 17) had concordant grading in both modalities: 55.2% (n = 16) graded both pathological, 3.4% (n = 1) graded both as normal. Conversely, 41.4% (n = 12) patients had discordant grading: 27.6% (n = 8) graded as normal MEPs, but pathological CHEPs, 13.8% (n = 4) graded as pathological MEPs, but normal CHEPs. **Conclusion:** Our findings indicate that CHEPs and MEPs provide complementary information in a considerable number of DCM patients. In this subset of a cohort with mild DCM, CHEPs were more sensitive to detect spinal cord damage compared to MEPs. A significant proportion with concordant pathology in MEPs and CHEPs may be due to the anatomic proximity of the spinothalamic and corticospinal tract to the lesion. Interestingly, several patients showed pathologic MEPs while CHEPs were normal. This analysis is limited by its retrospective design and selection bias of patients that underwent additional MEP recording. Future investigations may elaborate if concordant grading is more frequent in patients with extended spinal lesions.

ID: AGS26/1095
P0461: The role of electrophysiological workup in lumbar spinal canal stenosis (LSCS): a systematic review

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Introduction: LSCS is a highly prevalent degenerative spine condition characterized by neurogenic claudication, radicular pain, and muscle weakness. While lumbar spine MRI is the imaging modality for detecting spinal canal narrowing, it correlates poorly with clinical symptoms. Electrophysiological methods, including electromyography (EMG), nerve conduction studies (NCS), and evoked potentials (MEP and SEP), may provide complementary information on neural dysfunction. Current guidelines support paraspinal electromyography (EMG) mapping for symptomatic patients with imaging confirmed stenosis (grade B). In contrast, the diagnostic value of other electrophysiologic tests in lumbar spinal canal stenosis (LSCS) remains uncertain. **Material and Methods:** A systematic literature search was conducted in Medline and Embase for original studies on LSCS between 2020 and 2024. Two independent reviewers screened studies for inclusion. Extracted data was synthesized qualitatively. Study quality was assessed using the Robins-V2 tool. PROSPERO registration (CRD42024622427). **Results:** Thirteen studies met the inclusion criteria; study quality was moderate. Needle EMG of the limbs was evaluated in 23% of studies to detect denervation as a sign of radiculopathy. 23% of the studies examined tibial nerve SEP or cauda equina MEP conduction time for lesion localization, with varying findings and utility for diagnosing LSCS. Surface EMG was investigated in 31% of studies and revealed significantly altered muscle activation patterns and compensatory gait adaptations in LSCS. **Conclusion:** There is an increasing number of studies combining surface EMG with gait assessments and tasks. This approach is interesting for being non-invasive with clinical utility to be further determined. Based on previous guidelines, paraspinal mapping is considered the gold-

standard electrophysiological diagnostic tool. Interestingly, there were no recent studies on paraspinal mapping, indicating a shift to alternative methods.

ID: AGS26/1149
P0462: Does preoperative psoas muscle cross sectional area predict post-operative outcomes following lumbar spine fusion surgery? A systematic review

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Introduction: Low back pain remains a leading cause of global disability, with lumbar fusion surgeries increasingly utilized despite variable outcomes. Preoperative psoas muscle morphology has been proposed as a potential predictor of postoperative success. However, evidence supporting a link between psoas morphology and outcomes post fusion surgery is growing yet remains unclear. The purpose was to systematically evaluate whether preoperative psoas muscle characteristics predict clinical and radiographic outcomes following lumbar fusion surgery. **Material and Methods:** Five databases were searched from inception to June 2025. Included studies assessed preoperative psoas morphology (cross-sectional area, functional cross-sectional area, or volume) and reported postoperative clinical (pain, disability, quality of life) or radiographic outcomes (fusion rates, alignment, complications). Risk of bias was assessed using QUIPS, and evidence evaluated using GRADE. **Results:** Sixteen retrospective cohort studies encompassing 2,250 patients were included. Overall, data indicates that psoas morphology is not a consistent predictor of outcomes following fusion procedures. A small number of studies, however, suggests that the surgical approach may influence this relationship. Posterior fusion techniques showed some association where a larger psoas was linked to early improvements in pain and function, while lateral and anterior approaches demonstrated no relationship. However, findings were based on a limited number of low-quality studies and there remains a paucity of primary research. **Conclusion:** Current evidence does not support preoperative psoas assessment for predicting lumbar fusion outcomes. Higher-quality prospective studies with standardized measurement protocols are needed to clarify the prognostic value of psoas morphology in spine surgery.

ID: AGS26/1211
P0463: A comparison between deep learning-based artificial intelligence and human performance in detecting osteoporotic vertebral compression fractures

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Introduction: Osteoporotic vertebral compression fractures (OVCFs) present significant health challenges, particularly as the population ages, and osteoporosis-related fractures become more common. Rapid and accurate diagnosis of an OVCF is crucial for appropriate treatment. However, in some cases, timely diagnosis and treatment are hindered by shortages of medical personnel and testing equipment. Deep learning-based artificial intelligence (AI) can solve such situations. This study aimed to assess the efficacy of deep learning-based AI in detecting OVCF and calculating compression rates on X-ray images. **Material and Methods:** Between January 2019 and December 2023, 100 patients with suspected vertebral compression fractures, comprising 780 vertebral bodies, were enrolled. Patients underwent anteroposterior and lateral spine X-rays, followed by CT or MRI within 5 weeks. BMD was assessed within a year of the X-ray. Each patient's plain radiograph was assigned a unique identification number, and diagnoses and compression rate calculations were based solely on these X-rays. To evaluate the AI model (version 3.0.0, DS-CF-01, DEEP NOID, Korea) in diagnosing osteoporotic vertebral fractures and calculating compression ratios, results were compared with those of two orthopedic surgeons (with 1 and 14 years of experience), one orthopedic resident, and one general physician. **Results:** AI demonstrated a diagnostic accuracy, sensitivity, and specificity of 92.9%, 66.3%, and 96.6%, respectively, while the orthopedic surgeon with 14 years of experience achieved 96.8%, 86.3% and 98.3%, respectively. The surgeon with 1 year of experience achieved 95.9%, 82.1% and 97.8%, respectively. The orthopedic resident achieved 95.5%, 80% and 97.7%, respectively. The general physicians achieved 94.6%, 75.8%, and 97.2%, respectively. Especially, the AI's sensitivity was significantly lower than that of all physician groups ($p < 0.01$), but its specificity was as high as that of most physician groups. Pearson correlation coefficients for compression rates showed strong positive correlations between AI and each group of physicians ($p < 0.01$). **Conclusion:** The current morphometric assessment AI model has not yet

achieved the diagnostic performance of a general physician. However, it has statistically useful specificity in large datasets. Further algorithm advancements are needed for primary use in clinical settings.

ID: AGS26/1395
P0464: Intraoperative neuromonitoring in diabetic spine surgery patients: a multivariate model for predicting neurological risk

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Introduction: Intraoperative neuromonitoring (IONM) is a cornerstone of spinal surgery safety, designed to detect and prevent neurological complications in real time. Diabetes mellitus (DM), a prevalent comorbidity in spine surgery patients, is thought to interfere with baseline monitorability and increase perioperative neurological risk, though evidence remains inconsistent. Current literature considers isolated risk factors but rarely examines the cumulative effect of comorbidities within multivariate models. While several clinical characteristics have been associated with increased risk of IONM alert, the interplay of these characteristics with high-risk comorbidities such as DM remains understudied. Addressing this gap could enable more precise risk stratification and improve perioperative management. **Materials and Methods:** We retrospectively analyzed IONM data from 102 patients undergoing thoracolumbar or lumbar decompression and fusion between March 2022-March 2024. Demographic and clinical risk factors were collected via chart review for a total of 15 variables, including age, sex, BMI, ASA score, A1C, DM status, and relevant comorbidities. IONM alerts without postoperative deficit, as identified by postoperative neurological exams, were classified as false positives. Separate stepwise logistic regression models were constructed to identify significant predictors of three outcomes: (1) IONM alert, (2) postoperative neurological deficit, (3) false-positive alert. Full models included all 15 variables, and simplified models were generated by iteratively removing non-significant predictors to optimize fit. Model performance was assessed using -2 Log Likelihood (-2LL), Nagelkerke's R^2, Hosmer-Lemeshow test, and area under the ROC curve (AUC). **Results:** Model performance varied across outcomes, with full models providing the best overall fit and all models showing higher specificity than sensitivity. For IONM alerts, the simplified three-variable model (BMI, DM status, total monitoring time) demonstrated fair discrimination and good calibration (AUC = 0.72, R^2 = 0.23, Hosmer-Lemeshow p = 0.696). Elevated BMI and longer total monitoring time were significant predictors of both IONM alert and postoperative neurological deficit ($p < 0.05$). Presence of DM was not a significant predictor of alert ($p = 0.082$, OR = 2.874) or false-positive alert ($p = 0.08$, OR = 2.437), but consistently demonstrated an elevated odds ratio suggesting a clinically relevant trend toward increased risk. **Conclusion:** Our findings suggest that readily available clinical factors-including BMI, monitoring time, and DM status-may inform perioperative risk modeling for patients undergoing spine surgery with IONM. While current model performance is modest, the observed effect size of DM highlights a trend likely limited by sample size. This study is ongoing, with a planned enrollment of 500 patients over multiple years to refine predictive accuracy and incorporate advanced modeling techniques. Such efforts may ultimately provide a robust, clinically actionable tool for perioperative decision-making in high-risk populations undergoing spine surgery.

ID: AGS26/1414
P0465: Occupational risks in spinal surgery: narrative review of the literature and perspectives for prevention

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Introduction: Spine surgery is a highly complex subspecialty, characterized by prolonged procedures and exposure to multiple occupational hazards. Several studies have reported high rates of musculoskeletal disorders, chronic ionizing radiation exposure, and psychological distress, including stress, anxiety, and burnout (1,2). These conditions negatively affect surgeon health, surgical safety, and professional productivity (3,4). International literature highlights that, compared with other surgical specialties, spine surgery entails particularly high occupational risks due to unfavorable ergonomic factors, intensive fluoroscopy use, and prolonged static postures (5,6). In Latin America, however, available evidence remains limited and largely descriptive. This review examines occupational risks among spine surgeons and the preventive measures reported in the literature. **Material and Methods:** We conducted a structured narrative literature review to synthesize evidence on occupational hazards in spine surgeons. Searches were performed in international databases (PubMed/MEDLINE, Scopus, Web of Science) and regional sources (SciELO, LILACS) using keywords such as "spine surgeon," "occupational hazards," "musculoskeletal disorders," "radiation exposure," "burnout," "ergonomics," "sharp injuries," and "occupational health." Literature published between 2015-2025 was prioritized, though earlier conceptually relevant studies were also included. Eligible publications

comprised original articles, reviews, surveys, and cross-sectional studies, as well as neurosurgery and orthopedic research with extrapolable findings. Anecdotal reports and documents lacking explicit methodology were excluded. Findings were organized into three categories: ergonomic and musculoskeletal risks, radiation exposure and environmental factors, and psychological and well-being outcomes. **Results:** Studies meeting inclusion criteria focused on spine surgeons or related specialties, with primarily descriptive and cross-sectional designs (1, 2, 7-11). Radiation exposure was the most frequently investigated risk, with reports of ocular, thyroid, and skin alterations, as well as neoplasms, often associated with inadequate protection and absence of real-time dosimetry (1, 7, 12, 13). Musculoskeletal disorders were also highly prevalent, exceeding 80% in international series, particularly affecting the neck, back, and shoulders, and linked to prolonged static postures and high ergonomic strain (8, 14-16). Sharps injuries were commonly reported but significantly underreported (17, 18). Psychosocial factors, including burnout, depressive symptoms, and occupational stress, were described as highly prevalent, with both individual and organizational determinants, and scarce evidence on effective interventions (2, 5, 6,1 9-22). No spine-specific guidelines were identified; most recommendations were extrapolated from orthopedics and general safety protocols (13, 16, 23-26). **Conclusion:** Spine surgery poses a substantial occupational burden, encompassing ergonomic, radiological, and psychosocial risks that compromise both surgeon health and patient safety. The available evidence, though limited, underscores the urgent need for integrated preventive strategies and methodologically robust studies to quantify risks, validate interventions, and inform institutional policies that ensure the sustainability of spine surgical practice.

ID: AGS26/1651
P0467: Spine biopsy using percutaneous vertebroplasty cannula under fluoroscopy; case series

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Introduction: Spinal lesions can occur due to a primary disease or the result of pathological processes elsewhere in the body. Biopsy and histological analysis are required for definitive diagnosis. In recent years, tomography-guided fine needle aspiration biopsy (FNAB) has gained popularity due to its minimally invasive nature, but it may not be sufficient for diagnosis in cases of infection or some malignancies. Therefore, we aimed to present the results of percutaneous vertebral biopsy using a fluoroscopy-guided vertebroplasty cannula due to it may allow for more accurate diagnosis by obtaining more sample material. **Material and Methods:** Thirty-seven patients were performed percutaneous transpedicular vertebral biopsy in the operating room by using fluoroscopy, vertebroplasty cannula, and pituitary rongeur under sedoanalgesia in our Neurosurgery department between 2021 and 2024. **Results:** Thirty-four patients were included in the study. The average age of the patients was 63.9%. Sixteen of the patients were male and 18 were female. The most commonly affected vertebraes were L2 and L4 (6 each). The most common presenting complaint was back pain. The most common systemic disease was diabetes mellitus. Histopathologically positive results were obtained in 22 patients (64.7%), and a pathogen was detected from cultures of 13 of 21 samples (61.9%) examined in the microbiology laboratory. Nine of the patients in the study had a history of previous malignancy, but 3 patients were diagnosed with malignancy for the first time. **Conclusion:** In cases of spondylitis and spondylodiscitis, bacterial detection is often absent in microbiology cultures, particularly during intensive antibiotic therapy and due to limited CT-guided FNAB material. Therefore, diagnosis can be challenging. Histological diagnosis of some systemic malignant diseases, such as lymphoma and myeloma can be difficult. We believe that in such cases, fluoroscopy guided percutaneous biopsy by using vertebroplasty cannulas and rongeur in the operating room may be superior to FNAB in making the diagnosis.

ID: AGS26/1727
P0468: Cervical angina: an often-overlooked cause of non-cardiac chest pain

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Introduction: Chest pain is the second most common chief complaint in all emergency department visits, with a broad differential diagnosis that includes life-threatening conditions. Therefore, immediate management of chest pain involves

ruling out life-threatening conditions such as acute coronary syndrome, which accounts for approximately 31% of chest pain cases. Once a cardiac cause of chest pain is ruled out, non-cardiac causes are investigated, with the most common being gastroesophageal reflux disease and musculoskeletal issues. However, cervical angina, a less common and less well-known cause of noncardiac chest pain, may be omitted from most clinicians' differential diagnoses. **Material and Methods:** We conducted a literature review using MEDLINE. Search terms included "cervical angina"; "cervical angina management"; "non-cardiac chest pain AND cervical spine"; "cervical radiculopathy AND chest pain"; "cervical sympathetic chain AND chest pain"; "degenerative cervical disease AND chest pain"; "pseudoangina AND cervical spine"; and "spondylosis". **Results:** We identified 15 articles that met our inclusion criteria. Of these, 7 articles included reports of cervical angina incidence, with incidence ranging from 1.4% to 32%. The most widely discussed etiology of cervical angina was cervical radiculopathy of the C6-C7 cervical spine. Diagnosis involves ruling out cardiac and common non-cardiac causes of chest pain, followed by collecting a focused history and conducting a physical examination. Imaging and ancillary tests can be performed to confirm the diagnosis. Literature review suggests both non-operative and operative interventions are effective in treating cervical angina. **Conclusion:** Cervical angina is an important non-cardiac cause of chest pain that mimics true angina pectoris. Because of these similarities, some patients might receive unnecessary cardiac procedures, which can raise their risk of complications from cardiac catheterization. Properly ruling out cardiac issues as the cause of chest pain and initiating spinal assessment are essential for a timely diagnosis. This is especially important because, although cervical angina often remains underdiagnosed, it has effective surgical and non-surgical treatment options. All physicians, especially those in emergency and primary care, should be aware of this potential cause of chest pain because many patients will initially go to them. They can then work with other specialists, such as those in orthopedics, to provide effective treatment for these patients.

ID: AGS26/1916
P0469: Global variation in fusion assessment following ACDF: a call for standardization

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Introduction: Despite the widespread use of anterior cervical discectomy and fusion (ACDF), no consensus exists on a gold standard for defining radiographic fusion. Variability in assessment methods leads to discrepancies in reported fusion rates, which in turn affect clinical decision-making and comparative research. This study used the Delphi method to explore expert perspectives on standardized fusion assessment criteria. **Material and Methods:** A cross-sectional, modified 30-item survey was distributed to global experts in cervical spine, selected based on their research impact. Items addressed surgeon demographics, preferred fixation and interbody techniques, bracing protocols, imaging strategies, and perceived strength of evidence for various fusion assessment criteria. Responses were analyzed descriptively. **Results:** Forty-four surgeons responded (40% response rate), predominantly orthopedic spine surgeons and neurosurgeons from North America. Substantial variation was observed in imaging preferences and fusion criteria. Most surgeons preferred plate fixation for both 1-2 level ACDF (mean 71%) and 3-4 level ACDF (mean 92%), making it the most commonly chosen fixation method across both groups. Similarly, metallic cages were the most frequently used interbody devices, with mean preferences of 40% for 1-2 levels and 42% for 3-4 levels. Follow-up was most often discontinued one year after confirmed fusion. Fusion status and patient satisfaction were the primary determinants of follow-up duration. Flexion-extension radiographs and CT were the most frequently used modalities. The most strongly endorsed criteria for fusion were < 1 mm interspinous motion, $< 5°$ angular motion, and graft bridging bone ≥ 2 mm on CT, though up to 20% of surgeons still rated these measures as moderate or poor evidence. While 77.8% endorsed the need for standardized criteria, only half were aware of existing guidelines. **Conclusion:** This international survey of experts highlights significant variability in the assessment of fusion following ACDF, reflecting inconsistencies in imaging use and confidence in radiographic criteria. These findings underscore the urgent need for a universally accepted, evidence-based standard to improve reliability in research and consistency in clinical practice.

ID: AGS26/2318
P0470: Spinal arachnoid cysts after intradural surgery: iatrogenic or natural history?

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Background: Spinal arachnoid cysts are rare, typically congenital or idiopathic. They may also appear after intradural surgery, raising questions about whether they are iatrogenic or

a natural postoperative development. **Objective:** To analyze spinal arachnoid cysts occurring after intradural tumor or vascular surgery and discuss their pathophysiology, diagnosis, and management. **Materials and Methods:** We retrospectively reviewed patients who developed arachnoid cysts following intradural spinal procedures. Clinical presentation, imaging, surgical history, and treatment outcomes were assessed. Literature was reviewed to contextualize findings. **Results:** Patients presented months to years post-surgery with myelopathy or radiculopathy. MRI revealed cystic collections compressing the spinal cord, sometimes communicating with the subarachnoid space. Management included cyst fenestration, resection, or CSF diversion. Outcomes varied: some patients improved significantly, others only partially recovered. **Conclusion:** Postoperative spinal arachnoid cysts may represent a spectrum from iatrogenic arachnoid adhesions to natural arachnoid remodeling. Awareness is key for early diagnosis and management. Further studies are needed to determine whether these cysts are preventable sequelae or inevitable in certain cases.

ID: AGS26/2398
P0471: Assessment of online information quality on lumbar disc herniation

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Introduction: The internet is a widely used source of health-related information, but the quality and reliability of online content vary significantly. This study aimed to evaluate the quality of web-based information on lumbar disc herniation using the DISCERN instrument, JAMA benchmarks, and a custom attachment criteria scale. **Material and Methods:** A Google search using the term 'lumbar disc herniation' was conducted on May 9, 2025. The first 100 search results were screened. Websites were excluded if they were video-only, duplicates, promotional/product-focused, or file-based (PDF/Word). A total of 100 unique websites were included. Each website was evaluated using the DISCERN instrument (16 questions, score range: 1-5 per item), JAMA criteria (authorship, attribution, disclosure, currency; score range: 0-4), and categorized based on content producer and information type. Additionally, the proportion of AI-generated or AI-assisted text was estimated. **Results:** Among the 100 websites, 45% were affiliated with hospitals or clinics, 20% with individual medical professionals, 15% with physiotherapists, and 20% with general health platforms or blogs. The mean DISCERN score was 3.73 ± 0.32 and the mean JAMA score was 1.87 ± 0.84. While many websites provided basic information on symptoms and treatment, only 12% offered cited, up-to-date, and transparent content. An estimated 78% of the websites included partially or fully AI-assisted text, particularly among blogs and commercial health sites. **Conclusion:** The quality of online information on lumbar disc herniation is variable and generally moderate. Most websites lack comprehensive sourcing, transparency, and regularly updated content. Healthcare professionals should be aware of these limitations and guide patients toward more reliable resources.

ID: AGS26/2511
P0472: Extraspinal sciatica mimicking lumbar radiculopathy: a case report

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Introduction: Sciatica is defined as low back or gluteal pain radiating down the posterior aspect of the lower limb, reaching the foot, with a reported incidence of 13-40%. True radiculopathy of spinal origin is considerably less frequent, with a reported incidence of 3-5%, most commonly caused by disc herniation. The objective of the following case report is to highlight the importance of the physical examination given the overlap of pain distribution areas. **Materials and Methods:** A 32-year-old female patient, athlete, with no relevant medical history, was referred by her primary care physician for "left-sided lumbosciatica." She reported pain along the posterior aspect of the left lower limb (from buttock to foot) with a 6-month history. On physical examination, FADIR and FABER tests were positive, mild low back pain was present, and the Lasègue test was negative. Complementary studies were requested. **Results:** MRI showed no significant discopathy; however, MR arthrography revealed an anterosuperior labral tear of the left hip, with a positive lidocaine test. **Discussion:** The overlap in pain distribution between lumbar and hip joint pathology may complicate diagnosis. In 1983, the "hip-spine syndrome" was described within this diagnostic challenge. This overlap often leads to misdiagnosis between true sciatica and pseudosciatica, which can be caused by differential diagnoses such as piriformis syndrome, paralabral cysts, labral tears, and sacroiliitis. Although not specific, clinical maneuvers may be suggestive and guide the appropriate evaluation of the patient, particularly when root traction tests are negative or

when the pain does not reproduce the typical features of spinal radiculopathy. **Conclusion:** The physical examination of patients presenting with spinal symptoms should include a hip evaluation, as symptom overlap is frequent. In young patients, the hip-spine syndrome encompasses labral tears, paralabral cysts, and piriformis syndrome.

ID: AGS26/2542
P0473: A global survey on intra-operative neuromonitoring (IONM) practices, attitudes towards its use, and barriers among spine surgeons

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Introduction: Intra-operative neuromonitoring (IONM) is a critical tool for minimizing neurological risk during spine surgery. This study aims to provide an up-to-date, global perspective on the current practices, attitudes, and perceived barriers related to IONM among spine surgeons. **Material and Methods:** A cross-sectional survey was conducted among 529 spine surgeons from various AO spine regions, including Asia Pacific (31.3%), Europe & Southern Africa (26.4%), and North America (15.0%). The respondents, predominantly male (90.7%) orthopaedic surgeons (63.7%), primarily work in academic or university hospitals (42.5%). The survey collected data on demographics, IONM access and models used, actions taken during an unexpected loss of intraoperative potentials, attitudes towards its use, and perceived limitations. **Results:** Access to IONM was reported as "always" available by 55.5% of surgeons, with 35.7% having occasional access and 8.8% reporting no access. The most common model used was an external company (59.5%), followed by in-house services (40.5%). IONM data interpretation was primarily handled by a neuromonitoring technician (63.6%), while surgeons themselves interpreted the data in 26.1% of cases. A majority of surgeons (76.3%) reported using a checklist in the event of an unexpected loss of potentials, whereas fewer would perform a wake-up test (17.7%) or abort the surgery (9.1%). A strong majority of surgeons agreed that IONM is crucial for enhancing outcomes (89.9%), important for medicolegal protection (91.2%), and provides surgeon reassurance (87.8%). Half of all surgeons (50.5%) reported a positive attitude towards the use of IONM, and only 5.3% reported negative attitude. The main limitations to IONM use were identified as economic (38.2%), logistical (27.4%), and a lack of training (25.6%). **Conclusion:** This global survey reveals that a majority of spine surgeons have regular access to and hold overwhelmingly positive attitudes towards IONM, particularly regarding its impact on patient outcomes and medicolegal protection. However, significant barriers, especially economic and logistical challenges, remain, highlighting the need for continued efforts to improve the accessibility and implementation of this technology worldwide.

ID: AGS26/2573
P0474: Spinal cord injury due to vertebral destruction syndrome from thoracic aorta aneurysm: report of 1 case

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Introduction: Thoracic aortic aneurysms (TAA) are pathological dilatations that often remain silent until advanced or complicated stages. They are less prevalent than abdominal aortic aneurysms, occur more frequently in men over 60 years of age, and are associated with hypertension, atherosclerosis, and connective-tissue disorders. A rare but clinically significant complication of giant TAA is erosion of adjacent bone-most notably the vertebral bodies-driven by chronic pulsatile compression, contained rupture with periaortic hematoma, or direct invasion in mycotic/inflammatory settings. **Materials and Methods:** We report the case of a 73-year-old woman with remote vertebral tuberculosis (Pott's disease) involving T6, treated medically ~30 years earlier. She subsequently underwent spinal surgery with bone graft and stabilization bars for a paravertebral mass that was ultimately proven to be a lipoma, with good clinical recovery. At 62 years of age, she developed progressive thoracic pain and a left subscapular pulsatile mass, followed by worsening motor and sensory deficits that culminated in a complete spinal cord injury at and below the T7 level. **Results:** Contrast-enhanced CT demonstrated a large thoracic aortic aneurysm and a destructive lytic lesion of the T6 vertebral body-the same level previously affected by tuberculosis. The paravertebral mass was resected and confirmed histologically as a lipoma; the prior hardware was removed. Given the aneurysm's morphology and the patient's hemodynamic stability, conservative management with a beta-blocker and an angiotensin II receptor blocker plus imaging surveillance was chosen. The aneurysm appeared as a partially thrombosed saccular lesion (approximately 3-5.5 cm in maximal dimension). Although earlier comparable imaging

was unavailable, the vertebral lysis has remained radiographically stable over ~12 years, consistent with a chronic, partially thrombosed aneurysm exerting low-grade mechanical and/or inflammatory effects. **Conclusion:** This case highlights a rare but important complication of TAA: progressive vertebral erosion at a site of prior infection/surgery. In patients with known or suspected TAA, persistent localized pain or new neurological findings should prompt targeted imaging to assess for osseous involvement. Early multidisciplinary evaluation can align vascular and spine strategies to balance aneurysm control, mechanical stability, and neurological preservation.

Keywords: spinal cord injury; Frankel A; sequelae; aneurysm; vertebral lysis; bone tumor-like lesion.

ID: AGS26/2584
P0475: Prevalence of osteoporosis and osteopenia diagnosed using DEXA and quantitative CT in patients undergoing thoracolumbar fusion surgery

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Introduction: Osteoporosis and osteopenia are common in patients undergoing spine surgery and are associated with hardware loosening, implant failure, and non-union. Preoperative identification of low bone mineral density (BMD) is therefore essential. Dual-energy X-ray absorptiometry (DEXA) remains the standard diagnostic tool but has limitations in the spine, whereas quantitative computed tomography (QCT) may provide more accurate assessment. **Material and Methods:** This case-control study included 80 patients undergoing thoracolumbar fusion and 80 matched controls. All subjects underwent DEXA and QCT. BMD categories were defined using standard thresholds. Prevalence was reported with 95% confidence intervals (CI). Logistic regression was performed to identify risk factors for osteoporosis, with results expressed as odds ratios (OR) and corresponding 95% CI. Postoperative complications were also recorded. **Results:** The prevalence of osteopenia and osteoporosis was high in both surgical patients and controls, with no significant differences between groups. Females had a significantly higher prevalence of osteopenia compared with males ($p = 0.031$). Logistic regression identified age ($p = 0.021$) and female sex (OR 3.7; $p = 0.011$) as independent predictors of osteoporosis. No significant differences were observed between DEXA- and QCT-based BMD classifications. Postoperative complications were reported in 26 patients (16%), including screw loosening (12%), implant failure (3%), and proximal junctional kyphosis (4%). **Conclusion:** Osteoporosis and osteopenia are highly prevalent among thoracolumbar fusion patients, particularly in older women. Given the comparable diagnostic performance of DEXA and QCT, and the fact that most patients already undergo preoperative CT, opportunistic QCT screening may serve as a practical approach to detect osteoporosis before surgery. Routine bone health assessment and early intervention could help reduce underdiagnosis and lower the risk of hardware-related complications.

ID: AGS26/2659
P0476: Optimization of patients for spinal instrumentation surgery: defining the magnitude of BMD overestimation with DEXA

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Introduction: Bone mineral density (BMD) assessment is critical in patients with degenerative spine disease undergoing surgery. Dual-energy X-ray absorptiometry (DEXA) is widely used, but its two-dimensional measurements are confounded by osteophytes, sclerosis, and vascular calcifications, leading to underestimation of osteoporosis. Quantitative computed tomography (QCT) provides volumetric BMD (vBMD) and site-specific analysis. However, direct comparative studies of QCT and DEXA performed in the same surgical cohort remain scarce in the literature. This study compared lumbar BMD and T-scores from DEXA and QCT in the same patient. **Material and Methods:** An observational study was conducted on 125 consecutive patients, including post-menopausal women over 50 and men over 70 years, all requiring surgery for degenerative spine disease. Lumbar BMD and T-scores were measured using both DEXA and QCT. Mean values with standard deviations (SD) were calculated and compared. **Results:** The average age of the patients was 70.5 ± 8.6 (range: 54-79). QCT demonstrated a lumbar T-score mean of -3.62 ± 1.10, significantly lower than DEXA (-1.95 ± 1.72). Among 125 patients with osteoporosis confirmed by QCT, DEXA mis-classified 67 patients (53.6%) as non-osteoporotic (T-score > -2.5), highlighting a substantial underestimation of bone loss. **Conclusion:** DEXA underestimates osteoporosis and is unreliable for medical management of osteoporosis and operative planning. QCT, by accurately capturing both T-scores and vBMD, offers superior assessment of spinal bone

quality, making it the preferred modality for surgical decision-making.

ID: AGS26/2661
P0477: Clinical characterstics and surgical treatment results of double crush syndrome by spinal degenerative disease and peripheral nerve entrapment disease

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Introduction: Double crush syndrome (DCS) is a clinical condition involving spinal degenerative disease (SDD) and peripheral nerve entrapment disease (PNED). The clinical features of DCS remain unclear. In this study, we report our DCS cases with a literature review. **Material and Methods:** We retrospectively reviewed the medical records of 711 surgical cases of SDD in our hospital between April 2019 and March 2023 (312 cervical spine cases, 399 thoracolumbar cases). Among these, surgical cases of PNED were subjected to this study. Clinical characteristics and surgical treatment results by NRS and McNab scale were evaluated at the first visit and 3-months postoperative and the end of follow-up. **Results:** The subjects included 11 patients (1.5% of the total, 6 men, 5 women, mean age 67.2 years); 2 cases of cervical myelopathy with carpal tunnel syndrome, 2 cases of cervical myelopathy with cubital tunnel syndrome, 1 case of cervical myelopathy with tarsal tunnel syndrome, 3 cases of cervical radiculopathy with cubital tunnel syndrome, 1 case of lumbar radiculopathy with piriformis syndrome and peroneal nerve disorder and 3 cases of lumbar radiculopathy with peroneal nerve disorder. The diagnosis was based on clinical symptoms and physical examination with clinical imaging for SDD and nerve conduction study for PNED. One-stage surgery was performed in 3 patients (27.2%) and staged surgery was performed in 8 patients (72.7%). In staged surgery cases, the average interval between surgeries was 16.6 months. 7 case (87.5%) of staged surgery cases underwent surgery for SDD at first. 7 patients of all (63.6%) have a negative Tinel-like sign particular to the PNED upon physical examination at first visit. In three of staged surgery cases, a Tinel-like sign changed from negative to positive at after spinal surgery. 3 patients (27.2%) showed satisfactory outcome (good or excellent by McNab scale) at 3-months postoperative, but 9 patients (81.8%) at the end of follow-up. **Conclusion:** Surgical DCS is a relatively rare condition. Although the diagnosis of DCS are challenging, the surgical treatment are effective. In DCS patients, Tinel-like sign characteristic of the PNED tend to be a negative and there is a possibility of the positive conversion after spine surgery. It is important carefully follow up the patient to detect changes in his or her condition. The surgical results for DCS diagnosed by doing this are good at the end without immediate effect. There was no difference between upper and lower limbs unless no detailed reports about DCS of lower limbs have been published.

ID: AGS26/2669
P0478: Enhancing clinical documentation and management of cauda equina syndrome: the development and impact of a structured assessment proforma

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Background: Cauda equina syndrome (CES) is a neurosurgical emergency associated with potentially devastating neurological sequelae and significant medico-legal implications. Timely surgical decompression is critical; however, effective management relies on precise documentation of clinical findings. In many settings, documentation of key neurovascular assessments remains suboptimal. This study aimed to evaluate and improve the quality of clinical documentation in suspected CES cases by implementing a structured assessment proforma, thereby facilitating timely and accurate clinical evaluation, expediting neurosurgical referral, and mitigating legal risks. **Methods:** A retrospective review was conducted to compare documentation practices in 50 patients with suspected CES before and 50 patients after the introduction of a custom-designed proforma in the Trauma and Orthopaedic Department. Documentation was evaluated for the following nine key parameters: clinical history, motor examination, sensory examination, bladder function, bowel function, reflexes, perianal pinprick test, sexual dysfunction assessment, and radicular pain. Referral times for urgent surgical intervention were also recorded. **Results:** Implementation of the proforma significantly improved documentation rates. Perianal pinprick testing increased from 12 (24%) cases pre-proforma to 44 (88%) cases post-proforma. Bladder function documentation improved from 31 (62%) cases to 49 (98%) cases, and sexual history documentation increased from six (12%) cases to 46 (92%) cases. Among patients requiring urgent surgical intervention, the time from referral to definitive management was reduced by an estimated seven hours. Eight urgent cases were identified pre-proforma, compared to five post-proforma. **Conclusions:** The structured assessment proforma significantly enhanced the completeness of neurovascular documentation and streamlined the management of suspected CES cases, resulting in a notable reduction in referral delays for urgent intervention. Adoption of such a proforma may improve

diagnostic accuracy, expedite neurosurgical referrals, and reduce medico-legal risk.

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P0479: Spontaneous intracranial hypotension with acquired tonsillar descent: diagnostic pitfalls and surgical repair of a thoracic ventral dural defect

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Introduction: Spontaneous intracranial hypotension (SIH) is an under-recognised yet increasingly diagnosed cause of orthostatic headaches. The condition arises most commonly from spinal cerebrospinal fluid (CSF) leaks, which may result from dural defects, meningeal diverticula, or CSF-venous fistulae. The consequent reduction in intracranial CSF volume and pressure can produce characteristic imaging findings, including diffuse pachymeningeal enhancement, venous engorgement, and acquired cerebellar tonsillar descent, often mimicking Chiari I malformation. Distinguishing SIH from other causes of hindbrain herniation is critical, as timely recognition and targeted treatment of the spinal CSF leak can lead to resolution of symptoms and reversal of radiological abnormalities. **Material and Methods:** We report the case of a 55-year-old man with a 10-year history of postural headaches. Despite two epidural blood patches, his symptoms persisted and later progressed to experiencing back pain, gait imbalance, sensory loss in the C2-C6 dermatomes, and behavioural changes consistent with a frontal syndrome, thought to reflect glymphatic system dysfunction. Follow-up imaging was initially labelled as Chiari malformation; however, detailed review demonstrated a subtle ventral epidural fluid collection extending along the thoracic and cervical spine. Localising the exact site of the CSF leak proved challenging: CT myelography failed to identify the defect, highlighting the limitations of conventional imaging in this context. Digital subtraction myelography (DSM), although not universally reliable in pinpointing small or ventral leaks, suggested a probable site at T3-T4. A hybrid approach was adopted, whereby intraoperative DSM was performed under the same anaesthetic immediately prior to surgical exploration. This confirmed the level of the leak, allowing T3-T4 laminectomy and intradural repair of the ventral dural defect with patch and suture closure. **Results:** Patient recovered with complete resolution of symptoms with no neurological deficits or weakness. Two-month post-operative MRI scans showed a full resolution of cervical cord oedema, near complete resolution of syrinx and major improvement of the displacement of brainstem and cerebellar tonsils and other features of intracranial hypotension. **Conclusion:** SIH-related persistent headaches and symptoms can present as a troublesome condition for patients to live with. Identifying the pathological defect on imaging can be challenging, which may delay treatment. Our case report illustrates that appropriate surgical intervention has the capability of near-complete resolving of pathological deformities including Chiari malformation, syrinx formation and oedema, and other associated changes due to intracranial hypotension. This in turn allows a complete resolution of symptoms and minimal disruption upon return to normality for patients.

ID: AGS26/2895
P0480: Physical exam of the SI joint: what is the variation in force application?

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Introduction: Sacroiliac (SI) joint pain is implicated in up to 30% of low back pain cases, but diagnosis remains challenging due to symptom overlap with lumbar and hip pathology and the absence of a definitive imaging test. Physical examination maneuvers are widely used to provoke and assess SI joint pain, yet there is little evidence guiding the optimal force application or assessing inter-clinician variability. Our objective herein was to quantify the variation in force applied by experienced spine surgeons during standardized SI joint provocative maneuvers. **Material and Methods:** Sixteen spine surgeons performed common SI joint physical exam maneuvers (palpation, distraction, thigh thrust, and compression) on a volunteer lying on a force plate, blinded to force readouts. Palpation measurements were repeated to determine intra-examiner reliability. Surgeon demographics, specialty, years of practice, and relevant surgical experience were collected. Force data were analyzed for range, intra-examiner reliability, and correlation with surgeon background. **Results:** Considerable force variation was observed across all maneuvers: palpation (69-236N), palpation repeat (49-292N), distraction (231-545N), compression (214-532N), and thigh thrust (299-697N). Palpation exhibited the highest intra-examiner reliability (Pearson r = 0.95). No significant relationships were detected between applied force and surgeon specialty, years in practice, or surgical volume. Despite moderate clustering around mean forces, substantial outliers existed. **Conclusion:** Examiners had a high intra-observer reliability for force applied during palpation. There was

substantial inter-examiner variability in the force applied during SI joint physical examination maneuvers which was independent of surgeon specialty or experience. This variation may contribute to inconsistent diagnostic yield reported in the literature, and standardization of applied force may enhance the consistency of SI joint pain diagnosis. Future studies should explore optimal force thresholds and develop training protocols to improve clinical reproducibility.

ID: AGS26/2936
P0481: Management of recurrent dorsal spinal arachnoid cyst: a case report and review of the litterature

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Introduction: Spinal arachnoid cysts (SACs) are rare intradural lesions that can cause radicular or myelopathic symptoms due to spinal cord compression. Surgical cyst wall resection is the standard treatment, and recurrence after complete resection is exceedingly rare. **Material and Methods:** We present a 43-year-old female with a recurrent dorsal spinal arachnoid cyst. She underwent two prior resections, followed by a subarachnoid cyst shunt after a third recurrence, achieving 15 years of symptom-free status. She later developed progressive paraparesis due to a fourth compressive cystic recurrence. **Results:** For this recurrence, a cystoperitoneal shunt was performed, resulting in complete recovery of her paraparesis on follow-up. **Conclusion:** This case highlights the rare potential for long-term recurrence of dorsal SACs despite multiple surgical interventions. It underscores the importance of long-term follow-up in patients with spinal arachnoid cysts, as timely intervention can prevent neurological deterioration and ensure sustained recovery.

ID: AGS26/2969
P0482: Genetic testing informs surgical decision-making and reduces complications in spine surgery

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Introduction: Genetic testing reveals disease features that can be overlooked during standard clinical assessment. The impact of genetic testing on surgical decision-making in spine surgery requires investigation. We aimed to evaluate whether genetic testing informs surgical decision-making and reduces complications in spinal surgery. **Material and Methods:** Patients with a surgical indication for spinal deformity and a definitive genetic diagnosis were included. Patients who underwent surgery had a minimum of two years of postoperative follow-up. Propensity score matching was performed to match patients who received preoperative genetic testing (Pilot Group) to those who received postoperative genetic testing (Control Group). We identified genetic testing-informed refinements of perioperative plans and compared major and minor surgical complications between the two groups. **Results:** The study included 86 patients (30 in the Pilot Group, 56 in the Control Group). Genetic testing informed four alterations to perioperative plans in the Pilot Group and redirected treatment pathways. The rationale for these changes included the identification of altered spinal biomechanics and multisystemic involvement. These features were well-recognized as being associated with increased surgical risk but were often undetected during standard preoperative clinical assessments. The refined selection of the lowest instrumented vertebra and osteotomy approach can be generalized to hereditary connective tissue disorders, considering the characteristic spinal hypermobility due to connective tissue fragility. The clinical impact of preoperative genetic testing was demonstrated by a statistically significant decrease in the number of late postoperative complications among patients in the Pilot Group, without inter-group differences in baseline or surgical characteristics. Moreover, 4 out of 12 major complications in the Control Group could have been prevented with preoperative genetic testing. We further proposed a framework for dynamic assessment of surgical appropriateness that incorporates the understanding of genetic etiology, emphasizing its fundamental role in enhancing patient outcomes. **Conclusion:** Genetic testing informs surgical decision-making and improves surgical outcomes. Incorporating the understanding of genetic etiology enhances surgical appropriateness, paving the way for precision spine surgery.

ID: AGS26/3237
P0484: Spinal epidural venous angioma: a case report

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Introduction: Spinal vascular malformations are rare and usually intradural. Purely extradural venous angiomas are extremely uncommon, with only five cases reported to date.

We present a case of spinal epidural venous angioma in a patient with a prior malignancy, emphasizing the importance of radiological suspicion in atypical presentations. **Material and Methods:** A 42-year-old right-handed woman presented with a 3-week history of back pain, progressively associated with gait difficulties and sphincter disturbances. Her past medical history was significant for ovarian cancer treated by radical surgery two years earlier. Neurological examination revealed paraparesis (motor strength 3/5) with hyperactive deep tendon reflexes. Spinal MRI showed a T1 hypointense, T2 hyperintense epidural mass at T2-T6 with strong contrast enhancement, causing significant spinal cord compression. Metastatic epiduritis was initially suspected. The patient underwent emergency T2-T6 laminectomy. Intraoperatively, a highly vascular grayish mass was observed and gross total resection was performed. **Results:** Histopathology demonstrated cystically dilated vessels coalescing into larger channels, confirming a spinal epidural venous angioma. Postoperatively, the patient recovered fully, with no neurological deficits or radiological evidence of recurrence at two-year follow-up. **Conclusion:** Although exceedingly rare, spinal epidural venous angiomas should be included in the differential diagnosis of epidural masses, even in patients with a history of malignancy. Careful preoperative planning and meticulous surgical technique allow for gross total resection and excellent clinical outcomes. Early recognition is critical to prevent misdiagnosis and optimize neurological recovery.

ID: AGS26/3251
P0485: Posterior fixation of the cervicothoracic junction: technical challenges in a series of four cases

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Introduction: The cervicothoracic junction (CTJ) is a biomechanically complex transition between the mobile cervical spine and rigid thoracic spine. Pathologies such as trauma, degeneration, and tumors often require surgical stabilization. Posterior fixation remains technically challenging due to narrow pedicles, complex anatomy, and neurovascular risks. We report our preliminary experience with four patients undergoing posterior CTJ fixation. **Material and Methods:** We retrospectively reviewed four consecutive patients treated between 2022 and 2024. Indications included traumatic instability (n = 2), degenerative disease (n = 1), and metastatic lesion (n = 1). Posterior instrumentation involved pedicle screws at C7-T2, with or without lateral mass screws, tailored to anatomical feasibility. Operative data, radiological outcomes, complications, and clinical evolution were analyzed. **Results:** Posterior fixation was successfully achieved in all cases with correct screw placement on postoperative imaging. Mean operative time was 180 minutes and average blood loss 450 ml. No intraoperative neurovascular injuries occurred. One patient developed a superficial wound infection, managed conservatively. At a mean follow-up of 10 months, fixation remained stable without hardware failure. Neurological status improved in two patients and was stable in the others. Pain relief was achieved in three patients, and all regained the ability to perform daily activities. **Conclusion:** Posterior CTJ fixation is a safe and effective procedure when meticulous anatomical planning is observed. Despite technical challenges, pedicle screw constructs provided stable stabilization and favorable short-term clinical outcomes. Larger studies are warranted to validate these preliminary results and refine surgical strategies in this anatomically complex region.

ID: AGS26/3259
P0486: Spinal dural arteriovenous fistulas: a series of six cases

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Introduction: Perimedullary venous drainage spinal dural arteriovenous fistulas are rare. They represent the most common type of spinal vascular malformations. While their clinical presentation and imaging findings are now well understood, the optimal treatment approach remains a matter of debate. **Material and Methods:** The clinical presentation was dominated by a spinal cord compression syndrome in all patients. The diagnosis was confirmed by spinal angiography. Two patients underwent complete endovascular embolization, while four were treated surgically. The outcomes were marked by neurological stabilization and improvement in four cases. **Results:** The diagnosis was established through spinal angiography. Two patients underwent complete endovascular embolization, while four were treated surgically. Neurological outcomes showed stabilization and improvement in four patients. **Conclusion:** Spinal dural arteriovenous fistulas are associated with significant neurological morbidity, largely due to diagnostic delays.

ID: AGS26/3278
P0487: Emergency MRI in acute spinal cord syndromes: diagnostic yield and impact on patient triage - Literature review

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Introduction: Acute spinal cord syndromes (ASCS) are medical emergencies that require rapid assessment to prevent irreversible neurological deficits. MRI is the imaging modality of choice, but its real-time impact on emergency triage and decision-making remains under evaluation. **Material and Methods:** A systematic literature review was conducted using PubMed and Google Scholar with the keywords: "acute spinal cord syndrome," "emergency MRI," "triage," "diagnostic yield," and "management impact." Studies assessing MRI findings, diagnostic accuracy, changes in patient management, and time to intervention were included. **Results:** • Emergency MRI demonstrated a high diagnostic yield, detecting compressive, inflammatory, ischemic, and hemorrhagic lesions. • In 70-85% of cases, MRI findings directly influenced immediate clinical management, including surgical decompression or medical therapy initiation. • MRI facilitated prioritization of patients for neurosurgical intervention, particularly in cases with subtle clinical signs. • Early MRI reduced time to definitive treatment and improved risk stratification, enhancing patient safety and optimizing resource allocation in emergency settings. • Limitations include availability, scan duration, and need for patient stability during imaging. **Conclusion:** Emergency MRI provides critical diagnostic information in acute spinal cord syndromes, significantly impacting patient triage and management. Its integration into early assessment protocols ensures timely intervention, improves clinical decision-making, and enhances outcomes. Wider availability and streamlined protocols are recommended to maximize its clinical benefit in urgent care settings.

Disc degeneration

ID: AGS26/40
P0489: Does disc consistency matter? A comparative series on calcified and soft thoracic disc herniations

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Introduction: Though rare, thoracic disc herniation (TDH) can lead to debilitating myelopathy and poses considerable surgical challenges. The consistency of the herniated disc - soft versus calcified - may significantly influence surgical planning and perioperative outcomes. This retrospective study compares clinical features, surgical parameters, and neurological outcomes in patients with calcified versus soft TDH. **Material and Methods:** Thirty-six patients with thoracic myelopathy due to TDH were treated at a tertiary spine centre between 2018 and 2024. Patients were stratified into calcified (n = 20) and soft (n = 16) disc cohorts based on imaging and intraoperative findings. Data included demographics, imaging, operative details, and neurological outcomes. A p-value < 0.05 was considered significant. **Results:** Baseline characteristics were comparable between groups. The T10-T11 level was the most commonly affected. All soft disc cases were managed via a posterior approach, while calcified cases required more varied surgical approaches. Calcified TDH was associated with significantly greater intraoperative blood loss (450 mL vs 275 mL, $p = 0.027$) and more frequent intraoperative neuromonitoring alerts ($p = 0.02$). Immediate postoperative neurological deficits and non-neurological complications were more frequent in the calcified group but did not reach statistical significance. At a mean follow-up of two years, neurological outcomes were similar across both groups. **Conclusion:** Calcified TDHs are associated with greater surgical complexity and risk. However, with appropriate planning, long-term outcomes match those of soft discs. Disc morphology should inform intraoperative strategy but does not necessarily predict prognosis.

ID: AGS26/356
P0490: Intradural lumbar disc herniation: a case report and literature review

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Introduction: Clinically, most lumbar herniated nucleus pulposi are located epidurally, outside or under the posterior longitudinal ligament. Lumbar disc herniation into the dural space is a very rare phenomenon of degenerative lumbar lesions, accounts for only 0.04-0.33% of all lumbar disc herniations. **Material and Methods:** The pathogenesis and natural course of intradural disc herniation remain unclear. In this case study, we describe a patient with intradural disc herniation and review the literature to explore its potential pathogenesis, natural course, diagnosis, and treatment. **Results:** We describe a rare case of intradural lumbar disc herniation. A 68-year-old man presented with progressive lower back pain and radiating pain and numbness in both legs for 3 years. Magnetic resonance imaging revealed a large herniated disc at L4-L5. Posterior discectomy and fusion of the L4-L5 was performed after conservative treatment failed. Intraoperatively, only minimal disc fragments in the epidural space were found after meticulous probing following laminectomy of the L4-L5 vertebrae. The dorsal dura mater was saturated, tense, and bulged at the L4-L5 levels; additionally, an intradural mass was palpable and confirmed by intraoperative ultrasonography. Subsequently, dorsal middle durotomy was performed. Upon opening the dural sac, a large cauliflower-like mass similar to nucleus pulposus tissue was

found near the arachnoid membrane. The mass was dissociative and could be completely resected. The dorsal dural incisions were closed after careful exploration, followed by fixation and fusion of the L4-L5 levels. Pathological examination revealed disc tissue with central balloon-type cystic degenerative changes. The patient's lower back pain and radiating pain and numbness of both legs improved remarkably postoperatively, and he became asymptomatic at 3 months postoperatively. **Conclusion:** The pathogenesis and natural course of intradural disc herniation is still unclear. Several hypotheses have been used to explain it, including the "acute pressure" hypothesis, the "chronic compression" hypothesis and the "adhesions" hypothesis. In terms of the preoperative diagnosis of IDDH, the clinical manifestation of patients and preoperative imaging including radiographs and computed tomography often lack specificity. Intradural lumbar disc herniation should be highly suspected when intraoperative findings are incompatible with findings from the preoperative imaging examination, and it could be further confirmed via intraoperative ultrasonography and pathological examination of the resected tissue from the dural space. Prompt surgery is recommended, and surgical results are usually favorable.

ID: AGS26/572
P0491: A systematic review of the natural history of degenerative thoracic myelopathy

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Introduction: Degenerative thoracic myelopathy (DTM), a recently proposed term, encompasses a spectrum of degenerative spine conditions that cause thoracic spinal cord compression and progressive neurological dysfunction. The natural history of DTM is poorly characterised, hindering prompt diagnosis and management of this debilitating condition. This systematic review aimed to assess the initial symptoms, progression, and prognostic factors to aid clinicians to manage DTM. Studying DTM as a unified condition provides a larger body of evidence to draw conclusions from, analogous to progress achieved following the use of the term Degenerative Cervical Myelopathy. **Material and Methods:** A systematic literature search was performed in Embase and MEDLINE up to 15th December 2023 to identify papers assessing DTM, with relevant outcomes including initial symptoms, symptom progression over time, duration of disease and risk factors for progression. This review followed PRISMA guidelines, and risk of bias assessment was completed for each included study. **Results:** Sixteen studies met the inclusion criteria. Sensory disturbances were more common than motor symptoms in the early stages of DTM, with all 8 studies reporting initial symptoms finding that numbness, tingling or pain were most common. Gait disturbances and motor symptoms such as weakness were also commonly reported, although this tended to be later in disease progression. The prevalence of both sensory and motor disturbances increased over time. Symptom progression was highly variable in both severity and pace, with a mean duration from symptom onset to surgery of 25.5 months. Risk factors for progression include the underlying aetiology, age and the presence of T2 hyperintensity on spinal MRI. **Conclusion:** Despite a paucity of literature on the natural history of DTM, this review identifies several patterns which provide actionable guidance for clinicians. Recognising common early symptoms may reduce diagnostic delay, prognostic features can inform risk-stratified surveillance and understanding progression may inform treatment thresholds. Importantly, diagnostic delay is associated with poorer postoperative outcomes in DTM, highlighting the need for improved awareness of this under-recognised condition.

ID: AGS26/1317
P0493: Analysis of risk factors of intervertebral discs adjacent to thoracolumbar junction fractures treated by posterior fixation

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Introduction: Fractures of the thoracolumbar junction are among the most common spinal injuries. Posterior fixation is the gold standard treatment. However, the disc above or below a spinal fixation appears to be exposed to accelerated degeneration. Identifying risk factors is essential for surgical indication and long-term follow-up. The objective of our work is to determine the predictive factors of adjacent segment degeneration after treatment of thoracolumbar junction fractures. **Material and Methods:** This retrospective study included 120 patients surgically treated for thoracolumbar spine fractures between January 2010 and January 2020. The fractures were classified according to the Magerl classification. The intervertebral disc degeneration (IDD) was studied before surgery and at the last follow-up according to the UCLA classification. All patients underwent posterior fixation. At the final radiological follow-up, patients were divided into two groups: Group A: patients without IDD (n = 88). Group B: patients with IDD (n = 32). The following factors were analyzed: age, sex, body mass index (obesity), diabetes, tobacco use, neurological deficit, vertebral level (T12 or L1), posterior wall involvement, intra-canal fragment, pedicular fracture, articular fracture, fracture-dislocation, AO classification (types A2, A3, B, C), fixation

type (short, long, mixed), laminectomy, grafting, nonunion, material failure, infection, and hardware removal. Odds ratios (OR) with 95% confidence intervals (CI) were calculated, with $p < 0.05$ considered significant. **Results:** Our series included 120 patients with a mean age of 48.39 years. The sex ratio was 1.6. The body mass index (BMI) was 28 kg/m2 with extremes of 20.7 kg/m2 and 38.21 kg/m2. According to the Magerl classification, type A3 was the most frequent. 54.2% of the patients had a long fixation. 33 of our patients had a mixed fixation. The short fixation was used with 22 patients. The average follow-up was 57 months. IDD (UCLA 3 or 4) were observed in 32 patients (26.7%). The predictive factors for IDD were: age over 60 years (OR = 33.36, CI [11.04-100.78], $p < 0.001$), male sex (OR = 3.24, CI [1.40-7.51], $p = 0.05$), diabetes (OR = 2.97, CI [1.74-5.04], $p = 0.001$), obesity (OR = 4.17, CI [1.06-16.40], $p = 0.01$), short-segment fixation (OR = 3.00, CI [1.77-5.13], $p < 0.001$), and nonunion (OR = 4.10, CI [2.97-5.66], $p = 0.005$). Furthermore, long-segment assembly is a protector factors for IDD ($p = 0.02$, OR= 2.47, CI [1.07-5.70]. However, other parameters, including vertebral level, posterior wall involvement, intra-canal fragment, pedicular fracture, articular fracture, AO classification, mixed segment assembly, laminectomy, grafting, infection, material failure, and hardware removal, did not reach statistical significance. **Conclusion:** Advanced age, male sex, diabetes, obesity, nonunion, and short-segment fixation were identified as significant risk factors for degenerative changes after posterior fixation for surgical treatment of thoracolumbar junction fractures. Short-segment fixation was strongly associated with higher rates of IDD, while long fixation appeared to have a protective effect. These findings emphasize the need for individualized surgical strategies and careful long-term follow-up in patients with high-risk profiles.

ID: AGS26/1629
P0494: Cervical disc disease as a novel etiology of dropped head syndrome: targeted ACDF as a less invasive alternative to long-segment fusion

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Introduction: Dropped Head Syndrome (DHS) is an uncommon but highly disabling condition characterized by cervical kyphosis and inability to maintain horizontal gaze. The disorder has traditionally been attributed to neuromuscular causes such as myopathy or motor neuron disease, and surgical correction usually requires long-segment cervicothoracic fusion. While this approach can restore alignment, it carries substantial morbidity, loss of mobility, and non-negligible failure rates, with cervical-only procedures historically considered unreliable. To date, cervical disc disease has not been recognized as a primary etiology of DHS. We present what we believe to be the first case series establishing disc pathology as a distinct, surgically correctable cause of DHS, and we demonstrate that targeted anterior cervical discectomy and fusion (ACDF) can provide durable symptom relief without extensive constructs. **Material and Methods:** Four consecutive patients (3 males, 1 female; mean age 66.3 ± 5.2 years) presenting with DHS and severe forward gaze impairment were prospectively evaluated. All complained of intractable cervical pain (VAS ≥ 80 mm) and exhibited temporary improvement in alignment after diagnostic cervical disc block, confirming discogenic origin. Exclusion criteria included neuromuscular disease, widespread muscle atrophy on MRI, or significant cervical myelopathy. Patients underwent one- or two-level ACDF tailored to the symptomatic segment. Primary endpoints were pain reduction and maintenance of horizontal gaze. Secondary outcomes included operative time, hospital stay, perioperative complications, and radiographic bone fusion assessed by CT at one year. Clinical follow-up extended to a mean of 38.5 months (range 36-42). **Results:** All four patients experienced dramatic improvement in pain, with mean VAS decreasing from 92.5 ± 9.6 mm to 7.5 ± 5.0 mm (91.9% reduction, $p < 0.001$), surpassing established MCID thresholds. Horizontal gaze was restored in every case and maintained throughout follow-up. Mean operative time was 114 minutes (range 62-143), and hospital stay averaged 7.3 days. No intraoperative or perioperative complications occurred. At one year, CT scans confirmed 100% fusion. Importantly, none required revision surgery or subsequent extension to cervicothoracic fusion. This contrasts sharply with previously reported high failure rates of cervical-only approaches for DHS, which in some series exceed 60-70%. **Conclusion:** This case series highlights cervical disc disease as a previously underrecognized etiology of DHS and introduces a targeted, less invasive treatment strategy. Disc blockade proved valuable in identifying discogenic DHS, serving both as a diagnostic and predictive tool for surgical success. Unlike neuromuscular etiologies, which demand extensive mechanical support or rehabilitation, disc-related DHS responds to focused pain relief via ACDF. Our findings suggest that in patients with severe axial pain, a positive response to a diagnostic block, and the absence of diffuse muscle atrophy, limited ACDF can replace traditional long-segment fusion, preserving mobility and minimizing morbidity. While the small sample size warrants cautious interpretation, these results provide a strong rationale for larger, multicenter studies that stratify DHS by etiology. Ultimately, recognition of disc-related DHS could significantly expand treatment algorithms, offering surgeons a new, evidence-based pathway for carefully selected patients.

ID: AGS26/2568
P0496: Clinical-functional outcomes of patients with lumbar disc herniation when comparing different modalities of surgical treatment performed in a tertiary hospital in Mexico

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Introduction: Herniated discs (HD) occur more frequently in the lumbar spine, because it is the segment with the greatest mobility and is subjected to the highest axial load, with the L5-S1 segment accounting for 43%, followed by L4-L5 at 37%. They represent 85% of the causes of sciatica. In Mexico, the prevalence is 21.11%. It is a pathology that mainly affects the population aged 30 to 50 years, with a ratio of 2:1 in males. There are different treatment modalities, both conservative and surgical. Surgical indications for lumbar disc herniation (LDH) are carried out when there is the presence of cauda equina syndrome, progressive motor neurological deficit, following a period of 6 to 8 weeks of conservative treatment without improvement. **Objective:** To analyze the clinical-functional results of patients with lumbar disc herniation (LDH) by comparing the surgical treatment modalities performed at high specialty medical unit, trauma and orthopedics, Manuel Avila Camacho, spine surgery department in Puebla, Puebla Mexico. **Material and Methods:** A quasi-experimental study was conducted on patients with a diagnosis of LDH confirmed by MRI, at a single level herniated disc, aged 20 to 75 years, who attended outpatient follow-up consultations of the spine department from March 1 to July 31, 2024. Pain will be analyzed using the Visual Analog Scale (VAS) and functionality with the Oswestry Disability Index (ODI), before, one month, and two months after surgery, and only for VAS 24 hours from the surgery. The statistical analysis will involve the determination of means, standard deviation of the mean, as well as the Wilcoxon test as a hypothesis-testing method. The value considered statistically significant will be $p < 0.05$. **Results:** 56 patients, 62.5% male and 37.5% female, average age of 51.1 years. 53.6% with hernia at L5S1 and 5.7% at L4L5. Treated with T-LIF in 69.6% and Discectomy (DCM) in 30.4%. Complications in 7.1%. At one month, DCM with axial and lower limb pain VAS of 2, and ODI 20 vs. TLIF (Transforaminal Lumbar Interbody Fusion) of 2 for axial pain and 1 for lower limbs, and ODI 20. At two months, DCM with axial and lower limb pain VAS of 2 and ODI 15 vs. TLIF of 2 for axial pain and 1 for lower limbs, and ODI 17 with no significant difference. **Conclusion:** There are significant differences in the improvement outcomes of pain and function before and after surgical treatment when comparing both surgical modalities, but there are no significant clinical-functional differences measured by means of axial VAS, lower limbs, and ODI in postoperative patients with discectomy vs TLIF for patients with lumbar disc herniation.

Key words: Intervertebral Disc Protrusion; Intervertebral disc displacement; Discectomy; Laminectomy; Orthopedic procedures; Outcome assessment.

ID: AGS26/2879
P0497: Microbiology of lumbar disc herniations in the absence of underlying degenerative disease

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Introduction: When the contents of the nucleus pulposus are exposed to the host immune system during intervertebral disc degeneration autoimmune reactions have been observed, suggesting that the nucleus pulposus is an immune privileged site. Therefore, it is hypothesized that occult infection of the intervertebral disc may contribute to the pathophysiology of symptomatic disc herniations. Occult infections of the disc space have been previously studied in patients with significant degenerative spondylosis, however assessment for occult infections in acutely herniated discs in young patients in the absence of a background of degenerative disc disease represents a knowledge gap and the focus of this study. **Material and Methods:** In this single center prospective case series patients were eligible for inclusion if they were age 18-40 years, presenting with an acute/subacute operative lumbar disc herniation in the absence of moderate to severe degenerative changes to the lumbar spine as noted on MRI. At the time of surgery cultures swabs were sterilely collected and sent for gram stain and aerobic/anaerobic culture analysis. **Results:** There patients met study inclusion criteria. Gram stain resulted negative in all three cases. No patient had documented systemic antibiotic use within 6 months of surgical intervention. All patients experienced clinical improvement following surgery. A 31-year-old male presenting with radiculopathy and a left L5-S1 central/subarticular disc herniation final cultures came back negative. A 31-year-old female presenting with radiculopathy and a left subarticular disc herniation at L4/L5 had final aerobic cultures with scant growth of staphylococcus capitis. A 32-year-old female presenting with cauda equina from a large central L5-S1 disc herniation had final aerobic cultures with scant growth of Corynebacterium species and staphylococcus aureus. **Conclusion:** Multiple studies have documented that when swabbed and sent for microbiological analysis and culture, patients with significant degenerative disc disease grow organisms of low virulence

suggesting indolent infection. This report is the first to document that these indolent infections may be present prior to significant disc degeneration, and may contribute to the inflammatory cascade that ultimately leads to degenerative lumbar disc disease.

ID: AGS26/2896
P0498: Heavy metal exposure induces ROS, senescence and inflammation in the disc resulting in allodynia

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Introduction: The heavy metal tungsten has been increasing in demand for use in manufacturing and recently, medical devices, as it imparts flexibility, strength, and conductance of metal alloys. Given the surge in tungsten use, our population may be subjected to elevated exposures. We recently determined that when mice are exposed to tungsten [15 ppm] in their drinking water, it bioaccumulates in the intervertebral disc (IVD) and vertebrae tissues leading to disc degeneration, fibrosis and increases in markers on inflammation and pain. This study was performed to determine the mechanism and physiological effects following tungsten exposure in the IVD. **Material and Methods:** Bovine nucleus pulposus (hNP) were cultured in medium supplemented with tungsten in the form of sodium tungstate [0, 1, 5 and 15 ug/mL] or H_2O_2 [100 μm]. QPCR was performed to measure changes in the expression of matrix, inflammatory and pain markers. Assessment of oxidative stress was performed using H2DCFDA to measure ROS cellular levels. DNA damage was measured using γH2AX fluorescence. Cellular senescence was determined by measuring changes in β-galactosidase activity. IHC for MOMA staining was performed IVDs from C57BL/6 mice on water supplemented with 15 ppm tungsten for 4 weeks. Von Frey performed on mice following 6 months of tungsten exposure. **Results:** Tungsten and H_2O_2 significantly increased the expression of *IL1B*, *TNFA*, *NGF* and *COLII* in NP cells ($p < 0.01$, $n = 4$). On the contrary, the matrix protein aggrecan (*ACAN*) was downregulated suggesting a degenerative phenotype ($p < 0.01$, $n = 4$). Oxidative stress was found to be increased in a dose-dependent manner in NP cells ($p < 0.05$; $n = 4$). Interestingly, there were no changes in DNA damage; however, we did observe an induction of cellular senescence following tungsten exposure. Tungsten significantly increased the infiltration of macrophages at lumbar IVD sites ($p < 0.05$, $n = 4$). Mice exposed to tungsten for 6 months in their drinking water showed significant changes in mechanical allodynia ($p < 0.05$, $n = 5$). **Conclusion:** We provide evidence that chronic tungsten exposure induces disc degeneration and pain behaviour in mice and may play a role in disc degeneration disease.

ID: AGS26/3022
P0499: Anterior lumbar interbody fusion (ALIF) for recurrent lumbar disc herniation or post-discectomy degeneration: a single-center retrospective study

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Introduction: Lumbar microdiscectomy is the standard treatment for disc herniation, but recurrence and post-discectomy disc degeneration remain common clinical challenges. Anterior lumbar interbody fusion (ALIF) has been proposed as an alternative surgical strategy in these cases, but comparative evidence remains limited. The aim of this study was to evaluate the safety and efficacy of ALIF in patients previously operated on with microdiscectomy who later developed recurrent herniation or associated disc degeneration. **Materials and Methods:** We retrospectively analyzed 108 patients treated with ALIF at our institution between January 2017 and April 2025. Evaluated parameters included intra- and perioperative complications, length of hospital stay, clinical outcomes (VAS, ODI, RMDQ), radiological parameters (pelvic indices, lumbar lordosis, disc height) before and after surgery, fusion rate, recurrence rate, patient satisfaction, and return to work at 6 months. Results were compared with literature data on patients undergoing repeat microdiscectomy for recurrence. **Results:** ALIF demonstrated significant clinical improvements in terms of VAS, ODI, and RMDQ scores, along with radiological improvements in lumbar lordosis and disc height. The fusion rate was high, with low recurrence and complication rates. Compared with the literature on re-microdiscectomy, ALIF showed no increase in morbidity and a reduced risk of re-recurrence, while maintaining favorable patient-reported satisfaction and return-to-work rates at 6 months. **Conclusions:** ALIF represents a safe and effective surgical option for patients with recurrent lumbar disc herniation or post-discectomy degeneration, offering significant clinical and radiological benefits without increasing morbidity compared to repeat microdiscectomy.

ID: AGS26/3034
P0500: Intervertebral disc degeneration: a risk factor for metastatic vertebral fractures

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Introduction: Vertebral metastases have become a major concern for the healthcare system over the past decade. They compromise vertebral microstructure, reducing load-bearing capacity and increasing the risk of fracture. Among the biomechanical parameters used to stratify metastatic patients and assess the vertebral risk of fracture [1], intervertebral disc (IVD) conditions are overlooked. However, evidence suggests that age-related degeneration alters IVD mechanical properties and load-sharing function, and may significantly influence the mechanical behaviour of the adjacent vertebrae [2,3]. This study aimed to assess whether IVD degeneration affects the failure mode of metastatic vertebrae. **Material and Methods:** Thirteen thoracic spinal segments, with one lytic and one radiologically healthy vertebra, were harvested from human metastatic donors (Prot.113043). 1.5T MRI scans (T2-weighted sequence) were acquired to characterise the IVDs' degeneration level [4]. Five specimens were injected in the Nucleus Pulposus (NP) of the central IVD with a solution of Collagenase type II (GibcoTM, 125 U/mg) and Phosphate-Buffered-Solution [2mg/ml] [3] to induce a severe artificial degeneration. *In situ* mechanical tests were performed in a custom jig placed within a μCT scanner (VivaCT80, Scanco). Each specimen was μCT scanned twice: unloaded and at failure. Compressive deformations were measured in healthy and metastatic vertebrae through Digital Volume Correlation (BoneDVC) [5]. The failure location was identified by examining the deformation maps and overlaying the microCT scans acquired in unloaded condition and after failure. Results from the non-degenerated specimens were compared with the degenerated specimens. **Results:** Compressive strains in the non-degenerated specimens reached -8557 με in lytic vertebrae and -3560 με in control vertebrae, whereas in degenerated specimens they were -8927 με and -8716 με, respectively. The non-degenerated specimens failed at or near the vertebral endplates; in particular, the collapse usually occurred between the endplate and metastatic lesions. The degenerated specimens, instead, failed at mid-height of the metastatic and/or control vertebral body; failure involved both trabecular and cortical bone, while the endplates remained intact. **Conclusion:** IVD degeneration was found to be a key factor in determining the failure mode and location not only of metastatic vertebrae, but also of healthy ones. In non-degenerated specimens, the NP bears the majority of the load, resulting in endplate collapse and damage of the underlying trabecular bone[5]. Conversely, in degenerated IVDs, the load is shifted from the NP towards the Annulus Fibrosus (AF), increasing the load transferred to the cortical shell of adjacent vertebrae. This altered load distribution leads to cortical shell failure at the mid-height of the vertebral body, resulting in transverse fractures. Therefore, if the metastatic lesions are confined to the trabecular region, IVD degeneration may act as a protective factor for the cortical bone shell, whereas if the lesion involves the cortical shell, failure is more likely to occur. These results highlight the clinical relevance of introducing MRI-based IVD degeneration assessment in the clinical routine to improve vertebral fracture risk evaluation and metastatic patient stratification.

References

1. Fisher et al. Spine 2010.
2. Pasini et al. JMBBM 2025.
3. Cavazzoni et al. Acta Biomaterialia 2025.
4. Pfirrmann et al. Spine 2001.
5. Palanca et al. Bone 2023.

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ID: AGS26/3234
P0501: Thoracic disc herniations: a series of 25 cases

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Introduction: Thoracic disc herniations are rare, with an estimated annual incidence of 1 per 1,000,000 inhabitants. Clinical presentation is often non-specific, making systematic assessment of sublesional syndromes essential. MRI is the key diagnostic tool, complemented by electrophysiological studies to evaluate functional impact. Surgical treatment is generally indicated for symptomatic cases. **Material and Methods:** We retrospectively reviewed 25 patients (15 males, 10 females; mean age 51 years, range 21-73) who underwent surgery for thoracic disc herniation. Clinical presentation, imaging, surgical approach, complications, and postoperative outcomes were analyzed. The diagnostic delay ranged from 3 weeks to 8 years (mean 15 months). Six patients had a history of spinal trauma. **Results:** Presenting symptoms included pain (72%), motor or bladder dysfunction (52%), and sensory disturbances (52%). Neurological examination revealed pyramidal signs in all patients, paraparesis in 72%, and sensory deficits in 52%. Standard radiographs were positive in 10 patients, with calcifications in 3 and Scheuermann disease in 4. CT was positive in 17 patients. MRI localized herniations mainly at D10-D11

and D11-D12 levels. Eleven patients underwent preoperative arteriography. Surgical approaches included posterior (n = 9), posterolateral transpedicular (n = 4), lateral costotransversectomy (n = 6), and anterolateral thoracotomy (n = 6). One patient required reoperation due to wrong level identification. Postoperatively, no immediate surgical complications occurred. At follow-up (11 months-6 years), 40% of patients reported persistent sensory symptoms (paresthesia/electric shocks), and 28% experienced resolution of bladder dysfunction. **Conclusion:** Thoracic disc herniation is a rare but potentially debilitating condition. MRI remains the diagnostic gold standard, and individualized surgical approaches provide good decompression and neurological improvement. Long-term follow-up is essential due to residual sensory deficits and variable recovery of bladder function.

ID: AGS26/3250
P0502: Cauda equina syndrome on disc herniation: about our experience and review of the literature

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Introduction: Cauda equina syndrome is the clinical manifestation of compression of the conus medullaris. Herniated discs are the predominant cause. The severity of the sequelae of this relatively rare spinal condition encourages the development of a better understanding aimed at codifying the management of this condition, which remains a subject of controversy. **Material and Methods:** This is a retrospective study including seven cases treated in our department between May 2003 and September 2018 involving disc herniation associated with bladder-sphincteric disorders. **Results:** Our series includes six women and one man. The average age is 47, ranging from 29 to 62. All patients presented with symptoms of spinal syndrome with unilateral or bilateral polyradiculopathy in four cases and three cases, respectively. The bladder-sphincteric disorders were incontinence, urinary retention with overflow leakage, and sexual dysfunction. Four patients had saddle anesthesia and loss of anal reflex, but none of the patients had a gaping anus on admission. All patients had associated motor and/or sensory deficits. Radiological examination was performed by lumbar spine X-ray for all seven patients, MRI for five, and CT scan for the other two patients. The time to surgery was six hours for one patient, 12 hours for another, and more than 48 hours for the rest. In terms of treatment, three patients underwent laminectomy, discectomy, and PLIF, one patient underwent laminectomy, dissection, and TLIF. Two patients underwent laminectomy with discectomy without instrumentation, and the last patient underwent recalibration with posterior instrumented arthrodesis. The complications that occurred were a dura mater breach in one case and an infection at the surgical site in another. At a mean follow-up of 57 months, three patients had made a full recovery, while two patients had persistent perineal paresthesia with sensory-motor recovery. Two patients are still recovering (short follow-up). **Conclusion:** The lack of consensus in terms of definition and treatment makes cauda equina syndrome a real challenge for any practitioner treating spinal disorders.

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P0504: Posterior decompression alone in giant thoracic disc herniation: a case report and review of surgical controversies

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Introduction: Thoracic disc herniations (TDHs) are rare, accounting for only 0.25-1.8% of all herniated disc cases, with an estimated incidence of 1 per 1,000,000 individuals. A subset, known as giant thoracic disc herniations (GTDHs), involves compression of more than 40% of the anteroposterior diameter of the spinal canal. These lesions may result in myelopathy or radiculopathy, often necessitating surgical intervention. However, there is no consensus regarding the optimal surgical approach, with entire resection osteotomy vs posterior decompression alone. **Material and Methods:** We present the case of a 41-year-old male who developed progressive thoracic myelopathy secondary to a massive GTDH. MRI and CT imaging confirmed a large, calcified disc herniation at the thoracic level, significantly compressing the spinal cord. Given the patient's clinical status and surgical risk profile, a posterior decompression alone was performed, avoiding the need for complete calcified disc resection with interesting results. We made a review of the available evidence to summarize recommendations to determine surgical options for these cases. **Results:** The patient showed significant neurological improvement after surgery, with sustained neurological recovery in follow-up. There were no major complications, and imaging confirmed adequate decompression of the spinal cord. The clinical outcome suggests that decompression without full resection may suffice in select cases, particularly when the disc is calcified or adherent to the dura. Posterior decompression alone may offer a safer and effective alternative in selected patients, especially those with comorbidities, older age, or surgically challenging disc anatomy. The case also underscores the importance of individualized surgical planning and highlights key areas of controversy in GTDH management. **Conclusion:** Posterior decompression alone may be a viable treatment option for select patients with GTDH, challenging the traditional paradigm of complete disc removal. Further studies are

warranted to better define criteria for patient selection and to compare outcomes across different surgical approaches.

ID: AGS26/3291
P0505: Surgical techniques and outcomes in giant calcified thoracic disc herniation: a scoping review

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Introduction: Massive calcified thoracic disc herniations (MCTDH) are a rare yet clinically significant pathology, often leading to spinal cord compression and myelopathy. Surgical management is considered the primary treatment in symptomatic cases; however, the presence of dense calcification and complex anatomy poses significant technical challenges with no clear management consensus. The objective of this scoping review is to understand the extent and type of evidence regarding the surgical techniques used for the management of massive calcified thoracic disc herniations, with a particular focus on bleeding, surgical time, dural tears, intra and postoperative complications and neurological outcomes and functional recovery. **Material and Methods:** This scoping review was conducted following the Joanna Briggs Institute (JBI) methodology. A systematic literature search was performed in Medline, Embase, Central, and LILACS. The search will include publications from 2010 to 2025 and be limited to articles in English and Spanish. This review included studies involving adult patients diagnosed with giant or massive calcified thoracic disc herniations treated surgically. Studies reported on the surgical approach, decision making and associated clinical outcomes, particularly neurological complications. All analytical and descriptive observational studies with more than 10 patients, as well as systematic reviews, were considered. Single case reports, qualitative studies, and expert opinion articles were excluded. **Results:** A total of 4,300 articles were initially identified through the database and grey literature search. After title and abstract screening, followed by full-text review and eligibility assessment, 18 studies met the inclusion criteria. Across these studies, surgical intervention remains the primary treatment for symptomatic giant calcified thoracic disc herniation (GTDH), particularly in the presence of neurological deficits. However, the unique anatomical features of the thoracic spine, including its narrow spinal canal, complex vascular anatomy, and proximity to vital thoracic structures, make surgical management significantly more challenging than in the lumbar region. Multiple surgical approaches have been reported, ranging from traditional anterior thoracotomy and posterolateral costotransversectomy to more recent minimally invasive techniques. These include the use of high-speed drills, ultrasonic aspiration devices, and other advanced surgical tools to reduce morbidity. A recurring theme in the literature is the ongoing debate regarding the necessity of complete disc resection, especially in calcified herniations. Historically, total excision was considered the gold standard, particularly for large, central lesions. However, several recent studies have investigated posterior decompression alone as a potentially safer and equally effective alternative in select cases-particularly in older patients, those with significant comorbidities, or when the herniated disc is densely adherent to the dura mater. Notably, these studies report comparable neurological outcomes between complete resection and decompression-only strategies in carefully selected patients. **Conclusion:** Surgical management of giant calcified thoracic disc herniation remains complex, with no clear consensus on the optimal approach. While complete resection is traditionally favored, recent evidence supports posterior decompression alone as a safe and effective option in selected patients. Further studies are needed to guide surgical decision-making and standardize treatment strategies.

ID: AGS26/3333
P0512: Recurrence of operated lumbar disc herniations: a study of risk factors

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Introduction: Lumbar disc herniation is the most common degenerative condition of the spine. Lumbar discectomy is the surgical procedure that ensures radicular decompression after the failure of a well-conducted conservative treatment. However, this surgical procedure carries the risk of hernia recurrence. These recurrences are influenced by certain factors. Therefore, the aim of our study was to identify the risk factors for recurrent lumbar disc herniation after surgery. **Material and Methods:** We conducted a retrospective study on patients who underwent lumbar discectomy for lumbar disc herniation at the Department of Neurosurgery of the Main Military Instruction Hospital in Tunis between 2013 and 2021. Our study included 180 patients divided into two groups: the first group comprised 90 patients who underwent surgery for lumbar disc herniation without recurrence, and the second group included 90 patients who underwent surgery for lumbar disc herniation and were subsequently reoperated due to recurrence. **Results:** The prevalence of recurrences of operated lumbar disc herniation in our study was 21.4%. The risk factors identified in our work included prolonged standing occupation ($p = 0.003$), belonging to the military population ($p = 0.002$), the type of herniation: subligamentous ($p = 0.04$), Pfirmann stage III ($p = 0.012$), MODIC type I changes ($p < 10\text{-}^{3}$), partial discectomy ($p < 10\text{-}^{3}$), and the absence of postoperative rehabilitation ($p < 10\text{-}^{3}$). Among these factors, we

identified independent factors correlated with a higher rate of hernia recurrence. In this study, partial discectomy ($p = 0.001$; OR = 0.123) and the absence of postoperative rehabilitation ($p = 0.002$; OR = 56.5) were independent risk factors for the recurrence of operated lumbar disc herniation. **Conclusion:** It is essential to identify the risk factors for recurrent lumbar disc herniations. This in-depth study has enabled the establishment of recommendations regarding surgery for lumbar disc herniations, as well as the determination of specific criteria for surgical indications and techniques, with the aim of preventing recurrences.

ID: AGS26/3337

P0513: Recurrent lumbar disc herniation in the Tunisian population: surgical outcomes and risk of spinal instability (2000-2025)

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Introduction: Recurrent lumbar disc herniation (rLDH) remains a common cause of persistent pain and disability following lumbar discectomy, with recurrence rates ranging from 5% to 15%. The optimal surgical strategy remains debated, particularly regarding the prevention of postoperative instability. This study aimed to assess surgical outcomes and the risk of spinal instability in Tunisian patients operated for rLDH. **Material and Methods:** We retrospectively reviewed 124 patients operated for rLDH between 2000 and 2025 at the Mohamed Taieb Kassab Institute. Inclusion required MRI-confirmed recurrence at the same level and side, after $\geq$ 6 months symptom-free. Patients underwent either revision microdiscectomy (74%) or discectomy with fusion (26%). Clinical outcomes were assessed using VAS and ODI scores. Postoperative stability was evaluated radiologically. Mean follow-up: 42 months. **Results:** The cohort included 64% males, mean age 46 years. At last follow-up, 78% of patients achieved good/excellent outcomes, with mean ODI improvement from 58% to 24% ($p < 0.001$) and VAS reduction of 5.6 points. Complications occurred in 11% of cases (dural tears, superficial infection). Postoperative instability developed in 14% of patients after revision discectomy versus 6% after fusion. Re-recurrence occurred in 8% of cases, predominantly after discectomy alone. **Conclusion:** This 25-year experience demonstrates that surgery for rLDH provides significant functional improvement in Tunisian patients. However, the risk of spinal instability is not negligible after isolated revision discectomy. Fusion procedures, although more invasive, reduced instability and re-recurrence in selected patients. Individualized surgical strategy remains essential to optimize long-term outcomes.

ID: AGS26/3358

P0514: A systematic review of the spectrum of magnetic resonance imaging features of degenerative thoracic myelopathy: a global perspective

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Introduction: Degenerative thoracic myelopathy (DTM) is an umbrella term encompassing a range of degenerative pathologies leading to symptomatic compression of the thoracic spinal cord. Diagnosis is achieved through clinical history, examination, and magnetic resonance imaging (MRI). A comprehensive review of the pathological findings seen on MRI and their clinical significance is currently lacking in DTM. The objective was therefore to synthesise current evidence on MRI features of DTM. **Materials and Methods:** A systematic review was registered on PROSPERO (CRD42024518673) and performed adhering to PRISMA guidelines. MEDLINE and Embase were searched from conception to February 2025. Screening, data extraction and risk of bias assessments were performed in duplicate. Studies reporting on MRI imaging for adult patients with degenerative thoracic myelopathy met inclusion criteria. A qualitative synthesis of the literature was conducted, following the Synthesis Without Meta-Analysis (SWiM) reporting guidelines. **Results:** Of 7937 screening records, 59 papers satisfied inclusion criteria, including one cross-sectional and 58 cohort studies. A total of 2940 patients were included. DTM was most commonly localised to the lower thoracic spine (62.5%, 880/1409), with the remaining cases split evenly between the upper (18.2%, 256/1409) and middle regions (19.4%, 273/1409). Ossification of the ligamentum flavum (OLF) was the most common pathology (71.4%, 2065/2893), followed by ossification of the posterior longitudinal ligament (OPLL) (19.7%, 569/2893) and disc herniation (20.1%, 582/2893). Measurements of spinal canal compromise were described in 55.5% of patients (1631/2940) and hyperintensity of the spinal cord was reported in 30.0% (881/2940). High grade spinal cord hyperintensity, spinal canal compromise, OLF, OPLL and multilevel disease were all predictive of greater severity of myelopathy and poorer functional recovery. **Conclusion:** In the published literature, ligamentous pathologies are significantly more prevalent than disc related pathologies in DTM. DTM is most common in the lower thoracic spine. T2 signal change and the extent of spinal canal compromise correlate with clinical

outcomes. Standardisation of the terminology used to describe imaging features, in addition to a more consistent approach to study design may help to improve future research.

Epidemiology

ID: AGS26/26
P0515: Crosstalk between osteoporosis and fat-infiltrated psoas at the upper lumbar levels

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Introduction: Osteoporosis is a chronic metabolic bone disease characterized by reduced bone mass, microarchitectural deterioration, and an increased risk of fractures. Alongside osteoporosis, sarcopenia, the age-related decline in skeletal muscle mass and strength, is commonly observed in the elderly, especially among women. Prior studies have linked vertebral compression fractures with impaired spinal mobility, muscle atrophy, fatty degeneration of paraspinal muscles, and balance deficits. However, the relationship between osteoporosis in the absence of vertebral fractures and the condition of paraspinal muscles remains unclear. This study aimed to investigate whether osteoporosis is associated with fatty infiltration of the paraspinal muscles in patients experiencing chronic low back pain. **Material and Methods:** Age- and sex-matched patients with and without osteoporosis, all presenting with chronic low back pain, were retrospectively assessed using lumbar magnetic resonance imaging. Evaluations included the degree of intervertebral disc degeneration (IVDD), Modic changes, and fat infiltration in the multifidus, erector spinae, and psoas muscles at all lumbar levels. **Results:** No significant differences were found between osteoporotic and non-osteoporotic groups regarding the severity of IVDD or the presence of Modic changes. However, patients with lumbar spine osteoporosis exhibited significantly greater fatty infiltration in the psoas muscle at the L1-L2 (odds ratio [OR] = 6.191; $p = 0.015$), L2-L3 (OR = 3.205; $p = 0.028$), and L5-S1 (OR = 1.564; $p = 0.040$) levels. Additionally, those with femoral neck osteoporosis demonstrated greater fat infiltration in the psoas muscle specifically at L1-L2 (OR = 4.487; $p = 0.043$). **Conclusion:** Osteoporosis appears to be associated with increased fatty infiltration of the psoas muscle, particularly at the upper lumbar levels. Therefore, detailed evaluation of the psoas muscle should be considered in osteoporotic patients. Conversely, the presence of fat-infiltrated psoas muscles at upper lumbar levels may warrant clinical suspicion for underlying osteoporosis. Management strategies for osteoporosis should incorporate interventions aimed at enhancing the quality and strength of the psoas muscle to help prevent vertebral compression fractures.

ID: AGS26/477
P0517: Spinal injuries in athletes: an 18-year retrospective analysis at a university hospital

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Objective: To analyze the prevalence, segment distribution, and etiological diagnosis of spinal injuries in athletes treated over an 18-year period in a Sports Traumatology outpatient clinic. **Methods:** A retrospective review of 550 athlete medical records from 2006 to 2023 was performed. Inclusion criteria were regular sports practice and confirmed diagnosis of spinal pathology. Statistical analysis included Chi-Square and Two-Proportion Z-tests (significance $p < 0.05$). **Results:** Lumbar involvement was predominant (90.5%), followed by cervical (10.4%) and thoracic (1.6%). The most common diagnoses were lumbar disc disease (32%), spondylolisthesis (8.2%), and scoliosis (4.2%). Notably, 25% of cases were managed conservatively without imaging. Males accounted for 54.9% of the sample. **Conclusion:** Spinal injuries are prevalent among athletes, with clear predominance of lumbar involvement. Clinical evaluation and conservative treatment were effective in many cases.
Keywords: Spine injuries; athletes; epidemiology; low back pain; conservative treatment.

ID: AGS26/727
P0519: Predictors of long-term patient satisfaction after lumbar spine surgery: a two-year prospective analysis

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Introduction: Rising rates of lumbar spine surgery have heightened focus on patient satisfaction as a key metric of surgical success. While studies have identified demographic factors affecting immediate outcomes, the impact of baseline characteristics on long-term satisfaction remains unclear. This study examines how initial patient presentation predicts satisfaction trajectories, aiming to enhance preoperative counseling and optimize outcomes. **Material and Methods:** A prospective multicenter database was queried for patients undergoing lumbar spine surgery at a tertiary care institution from 2013-2023. Patients presenting emergently or lacking two-year follow-up

satisfaction data were excluded. Satisfaction, assessed at 90 days, 1 year, and 2 years postoperatively, was dichotomized into "satisfied" (met expectations/improved, would repeat) and "not satisfied" (improved, but would not repeat/did not meet expectations). Baseline symptoms, prior interventions, medical history, education and employment plans were evaluated as predictors of satisfaction. T-tests and Chi-square tests were used for continuous and categorical variables respectively. Multivariable logistic regression was employed to identify predictors. **Results:** 1161 patients were included in final analysis. The cohort had a mean age of 60.4 ± 14.1 years, was predominantly white (92.6%) and male (56.0%), with 38.0% retired and 33.8% employed. Most patients presented with radicular symptoms (92.9%) and axial back pain (88.7%), and 42.5% had prior spine surgery. Satisfaction rates declined from 86.1% at 90 days to 82.0% at 2 years. Variables associated with satisfaction at 2yrs included: Education (post-college vs. high school: 66.0% vs. 47.0% at 2 years, $p < 0.001$), COPD status (no-COPD vs. COPD: 83.5% vs. 67.3%, $p < 0.001$), Smoking status (never vs. current: 84.8% vs. 79.4%, $p < 0.001$), Previous spine surgery (no previous vs. previous: 86.2% vs. 76.6%, $p < 0.001$). From 90d to 2yrs, satisfaction gaps widened over time for education (13.0% to 19.0%), COPD (13.0% to 16.2%), and previous surgery (6.1% to 9.6%), while remaining stable for smoking status (~5.4-6.5%). In multivariable logistic regression (n = 532 with complete data), independent predictors of greater satisfaction at 2 years included:

- Male gender (OR 1.75, 95% CI 1.06-2.87, p = .027).
- Lower BMI (OR 0.94 per unit increase, 95% CI 0.91-0.98, p = .001).
- Absence of COPD (OR 0.37, 95% CI 0.16-0.87, p = .023).
- No prior spine surgery (OR 0.48, 95% CI 0.30-0.77, p = .002).
- Being retired (vs unemployed) (OR 2.96, 95% CI 1.38-6.34, p = .005).
- Planning to return to work (OR 4.12, 95% CI 1.73-9.80, p = .001).

Other employment categories (disability, part-time, full-time) were not significant. Education was significant in earlier steps but did not remain in the final model after stepwise selection. **Conclusion:** While overall satisfaction remains above 80% at two years, specific patient factors-including sex, BMI, COPD, surgical history, and employment outlook-strongly predict long-term outcomes. The widening satisfaction gaps over time, particularly for education level (13.0% to 19.0%) and COPD status (13.0% to 16.2%), suggest these factors have compounding effects on outcomes. These findings identify key targets for intervention: tailored preoperative education, optimization of pulmonary function, and comprehensive counseling on smoking cessation, weight management, and return-to-work planning to improve patient satisfaction trajectories following lumbar spine surgery.

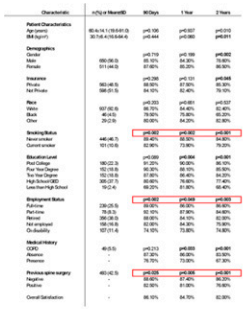


Table 1. Patient Demographics, Clinical Characteristics, and Satisfaction Trends (N=1,161)

*For Age at Y2: Significant difference between "Improved, would not repeat" and "Improved, would repeat" groups (p=0.012) *For BMI at Y2: Significant difference between "Met expectations" and "Did not meet expectations" groups (p=0.046)

Variable	OR	95% CI	p-value
Male gender	1.75	1.06 – 2.87	**0.027**
BMI (per unit increase)	0.94	0.91 – 0.98	**0.001**
COPD (yes vs no)	0.37	0.16 – 0.87	**0.023**
Previous spine surgery (yes vs no)	0.48	0.30 – 0.77	**0.002**
Employment status			
↳ Retired vs Unemployed	2.96	1.38 – 6.34	**0.005**
↳ On disability vs Unemployed	1.67	0.72 – 3.89	0.234
↳ Full-time vs Unemployed	1.39	0.59 – 3.27	0.456
↳ Part-time vs Unemployed	1.05	0.36 – 3.06	0.936
Plan to return to work			
↳ Yes vs No	4.12	1.73 – 9.80	**0.001**
↳ Unknown vs No	1.53	0.71 – 3.31	0.282

Table 2. Multivariable Predictors of 2-Year Satisfaction After Lumbar Spine Surgery (N=532)

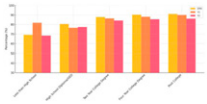


Image 1: Satisfaction over time stratified by education level at initial presentation

ID: AGS26/891
P0520: Different pathoanatomy of central stenosis in lumbar spondylolytic spondylolisthesis: an intersegmental stenosis

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Introduction: Spondylolytic spondylolisthesis (SS) has classically been described as a condition that primarily induces foraminal stenosis, while central stenosis has been regarded as a rare finding in standard textbooks. However, in clinical practice, central stenosis is frequently encountered in patients with SS and may significantly contribute to neurological symptoms. Despite this, the morphologic basis of central stenosis in SS has not been clearly characterized. This study aimed to investigate the incidence and contributing factors of central stenosis in SS and to elucidate its unique pathophysiology, distinct from degenerative spondylolisthesis. **Material and Methods:** We retrospectively analyzed

280 patients diagnosed with SS using T2-weighted mid-sagittal magnetic resonance imaging. Quantitative parameters included dural sac anterior-posterior diameter (DSAPD), disc height, anterior translation, pseudo-bulging of the disc, and ligamentum flavum hypertrophy. Central stenosis was graded as mild (7-10 mm), moderate (5-7 mm), or severe (< 5 mm) according to DSAPD. Correlations between each factor and the presence of central stenosis were statistically examined, and characteristic morphologic patterns were described. **Results:** Patients with central stenosis demonstrated significantly reduced disc height (5.19 mm vs. 7.67 mm, $p < 0.001$), greater anterior translation (6.92 mm vs. 4.35 mm, $p < 0.001$), more pronounced pseudo-bulging (6.25 mm vs. 5.51 mm, $p = 0.001$), and marked ligamentum flavum hypertrophy (8.03 mm vs. 4.16 mm, $p < 0.001$). In contrast to degenerative spondylolisthesis, where stenosis occurs mainly at the slipped level, SS revealed a distinct mechanism of "intersegmental stenosis," produced by the pseudo-bulging disc of the spondylolytic vertebra and the buckled, hypertrophied ligamentum flavum of the upper vertebra. **Conclusion:** Central stenosis in SS is strongly correlated with disc height loss, anterior translation, pseudo-disc bulging, and ligamentum flavum hypertrophy. The characteristic morphology is best described as intersegmental stenosis, representing a novel pathophysiologic concept distinct from degenerative disease. These findings underscore the importance of targeted imaging assessment and may influence surgical decision-making in this unique patient population.

ID: AGS26/1035
P0521: The impact of COVID-19 on spine surgery: temporal trends in complications and patient-reported outcomes across a statewide cohort

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Introduction: The COVID-19 pandemic caused major disruptions in elective surgical care, including spine surgery, due to widespread hospital restructuring and resource limitations. Although previous studies have examined surgical volumes and safety during the pandemic, limited data exist on how outcomes varied across multiple phases of the pandemic, especially in real-world, multicenter spine surgery populations. **Material and Methods:** This retrospective cohort study used data from the Michigan Spine Surgery Improvement Collaborative (MSSIC) to compare outcomes in patients undergoing lumbar or cervical spine surgery across four COVID-19 timeframes: pre-COVID (1/2019-2/2020), onset-COVID (3/2020-9/2020), active-COVID (10/2020-2/2022), and post-COVID (3/2022-12/2022). Patient demographics, surgical characteristics, 30- and 90-day adverse events, and patient-reported outcomes (PROs) were compared across cohorts using Chi-squared or Fisher's exact tests for categorical variables and ANOVA or Kruskal-Wallis tests for continuous variables. **Results:** Among 47,831 patients (33,532 lumbar; 14,299 cervical), demographics were consistent across phases. For lumbar surgery, onset-COVID was marked by higher durotomy, urinary retention, and 90-day return-to-OR, while CSF leak and 30-day readmissions declined during active-COVID. Cervical surgery showed increased dysphagia during active-COVID and higher 90-day return-to-OR and readmissions during onset-COVID, with urinary retention rates declining over time. Patient-reported outcomes were generally stable, however, lumbar patients were more likely to achieve back pain MCID during onset-COVID. Notably, cervical patients reported higher one-year satisfaction during onset-, active-, and post-COVID compared with pre-COVID. Functional recovery showed different patterns: lumbar return-to-work dropped at onset but later stabilized, whereas cervical return-to-work stayed consistent across phases and improved post-COVID. Readmission causes also shifted: pulmonary complications increased at onset then decreased, while electrolyte, pharmacologic, and stroke-related readmissions declined over time. **Conclusion:** Spine surgery outcomes remained largely stable throughout the COVID-19 pandemic. Although certain complications temporarily increased during the onset phase, outcomes normalized as healthcare systems adapted. Long-term patient-reported outcomes were not adversely impacted and, in some cases, improved, suggesting resilience in surgical care delivery despite pandemic-related challenges.

ID: AGS26/1195
P0522: Trident approach to chronic low back pain classification: a comprehensive cohort study of patients with nociceptive and neuropathic pain assessed by the PainDETECT Questionnaire

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Introduction: Low back pain (LBP) is the leading cause of disability world-wide with more than 500 million people at one time significantly limited in their ability to undertake activities of daily living. The nature of LBP is varied at each individual level and complex at a systems level. At an individual level, it is hypothesized that pain is either generated via mechanical compression or chemical irritation via inflammatory biomarkers. Pain has been traditionally studied using a scalar measurement for its intensity, however, the nature of pain incorporates various descriptors. Nociceptive LBP (NoP) results from the activation of nociceptors which innervates many structures in the lumbar spine. Neuropathic LBP (NeP) is caused by a 'lesion or disease of the somatosensory nervous system'. Traditionally, NeP and NoP have been regarded as discrete entities, primarily attributed to patho-anatomical abnormalities within the lumbar spine. However, it is increasingly evident that the nature of both pain classifications is multifaceted, encompassing a range of physical, biomechanical, chemical, and psychosocial factors. As such this study aims to address current shortcomings in the literature regarding LBP classification by (1) investigating whether there is a difference in pain severity, disability, quality of life, and sociodemographic factors between patients with NeP and NoP, (2) exploring associations between radiological findings on MRI and X-ray and NeP and NoP, and (3) elucidate associations between non-spinal comorbid conditions and NeP and NoP. **Methods:** This study received approval from the Human Research Ethics Committee of the University of Wollongong (No. 2020/329) and the University of New South Wales (No. HC210096). The developer of the PainDETECT Questionnaire (PDQ) provided written approval for its use in this study, a score of $\leq$ 12 indicated NoP and $\geq$ 19 indicated NeP. A retrospective analysis of a prospectively collected database involving a cohort of adult patients (> 18 years) presenting with chronic LBP (> 3 months) to a tertiary spine clinic was conducted. Patients were excluded if they had a history of spinal surgery, were diagnosed with specific spinal pathologies (fracture, malignancy, infection, axial spondylarthritis, cauda equina syndrome), or were diagnosed with non-spinal conditions that present with neuropathic symptoms (diabetic neuropathy, complex regional pain syndrome, central nervous system disorders, peripheral neuralgia). Patient demographic, radiology, and comorbidity analysis is outlined in. Independent t-test and Mann-Whitney U was used to analyze the difference in continuous and ordinal parameters, respectively. Pearson Chi-square was used to analyze the independence of association. A binary logistic regression model was used to analyze the confounding status of comorbid medical conditions to determine independent relationships between specific conditions and neuropathic pain. **Results:** A total of 707 patients completed the PainDETECT questionnaire and were included in the study. 512 met the inclusion and exclusion criteria and were included in the analysis, of which 279 had completed MRI and X-ray images and 400 had completed comorbidity questionnaire information. The NeP group had a lower mean age than the NoP group (55 ± 15.6 vs. 59 ± 17.8, $p < 0.05$), there was no difference in gender between the groups. The NeP group had higher pain severity (8.0 ± 1.5 vs. 5.8 ± 2.3, $p < 0.001$), higher disability (48.7 ± 21.4 vs. 25.7 ± 19.4, $p < 0.001$), and lower quality of life (0.562 ± 0.26 vs. 0.278 ± 0.25, $p < 0.001$) compared to the NoP group. Smokers and patients with no partner marital status were 2.4 (OR 2.373, 95%C.I. [1.319-4.266] and OR 2.384, 95%C.I. [1.390-4.092], respectively, $p < 0.01$) times more likely to have NeP compared to NoP. Additionally, the NeP group were of lower income class (Z=-2.425, $p < 0.05$). In the radiology study, patients with NeP had higher foraminal ($U = 18.962$, $p = 0.002$) and spinal stenosis ($U = 14.481$, $p = 0.005$) severity. A subgroup analysis of patients without stenosis also revealed that the NeP group had higher prevalence of disk bulge (96% vs. 78%, $p = 0.002$), high-intensity zones (51% vs. 19%, $p < 0.001$) and Pfirmann grade ($U = 11.321$, $p = 0.020$). In the comorbidity analysis, Patients with depression, rheumatoid arthritis (RA) and gastrointestinal disorders were 2.844 (Exp(B) = 2.844, 95% C.I. [1.426-5.670], $p < 0.01$), 2.726 (Exp(B) = 2.726, 95% C.I. [1.183-6.283], $p < 0.05$) and 2.847 (Exp(B) = 2.847, 95%C.I. [1.473-5.503], $p < 0.05$) times more likely to suffer NeP than NoP, respectively. **Discussion:** NeP is associated with higher levels of disability and lower quality of life. Smokers, individuals with a no partner marital status, and individuals with a lower income class were more likely to suffer NeP rather than NoP. The study also reveals that NeP is associated with more severe neural compression, increased presence of discogenic disease and inflammatory disk severity. Additionally, NeP correlates with gastrointestinal conditions, rheumatoid arthritis, and depression, highlighting the potential involvement of the gut microbiome as a common factor linking non-spinal comorbidities. These findings emphasize the importance of individualized management plans tailored to the specific pain and medical profiles of patients, rather than relying on a one-size-fits-all approach. Furthermore, the detrimental impact of NeP on patient well-being underscores the need to represent pain on a nociceptive-neuropathic continuum to achieve more accurate differentiation of pain components and reduce unnecessary pharmacotherapy, imaging, and non-targeted surgical interventions.

ID: AGS26/1226
P0523: Prevalence study of atypical Scheuermann's kyphosis using computed tomography scans

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Introduction: Scheuermann's disease (SD) is a structural spinal disorder classically characterized by thoracic hyperkyphosis, anterior vertebral wedging, and associated radiographic changes. While the typical form predominantly affects the thoracic spine, the atypical variant involves the thoracolumbar region, presenting with distinct clinical and imaging features. Despite its relevance, epidemiological data on atypical SD remain scarce, as most prevalence studies do not differentiate between the two patterns. This study aims to determine the prevalence of atypical Scheuermann's disease in young adults using abdominal computed tomography as a screening tool. **Material and Methods:** This cross-sectional observational study involved 1287 computed tomography scans from patients aged 18 to 40 years of both genders. Criteria for diagnosing Atypical Scheuermann's Disease included wedging of 5° in three consecutive vertebrae, combined with a total Cobb angle of 10° or more within the thoracolumbar interval from T8 to L2. Positive cases were assessed for kyphosis severity, Schmorl's nodes presence, and scoliosis. Prevalence estimation and correlation analysis with age and sex were performed. **Results:** The study identified 28 cases of Atypical Scheuermann's Kyphosis, indicating a prevalence of 2.8%. **Conclusion:** This research, utilizing abdominal tomography, offers valuable insights into the prevalence of Scheuermann's disease in its atypical form within the sampled population.

ID: AGS26/1297
P0524: Risk of hip fracture and mortality significantly increases following lumbar fracture in older adults across high-risk comorbidity subgroups

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Introduction: The extent to which comorbidities compound the risk of hip fracture and mortality following lumbar fracture remains unclear. This study evaluated whether high-risk comorbidities amplify the risk of subsequent hip fracture and mortality among older adults with lumbar fracture, independent of osteoporosis and other bone density disorders. **Material and Methods:** We conducted a retrospective cohort study using the TriNetX Research Network, a large, nationally representative federated electronic health record database. Adults aged ≥65 years with a diagnosis of lumbar fracture between 2005 and 2025 were identified. Two analyses were performed: a single-cohort analysis to estimate the overall five-year risk of hip fracture (subtypes and composite) and all-cause mortality, and matched two-cohort analyses comparing patients with lumbar fracture plus a comorbidity (rheumatoid arthritis, type 1 diabetes mellitus, type 2 diabetes mellitus, or abnormal gait) against those with lumbar fracture alone. Propensity score matching accounted for demographics, clinical variables, corticosteroid use, and disorders of bone density. Patients with previous hip fracture were excluded from all hip fracture outcome analyses. Outcomes were assessed as relative risks (RR) with 95% confidence intervals (CI). **Results:** In the single-cohort analysis of 280,916 patients, fracture of the head and neck of the femur occurred in 8,064 (2.87%) patients, intertrochanteric fracture in 4,679 (1.67%) patients, subtrochanteric fracture in 918 (0.33%) patients, acetabular fracture in 1,257 (0.45%) patients, and the composite "all hip fracture" outcome occurred in 10,157 (3.62%) patients. All-cause mortality occurred in 47,666 of 280,916 (16.97%) patients without previous hip fracture and 51,930 of 299,035 (17.37%) overall. In the two-cohort analyses, comorbidity presence significantly increased hip fracture risk: rheumatoid arthritis (5.3% vs 4.5%; RR 1.175, 95% CI 1.055-1.308; $p = 0.003$), type 1 diabetes (5.8% vs 4.3%; RR 1.342, 95% CI 1.170-1.540; $p < 0.001$), type 2 diabetes (4.5% vs 3.9%; RR 1.146, 95% CI 1.083-1.212; $p < 0.001$), and abnormal gait (6.6% vs 4.7%; RR 1.398, 95% CI 1.324-1.476; $p < 0.001$). Mortality was significantly elevated in all subgroups except abnormal gait. **Conclusion:** Lumbar fracture combined with high-risk comorbidities independent of osteoporosis confers an elevated risk of subsequent hip fracture and, in most subgroups, increased mortality.

ID: AGS26/1370
P0525: Prevalence, risk factors, and impact of back pain on physical function and psychosocial health in a multi-ethnic Asian population in Singapore: a cross-sectional study

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Introduction: Back pain is a major cause of disability worldwide. Current epidemiological studies have focused largely on Caucasian populations, and Asian ethnicities are underrepresented. Ethnic, cultural and social disparities may significantly impact the efficacy of public health interventions. This study aims to characterise the prevalence of back pain across all ages in a multi-ethnic, Asian population, identify associated epidemiological factors, and examine its impact on physical function and psychosocial health. **Materials and Methods:** This is a prospective, population-based, cross-sectional study conducted in the format of a survey administered to a multi-ethnic residential cohort in a major housing estate of Singapore, conducted between September 2023 and May 2024. Demographic information was obtained from the Department of Statistics to determine a representative sample. All Singapore citizens/Permanent Residents aged 21 years or older were eligible to participate. Clinical, functional, mental health, and subjective quality-of-life measures were compared between participants with back pain and those without. **Results:** This study included 4274 participants. Age prevalence of back pain showed a bimodal distribution, with peaks in the age groups of 41-50 and > 90 years. Younger age, higher education levels, employment status, multimorbidity, smoking, and alcohol intake were factors associated with back pain ($p < 0.05$). Individuals with back pain were more likely to be physically inactive, impaired in their instrumental activities of daily living, and frail. Psychosomatic/depressive symptoms, social isolation, and lower quality of life were also more prevalent in individuals with back pain. **Conclusion:** Public health interventions for back pain should be tailored to specific cultural and demographic contexts, and focus on increasing outreach to older adults from less privileged socioeconomic strata, so as to maximise their scope and impact. A multidisciplinary approach should be adopted for the management of back pain.

ID: AGS26/1371
P0526: High rates of spin bias in systematic reviews regarding anterior cervical discectomy and fusion vs posterior cervical foraminotomy

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Introduction: Cervical degenerative disc disease often presents with debilitating neck pain and radiculopathy or myelopathy. Initial treatment is conservative, followed by surgical management for refractory symptoms. Options for surgical management include anterior cervical discectomy and fusion (ACDF - the gold standard) and posterior cervical foraminotomy (PCF); however, current literature remains conflicted over the superiority of one procedure. Systematic reviews and meta-analyses allow for comprehensive synthesis of literature but are susceptible to spin bias that may skew results and affect clinical decision making. This study aimed to evaluate the presence and number of spin bias in systematic reviews and meta-analyses comparing ACDF and PCF. **Material and Methods:** A systematic search was conducted on PubMed, Web of Science, Embase, and Scopus for systematic reviews and meta-analyses comparing ACDF and PCF in June 2025. Included articles were assessed by 2 independent reviewers for the 9 most severe types of spin bias established by Yavchitz et al. Articles were also graded on methodological quality using the AMSTAR-2 tool. Any disagreements were resolved through discussion. Associations between AMSTAR-2 rating, number of citations, citations per year, impact factor of publishing journal, reported funding, adherence to PRISMA guidelines, performance of a meta-analysis and total types of spin bias or presence/absence of spin were assessed using Poisson regression modeling and a Firth's penalized likelihood regression model, respectively. **Results:** Twelve studies met inclusion criteria. Spin bias was found in 11 of 12 (92%) included articles, with number of different types of bias ranging from 0 to 2. Type 9 was the most common type of spin in 5 of 12 (42%) articles. Type 5 spin was found in 4 (33%) articles, Type 3 in 3 (25%) articles, Type 1 in 2 (16%) articles, and Types 2 and 4 in 1 (8%) article each. AMSTAR-2 quality assessments rated 7 of 12 (58%) articles as "critically low", and 5 of 12 (42%) as "low"; none received a "high" quality rating. AMSTAR-2 rating, number of citations, citations per year, impact factor of publishing journal, reported funding, adherence to PRISMA guidelines, and performance of a meta-analysis were not able to significantly predict the quantity or presence of spin bias (all $p > 0.05$). **Conclusion:** Spin bias is highly prevalent (92%) in systematic reviews and meta-analyses comparing ACDF and PCF, with a maximum of 2 types of spin per article. All studies received either "critically low" or "low" quality ratings according to AMSTAR-2 criteria, emphasizing the need for improving methodological quality in orthopaedic research comparing these interventions. Notably, all studies rated as "critically low" quality had at least 1 type of spin bias. Spine surgeons should exercise caution when reading systematic reviews comparing ACDF and PCF to inform clinical decision making, due to high prevalence of spin bias. Efforts and strategies to mitigate spin bias in orthopaedic

literature are imperative to collectively enhance published literature.

ID: AGS26/1378
P0527: The national burden of vertebral body fractures in Germany: a population-based analysis of statutory health insurance claims (2015-2022)

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Introduction: Vertebral body fractures impose a major clinical and socioeconomic burden worldwide. They arise after high energy trauma and increasingly from osteoporosis related fragility, with sequelae that include pain, kyphotic deformity, functional decline, and reduced quality of life. In Germany, demographic ageing is expected to increase their incidence, with implications for planning and resource allocation. Yet nationwide estimates across the full care continuum remain scarce. Hospital based reporting captures surgically treated cases, whereas many conservatively managed ambulatory cases are incompletely ascertained. We therefore analysed German statutory health insurance claims, assuming that almost every vertebral fracture generates at least one ambulatory contact and thus permits comprehensive case ascertainment. The aims were to provide a nationwide overview of vertebral fracture incidence from 2015 to 2022, to describe temporal trends by age and sex, and to characterise anatomical distribution across cervical, thoracic, and lumbar regions. **Material and Methods:** Retrospective population based analysis of German outpatient claims from the Central Institute for Statutory Health Insuranc, January 2015 to December 2022. Incident vertebral fractures were identified by ICD-10-GM S12.0, S12.1, S12.2, S22.0, and S32.0. To limit duplicate events, identical diagnoses for the same individual within the four subsequent quarters after the index quarter were excluded. Annual incidence per 100,000 by age, sex, and anatomical region was calculated using population denominators from the Federal Statistical Office. **Results:** Across 2015-2022, vertebral body fracture counts rose significantly from 153,636 to 180,824 (+17.7%; overall IRR 1.14, 95% CI 1.136-1.151). By location, lumbar fractures predominated (2022: 107,776; 59.4%), thoracic fractures accounted for 65,006 (35.8%), and cervical fractures, including atlas and axis, for 8,729 (4.8%). Incidence increased in all regions and these rises were significant: cervical from 7.6 to 10.3 per 100,000 (+36.3%; IRR 1.36, 95% CI 1.319-1.408), thoracic from 66.5 to 77.1 per 100,000 (+15.9%; IRR 1.16, 95% CI 1.146-1.172), and lumbar from 114.1 to 127.8 per 100,000 (+12.0%; IRR 1.12, 95% CI 1.110-1.130). A modest pandemic related dip in 2020 was evident for thoracic and lumbar fractures with rebound thereafter; both dips were significant (thoracic 2020 vs 2019 IRR 0.973, 95% CI 0.962-0.984; lumbar 0.986, 95% CI 0.977-0.994), whereas cervical fractures increased steadily throughout. Overall incidence rose from 188.1 to 215.2 per 100,000 (+14.4%). Adults ≥ 65 years accounted for 71.0% of cases in 2015 and 72.6% in 2022. Female incidence exceeded male throughout, reaching 285.6 versus 142.6 per 100,000 in 2022. **Conclusion:** Germany's vertebral body fracture burden increased substantially between 2015 and 2022, driven by ageing demographics and a persistently higher incidence in women, with lumbar and thoracic regions comprising the vast majority of cases.

ID: AGS26/1387
P0528: Assessment of the top authors in spine

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Introduction: Bibliometric analyses help define the intellectual architecture of spine research by quantifying publication trends, citation patterns, and authorship networks. Understanding the influence of individual contributors is particularly important in shaping evidence-based practice and guiding future inquiry. The present study aimed to conduct a focused bibliometric analysis of *Spine* to identify the most frequently cited authors to better understand the trajectory of academic influence in spine surgery and the evolving role of *Spine* as a cornerstone of the field. **Material and Methods:** The Web of Science (WoS) Core Collection database was queried for all articles and reviews published in Spine from January 1, 1976, to December 31, 2024. The number of citations for each author published in *Spine* was determined. The top 20 most cited authors in (1) first author position, (2) any author position, and (3) last author position were identified and listed separately. Citation number was confirmed for each author through a manual search of the author's name in the WoS database. Per previously reported protocol, the

MEDLINE database was utilized to find the number of published articles in *Spine* associated with each author's name. WoS was used to confirm each author's total publications in *Spine*. Relative citation index (RCI), a metric used to evaluate how an author's citation count compares to others in the field, was calculated by dividing each author's total citations by the number of articles published in *Spine.* Level of training and current institution were determined for each author. **Results:** The WoS search yielded 17,610 publications. The author group with the highest average number of citations was the authors in any authorship position cohort (5,207), followed by authors in last position (3,708), and authors in first position (3,438). Similarly, the top 20 authors in any authorship position demonstrated the highest RCI, with 1,265 citations per publication (range, 137-4,559). Alternatively, the top 20 authors in first position had the highest average number of articles published in Spine, at 74, followed by authors in first author position, 54, and authors in any authorship position, 13. The top ranked first author, D.E. Beaton, had only two first author publications in Spine, yet achieved the highest citation count amongst all authors. Seven authors were ranked as both a top 20 first author and a top cited author in any authorship position. Further, six of the top cited last authors were a top cited author in first position or any authorship position. **Conclusion:** As a highly regarded journal in the field of orthopaedics and spine research*, Spine's* top authors have significantly influenced spine research and its clinical applications. The average number of articles published for the top last authors was close to one and a half times what it was for first authors which may reflect last authors' ability to be involved in a greater number of projects. Our findings demonstrated a core group of researchers, highlighting the need for continued vigilance regarding repeat authorship based on citation metrics and visibility.

ID: AGS26/1507
P0529: Top cited articles in Global Spine Journal

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Introduction: Founded in 2011, *Global Spine Journal (GSJ)* has quickly established itself as an influential multidisciplinary journal covering a wide range of surgical, nonsurgical and emerging topics in spine surgery. The journal's impact factor has been steadily increasing over time with a current impact factor of 3.0, ranking in the first quartile of orthopaedic research. *GSJ* is AO Spine International's official journal, highlighting its worldwide reach and role in shaping macroscopic trends in spine research. Because of its broad visibility and growing popularity, highly cited articles and their authors published within *GSJ* drive international scientific discussion and investigation within this field. In this study, we examined the most cited articles within *GSJ* to better understand the journal's current standing as well as the state and evolving priorities of spine research worldwide. **Material and Methods:** Web of Science (WoS) Core Collection was searched for all articles and reviews published in *GSJ* from 2011 to 2025. The top 20 articles by citation count were identified and exported for further analysis. Title, authors, citation count, citation count per year since publication, article type, topic and level of evidence (LOE) were collected for each top article. LOE was determined following the Oxford 2011 Levels of Evidence guidelines. **Results:** The WOS search identified 2,324 publications. The average number of citations was 204 citations (range: 112-434). The average number of citations per year was 28 (range: 12-104). The majority of publications were literature reviews (55%), followed by systematic reviews/meta-analyses (30%). Most articles (60%) were LOE IV and V. There were a variety of topics covered across the top articles with cord compression/decompression (15%) and surgical complications (15%) being the most common. Several authors appeared multiple times within the top cited articles. Dr. Michael G. Fehlings was first author on three of the top articles and Dr. Keith L. Jackson was first author on two top articles. **Conclusion:** The young nature of *GSJ* is reflected in the relatively lower citation count of its top articles. Further, many of the top articles were literature reviews, a study type considered to be of lower quality. This is reflected in the majority of articles having a lower level of evidence (IV and V). Despite this, a considerable portion of the top articles were systematic reviews/meta-analyses, studies type considered to be of higher quality. The combination of having a majority of literature reviews and systematic reviews/meta-analyses reflects the maturation of GSJ and its growing influence. Notably, Dr. Micheal G. Fehling, the most frequent first author, focuses on spinal cord injuries, aligning with the prominence of spinal cord compression/decompression related topics. Similarly, Dr. Keith L. Jackson's work on patient risk factors underscores the multidisciplinary nature of *GSJ* . Examining the most cited articles within *GSJ* highlights its developing nature as it continues to publish higher impact studies and advance the understanding of key clinical challenges, such as spinal cord compression, related surgeries and surgical complications in general.

ID: AGS26/1802
P0530: Most impactful articles in Spine: comparing past and current research

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Introduction: *Spine* is one of the top journals in spine research and therefore *Spine's* most cited publications demonstrate this field's current landscape and future directions. However, when looking at citation count as a proxy for influence, older articles are overemphasized while recent articles are underrepresented due to limited time for citation accumulation. In order to provide a more balanced perspective on both emerging trends and historical impact, this study aimed to identify the top articles since *Spine's* inception and compare them to the top articles in the last 10 years. **Material and Methods:** All publications in *Spine* from 1976 to 2024 were identified using the Web of Sciences (WoS) Core Collection. Based on citation count, the most cited articles were separated into top 20 cited articles from 1976 to 2024 and top 20 cited articles from 2014 to 2024, to represent the most recent complete 10-year period. For each article, title, authors' names, publication date, citation count, article type, subject, and level of evidence (LoE) were collected. LoE was assigned based on the stated LOE within the abstract. If no LOE was listed, the Oxford 2011 Levels of Evidence were used to assign a level. Article type, subject and LoE were verified by two independent reviewers. **Results:** The WOS search yielded 17,610 publications. Among the top articles from 1976 to 2024 and 2014 to 2024, the average number of citations was 2,240 and 308 respectively, while the average number of citations per year was 90 and 43, respectively. For top articles from 1976 to 2024, the most common article types were methodological studies (30%) and case studies (25%), the most common subjects were back pain (25%), disability (15%), and surgical procedures (15%) and the most common LoE were levels V (45%) and IV (30%). For top articles from 2014 to 2024, the most common article types were cohort studies (30%) and database studies (20%), the most common subject was surgical procedures (35%) and adult spinal deformity (20%) and the most common LoE was level III (60%). **Conclusion:** Surgical procedures have become a greater focus in recent years, and *Spine* appears to be publishing studies with overall higher LOE. The top articles from 1976 to 2024 reflected a broad exploration into back pain, while recent publications have shifted toward understanding different etiologies of back pain such as adult spinal deformity. Further, studies utilizing databases have become increasingly common, allowing for larger datasets, which is reflected in a higher LoE. None of the overall top cited articles within *Spine* were published in the last 15 years, indicating these articles do not provide an accurate representation of the current direction of spine surgery and the challenges current patients and providers face in clinical practice. Looking at the most cited articles across multiple time points in *Spine*, a top ranked and influential journal, allows for a broad understanding of both the foundations and the trajectory of spine research.

ID: AGS26/1822
P0531: Most prolific articles in Spine comparing past and current research

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Introduction: *Spine* is one of the most influential journals and leading platforms contributing to the advancement of spine surgery. Its publications are largely responsible for curating the academic and surgical field that exists today. This study aims to identify the most prolific authors in this journal. Furthermore, this study aims to analyze patterns of authorship characteristics to better understand the individuals largely responsible for this journal's impact. **Material and Methods:** This study searched *Spine* for all articles and reviews, excluding letters, editorials and corrections. Authors were sorted by first, last and any position; solo authors were excluded from first and last iterations. In order to further analyze authorship, this study utilized the Shannon diversity index and the Gini coefficient. The Shannon diversity index was applied to authorship positions (first, middle, last) to assess the balance of roles among contributors. Values were normalized on 0-1 scale, 0 indicating an author's contributions were limited to a single position and 1 indicating equal distribution across all three positions. The Gini coefficient was calculated from the Lorenz curve of cumulative authorship contributions, ranging from 0 (perfectly equal distribution) to 1 (all output concentrated in a single position), thereby quantifying skew to a certain authorship position. Additional authorship characteristics were collected, including total citation count at the corresponding authorship position, gender, academic degree, H-index as a measure of scholarly impact, institutional affiliation, country of origin, and keywords of associated publications. **Results:** 17,396 publications were identified. Considering publications in any author position, the most prolific author was Lawrence Lenke (304 publications, H-index 105, 27,773 citations), followed by Alexander Vaccaro (248 publications, H-index 85, 11,169 citations) and Keith Bridwell (223 publications, H-index 102, 30,524 citations). Shannon diversity index ranged from 0.176 to 0.577, while Gini coefficients ranged from 0.17 to 0.435, indicating heterogeneity in authorship role distribution. Limiting the search to most prolific authors with first-author publications, Peter Passias (38 publications, H-index 41), Manohar Panjabi (37 publications, H-index 82), and Alexander Vaccaro (36 publications, H-index 85) were the most prolific. These authors demonstrated higher Shannon diversity index (0.522-0.650) and lower Gini coefficients (0.07-0.27). For last author publications,

Jonathan Grauer (69 publications, H-index 59), James Weinstein (64 publications, H-index 77), and Kern Singh (62 publications, H-index 40) were the leading contributors. Last author leaders generally demonstrated lower Shannon diversity index (0.295-0.454) and higher Gini coefficients (up to 0.39). Additionally, top authors in all categories had "complications" as one of their top 5 keywords. **Conclusion:** This study highlights those shaping the field of orthopaedics and who are responsible for some of its most impactful advancements. Gaining a better understanding of *Spine's* authorship community and its characteristics provides insight into the distribution of academic influence and the roles these individuals play as collaborators and leaders within the scholarly community.

ID: AGS26/1838
P0532: Demographic evolution of spinal fractures in a workers compensation hospital: a comparative analysis between 2015 and 2025

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Introduction: Spinal fractures (SF) represent a significant public health issue globally, with a notable increase in incidence, particularly among the elderly. Although age-standardized rates have decreased, the overall burden of SF continues to rise, driven by an aging population. This study aims to analyze how the demographics of patients with SF have changed in a workers' compensation hospital between 2015 and 2025, highlighting variations in patient profiles and the mechanisms of injury involved. **Material and Methods:** A retrospective analysis of medical records of patients with SF treated in a workers' compensation hospital was conducted. Data were collected from 90 patients in 2015 and 102 in 2025. Demographic variables such as age, sex, and type of work-related accident were examined. Average age and sex distribution were calculated and compared between the two years. Descriptive analysis was employed to evaluate the observed trends. **Results:** A total of 90 patients were recorded in 2015 and 102 in 2025 with diagnoses of SF. The average age of patients in 2015 was 46.01 years, increasing to 48.46 years in 2025. Regarding gender, 16.6% (15) of patients in 2015 were female, compared to 24.5% (25) in 2025. Furthermore, 45.6% (41) of cases in 2015 were due to commuting accidents, whereas this figure was 41.2% (42) in 2025. These data suggest that the patient profile is becoming older and that female representation is increasing. **Conclusion:** The analysis of these data indicates a significant demographic evolution among patients with SF in a workers' compensation hospital. An increase in average age and a higher incidence of injuries in women are observed, implying a shift in the demographics of this working-age population. Recognizing these trends is crucial for developing public health policies and intervention programs tailored to the specific needs of these patients, especially in a context where the population is aging. These changes also raise new questions regarding the current situation of working-age patients: Is the total number of SF increasing? Is there a higher proportion of cases caused by low-energy mechanisms due to workforce aging? Is there a decline in bone density among active workers? Future research should focus on better understanding the mechanisms of injury and implementing prevention programs aimed at the most vulnerable populations.

ID: AGS26/1842
P0533: Race and insurance disparities in discharge disposition following cervical spine trauma

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Introduction: Previous evidence describes racial and socioeconomic disparities in the treatment and outcomes of patients who have suffered cervical spine trauma. Although acute care and surgical intervention for cervical spine trauma are important, the ability of a patient to obtain sufficient rehabilitation following discharge from acute care is crucial in optimizing functional outcomes. The goal of this study is to investigate racial and socioeconomic disparities in the disposition of patients with cervical spine trauma. **Material and Methods:** We surveyed the National Inpatient Sample database (NIS) from 2016-2020 to identify all patients with a diagnosis of cervical spine trauma. Data were analyzed using standard descriptive methods and multinomial logistic regression to assess race- and insurance-based differences in discharge disposition after cervical spine trauma, controlling for patient factors. Patients with cervical spine trauma aged 18-64 years with complete data on race and insurance status, discharged alive from inpatient care, without significant injuries to other organ systems were eligible for study. **Results:** Of 3,530 patients who met eligibility criteria for the study 60% were White, 23% Black, 11% Hispanic, 1% Asian and 5% Other. Most patients had insurance, and highest levels of uninsured patients were seen in Hispanic patients (23%), Black patients (22%) and Other patient (21%). Compared to patients with government insurance, privately insured patients were more likely to be discharged to facility than home (RRR 1.2; 95% CI 1.03 - 1.45) and uninsured patients were less likely to be discharged to facility than home (RRR 0.55; 95% CI 0.45 - 0.67). When compared to White patients, there were

no statistically significant differences in disposition home vs facility for any other race/ethnic group. **Conclusion:** Insurance status serves as a strong predictor of discharge to facility following hospitalization for patients with cervical spine trauma. Although prior literature suggests that there are racial disparities in discharge disposition following traumatic injuries to various other organ systems, our study does not recapitulate these results in this subset of patients with cervical spine trauma.

ID: AGS26/2377
P0534: A scoping review: knowledge translation interventions, contextual factors, and their impact on surgical practice change

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Introduction: Knowledge translation (KT) interventions are essential for implementing evidence-based practices in healthcare However, despite their proven effectiveness in addressing global health challenges, KT strategies in surgery remain challenging to apply. This scoping review examines KT strategies in surgery, their effectiveness, and key barriers and enablers to their implementation. **Material and Methods:** This scoping review followed the Arksey and O'Malley and Levac et al. frameworks, integrating the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) and the PRISM (Practical Robust Implementation Sustainability Model) models to evaluate the effectiveness of knowledge translation interventions in surgical practice change and associated contextual barriers and facilitators. A systematic search was conducted across MEDLINE (PubMed, OVID), CINAHL (EBSCO), and PsycINFO (ProQuest). Articles were screened using predefined selection criteria, emphasizing experimental and quasi-experimental studies. Data extraction categorized KT interventions: knowledge diffusion, dissemination, and implementation approaches with regional specific adaptation. **Results:** A total of 34 studies met the inclusion criteria. Most were hospital-based (88%) and focused on guideline adherence. The review identified three primary KT strategies: i) educational materials and educational outreach, ii) reminders and prompts, and iii) audit and feedback systems. The most effective KT strategies used a combination of these interventions to maximize impact. Barriers included physician resistance, limited leadership support, financial constraints, and workflow disruptions, while enablers included institutional leadership, structured training programs, financial incentives, and interdisciplinary collaboration. A notable finding was the lack of standardized validation processes for adopting changes in the surgical setting, which often burdens individual surgeons and their institutions, thereby constraining both capacity and motivation for practice change. **Conclusion:** The integrated application of RE-AIM and PRISM frameworks proved valuable in assessing the interventions' sustainability and real-world effectiveness. Findings suggest that layered, interdisciplinary KT strategies are the most effective for driving surgical practice change and overcoming institutional barriers. This comprehensive analysis contributes to the growing body of knowledge on effective implementation strategies in surgical settings and provides a foundation for future practice improvement initiatives. Future research should focus on refining KT methodologies, expanding implementation frameworks, and addressing barriers to sustainability across diverse surgical settings.

ID: AGS26/2388
P0535: The prevalence of cervical ossification of the posterior longitudinal ligament (OPLL) in the Māori and Non-Māori population in the Bay of Plenty, New Zealand

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Introduction: The primary objective of this study is to determine the prevalence of cervical ossification of the posterior longitudinal ligament (OPLL) among Māori compared to non-Māori populations in the Bay of Plenty (BOP) region of New Zealand. **Material and Methods:** Cervical spine and trauma computed tomography (CT) scans performed between 2021 and 2025 in the Bay of Plenty, New Zealand were retrospectively reviewed for evidence of cervical OPLL. Patients aged ≥40 years with available ethnicity data and adequate imaging were included. Cases with a prior diagnosis of OPLL were excluded to reduce selection bias. **Results:** A total of 423 CT scans were from the BOP region, comprising 224 Māori and 199 non-Māori patients. Cervical OPLL was identified in 15 Māori patients, with one case excluded due to prior diagnosis. This yielded a statistically significant OPLL prevalence of 6.4% (14/223, $p = 0.0133$) among Māori in BOP. Māori in BOP were 6.6 times more likely to have cervical OPLL compared to non-Māori [OR 6.60, 95% CI

1.48-29.4]. In the non-Māori BOP cohort, two cases of cervical OPLL were identified, resulting in a prevalence of 1.0% (2/199). **Conclusion:** This study demonstrates a significantly higher prevalence of cervical OPLL in the Māori population of the Bay of Plenty compared to non-Māori.

ID: AGS26/2432
P0536: Vertebral artery injury in cervical spine fracture dislocation: our observation in Indian Spinal Injuries center

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Introduction: Incidence of traumatic vertebral artery injury (VAI) associated with cervical spine trauma varies widely in published trauma series. The purpose of this study was to determine the frequency of traumatic vertebral artery injury in patients with cervical spine trauma by using routine Magnetic Resonance (MR) imaging and identify associations with Age, Sex, Mechanism of injury, level of injury and severity of neurologic injury. Vertebral Artery Injury is mostly asymptomatic but serious complication like Cerebro vascular event or even death can occur when it occurs in dominant side or bilateral. **Material and Methods:** A retrospective review of 96 patients with cervical spine fracture dislocation with or without an associated spinal cord injury (SCI) who were admitted in Indian Spinal Injuries Center in last 10 years was performed. Cervical MR imaging was used to diagnose vertebral artery injury. Patients age, sex, cervical injury level, mechanism of injury, neurologic level of injury, and American Spinal Injury Association (ASIA) grade and clinical sequel of vertebral artery injury were recorded. **Results:** In this study, 96 patients met the inclusion criteria, 18 (18%) of whom had VAI on the admission MR imaging. All of VAI patients had an associated SCI. VAI was significantly more common in motor-complete patients (ASIA A 61% and B 22%) where no VAT in neurologically intact cervical spine injured patients. VAI incidence was significantly high in Flexion distraction type of injury (12, 66%). Most common level associated with VAI was C4/5 and C6/7 (22%). 27% of VAI was associated with Foraminal fracture, 72% of VAI was associated with Facet dislocation among the 44% bi-facetal and 28% uni facetal dislocation. **Conclusion:** Incidence of traumatic vertebral artery is not very Uncommon and need careful and meticulous screening and management. Otherwise, complications can happen. Mostly it is associated with high velocity injury and higher neurologically injure patient. MRI can be used as a good screening tool which can be confirmed by CT angiogram or Digital subtraction angiography (DSA). Proper pre operative evaluation of vascular injury in cervical spine fracture dislocation is very much important for patient management as well as patient counselling.

ID: AGS26/2452
P0537: Preoperative bone health optimization in lumbar fusion surgery: a missed opportunity

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Introduction: Many older adults undergoing lumbar fusion have underlying osteoporosis, a modifiable risk factor for mechanical complications and reoperation. Preoperative management with anabolic or antiresorptive medications can mitigate these risks, yet there is limited research on osteoporosis screening and treatment in this population. This study examined trends in the proportion of patients meeting osteoporosis screening criteria, undergoing preoperative dual-energy X-ray absorptiometry (DEXA) scans, and receiving preoperative medical management for osteoporosis. **Material and Methods:** The PearlDiver Mariner database was queried for patients undergoing one- to five-level lumbar fusion between 2012 and 2022. Patients under 18 years old, those with less than two years of preoperative follow-up, or indications related to trauma, malignancy, or infection were excluded. DEXA screening eligibility was determined using the International Society for Clinical Densitometry (ISCD) guidelines: females ≥ 65, males ≥ 70, or younger individuals with one or more established risk factors for osteoporosis. Temporal trends were assessed by comparing data from two periods: 2012-2016 and 2017-2022. **Results:** Among 460,334 patients undergoing lumbar fusion, those meeting osteoporosis screening criteria increased from 61.4% (2012-2016) to 70.1% (2017-2022) ($p < 0.001$). Despite this increase, preoperative DEXA utilization in the two years before surgery remained low, rising only marginally from 12.36% to 13.09% ($p < 0.001$). Among patients under the age threshold for screening, 45.58% met criteria due to other risk factors. These included tobacco use (27.77%), complicated diabetes (9.76%), bone-affecting medical conditions (9.43%), and high-risk medication use (8.52%). Of those meeting screening criteria, women were more likely than men to undergo preoperative DEXA. (18.60% vs. 3.58%, $p < 0.001$). The prevalence of diagnosed osteoporosis increased from 9.31% to 12.29% ($p < 0.001$), but rates of preoperative medical management declined slightly from 13.85% to 12.70% ($p < 0.001$). **Conclusion:** Although awareness of

osteoporosis's impact on surgical outcomes has increased, significant gaps in screening and management remain among lumbar fusion patients. As the population ages, optimizing preoperative bone health is critical. It is important for spine surgeons to recognize the high prevalence of undiagnosed and untreated osteoporosis in this population and prioritize standardized protocols for screening and intervention to improve surgical outcomes.

ID: AGS26/2663
P0538: Prevalence of vertebral compression fractures associated with bone fragility secondary to osteoporosis: a decade-long study in a tertiary care center

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Introduction: Vertebral compression fractures (VCFs) are the most common osteoporotic fractures and constitute a major clinical and public health challenge worldwide. (3) Data from the World Health Organization (WHO) indicate that 500 million people suffer from this disease; as a result, nine million fragility fractures occur annually. It is estimated that osteoporosis affects 10 million people in Mexico; a fragility fracture occurs every three seconds, and the risk of a second fracture increases by 86 percent. (4) It is estimated that 70 percent of patients with spinal fractures in Mexico do not require hospital treatment, due, among other reasons, to the fact that recovery is possible with outpatient medical treatment. (4). **Objective:** To determine the prevalence of vertebral compression fractures associated with bone fragility in patients treated at a tertiary referral medical center. **Material and methods:** An observational, descriptive, analytical, retrospective and cross-sectional study was carried out over a period of 10 years, with a total sample of 736 patients with osteoporosis, of which 174 patients met the inclusion criteria. The Chi square (X^2) test was used to establish the dependence between polytomous categorical variables. The Student t test was used to compare numerical variables between groups. A $p < 0.05$ was considered statistically significant. In the case of dichotomous variables, the Odds Ratio (OR) was calculated with its corresponding 95% confidence interval (95% CI) as a measure of risk association. **Results:** 174 patients presented vertebral compression fractures associated with bone fragility, representing a prevalence of 23.6%. The patients were treated between February 2015 and July 2025, highlighting the high clinical burden of this type of fracture in this population. **Discussion:** In this study, we found that almost one in four patients with osteoporosis had a vertebral compression fracture associated with bone fragility, equivalent to a prevalence of 23.6%. This finding is consistent with what has been reported in other international studies, where these fractures affect between 20% and 25% of patients with osteoporosis, especially in older adults. **Conclusion:** The findings of this study can serve as a basis for future prospective studies evaluating the effectiveness of prevention strategies in high-risk populations, as well as for research exploring the relationship between bone mineral density and fracture recurrence in older adults. The results of this study lead to the conclusion that vertebral compression fractures associated with bone fragility represent a common clinical problem in patients with osteoporosis, with a prevalence of 23.6% in the population treated at our tertiary center.

ID: AGS26/2724
P0539: First experiences with the implementation of a fast-track concept in spine surgery

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Introduction: ERAS (Enhanced Recovery After Surgery) concepts were established in the 1990s, particularly in abdominal surgery. Such programs have only been discovered in spinal surgery in recent years. The goal of the Fast Track approach is to accelerate patient recovery by reducing surgical stress and postoperative pain. This is achieved through preoperative patient optimization and training, multimodal anesthesia, and a reduction in surgical trauma and rapid mobilization. The rapid recovery of patients also leads to faster discharge from inpatient care, which also benefits our healthcare system. **Material and Methods:** A FastTrack concept for spinal surgery is currently being established at our hospital. Initially, all patients undergoing surgery via a dorsal approach to the thoracic and lumbar spine (decompression and fusion surgeries) will be included. Patients included in this program are screened preoperatively for anemia and nutritional status, are educated on the postoperative surgical procedure, and receive anesthesiological and analgesic treatment using a multimodal treatment pathway. Patients are mobilized on the day of surgery as part of a coordinated physiotherapy program. A key focus is also the ongoing motivation and support of patients by a FastTrack assistant. To capture initial changes resulting from the implementation of the FastTrack program, 18 patients before the implementation of the program were compared with the first 18 patients treated using the FastTrack method. For this purpose, the postoperative length of hospital stay and postoperative pain levels were comparatively evaluated. All data were collected prospectively. **Results:** Eighteen patients each were included in the FastTrack

and Non-FastTrack groups (44% male, 56% female vs. 61% male, 39% female). The median age in the Non-FastTrack group was 67.5 years (vs. 73 years), and the median BMI in this group was 30.1 (vs. 31.7). The postoperative median length of hospital stay was 10 days in the Non-FastTrack group (mean 14.28 days) and 4 days in the FastTrack group (mean 5 days). The median VAS in the non-FastTrack group was 6.5 on surgery day, 5 on the first post-operative day, 5 on the second post-operative day, and 4 on the third post-operative day (vs. FastTrack group: surgery day 5.5; 1 post-operative day 4.0; 2 post-operative day 3.0; 3 post-operative day 2.5). **Conclusion:** In summary, a significant reduction in postoperative hospital stay and postoperative pain reduction could be demonstrated within the patient cohort through a FastTrack concept in spine surgery.

ID: AGS26/2741
P0540: Predisposing factors for pseudarthrosis in spinal fusion: analysis of 107 patients

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Introduction: Pseudarthrosis remains a major late complication after spinal fusion surgery, often resulting in persistent pain, functional limitation, and the need for revision procedures. While surgical technique and implant selection are important, patient-related systemic comorbidities also play a critical role in bone healing and fusion outcomes. The aim of this study was to analyze predisposing factors for pseudarthrosis in a cohort of 107 patients, with particular emphasis on diabetes mellitus, hypertension, osteoporosis, and rheumatologic diseases. **Materials and Methods:** This retrospective study included 107 patients diagnosed with pseudarthrosis after spinal fusion surgery between November 2022 and September 2025. Diagnosis was based on clinical symptoms and confirmed radiologically using dynamic radiographs, computed tomography (CT), and/or magnetic resonance imaging (MRI). Demographic variables (age, sex, body mass index), surgical characteristics (fusion length, use of instrumentation, graft type), and systemic comorbidities were recorded. Patients with diabetes, hypertension, osteoporosis, and rheumatologic disorders were analyzed separately. Statistical analysis included chi-square and logistic regression to evaluate associations between comorbidities and pseudarthrosis outcomes. **Results:** Of the 107 patients, 62 were female (57.9%) and 45 male (42.1%), with a mean age of 61.4 years (range: 38-79). Diabetes mellitus was present in 34 patients (31.7%), and these patients demonstrated significantly lower fusion rates compared with non-diabetics ($p = 0.018$). Hypertension was identified in 50 patients (46.7%), and although it did not emerge as an independent predictor of pseudarthrosis, the coexistence of hypertension with diabetes markedly increased the risk of non-union ($p = 0.037$). Osteoporosis was diagnosed in 31 patients (28.9%), and this condition was strongly associated with higher pseudarthrosis rates, particularly in those undergoing long-segment fusion ($p = 0.012$). Rheumatologic disease was found in 16 patients (14.9%), and these individuals required revision surgery more frequently than those without rheumatologic disease (62% vs. 34%, $p = 0.041$). Multivariate regression confirmed diabetes and osteoporosis as independent predictors of pseudarthrosis, while rheumatologic disease showed a strong association with the need for revision surgery. **Conclusion:** This study demonstrates that systemic comorbidities substantially influence fusion success in spinal surgery. Diabetes and osteoporosis emerged as the strongest independent risk factors for pseudarthrosis, while rheumatologic disease significantly increased the likelihood of revision surgery. Although hypertension alone was not an independent risk factor, its coexistence with diabetes amplified the risk of non-union. Careful preoperative optimization and individualized surgical planning are essential to minimize complications in high-risk patients.

ID: AGS26/2845
P0541: A serial cross-sectional analysis of patient demographics in image-guided spinal fusion surgery

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Introduction: Intraoperative imaging systems in spinal fusion surgery allow surgeons greater accuracy in pedicle screw placement. Despite the benefits that may exist, adoption of a new technology is rarely equal across demographic groups. Analysis of past surgeries can allow for disparities in uptake of this surgical technique to be identified. This analysis can guide future decisions on how and where to implement this technology. The present study aims to retrospectively identify trends in race, age group, ZIP code income quartile, payer type, and urbanicity of patients that underwent image-guided spinal fusion surgery. **Material and Methods:** Using the National Inpatient Sample (NIS), a serial, cross-sectional analysis of spinal fusion cases from 2010 to 2021 was conducted, considering race, age group, ZIP code income quartile, payer type, and urbanicity to assess patterns across periods. The significance and magnitude of demographic shifts were determined using survey-weighted Poisson regression, difference-in-differences (DiD) risk ratios, and Cohen's h. **Results:** Relative to free-hand, image-guided spinal fusion

case share declined in central metropolitan areas (DiD RR 0.90, 95% CI 0.85-0.95, p < 0.001) with increased uptake in micropolitan counties (RR 1.09, 1.00-1.18, p = 0.049). Payer mix had less decline among private insurance payers (RR 1.04, 1.01-1.08, p = 0.013), increased growth among Medicare payers (RR 1.03, 1.00-1.06, p = 0.045), and decline in self-pay cases (RR 0.69, 0.54-0.88, p = 0.003). The highest income quartile saw decreases (RR 0.94, 0.89-0.99, p = 0.018) while the middle-upper quartile saw increases (RR 1.10, 1.04-1.17, p < 0.001). Patients 65 and over experienced slightly lower growth rates (RR 0.97, 0.94-1.00, p = 0.038). Native American patients displayed growth at substantially lower rates (RR 0.30, 0.21-0.43, p < 0.001). **Conclusion:** From 2010 to 2021, image-guided spinal fusion surgery shifted in demographic composition - use became less concentrated in urban, wealthy, and privately funded patients and diffused across more diverse geographies and financial contexts. Despite this trend, future expansion efforts in image-guided spinal fusion surgery should ensure that Native American patients are adequately supported.

ID: AGS26/2881
P0542: Prevalence and patterns of multi-system comorbidities among non-vertebral deformity scoliosis: a cohort study of 1,826 patients

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Introduction: This study proposes a novel clinical entity designated as non-vertebral deformity scoliosis (NVDS), characterized by scoliosis independent of vertebral malformations. NVDS demonstrates early-stage radiological homogeneity, thus leading to diagnostic oversimplification as scoliosis alone, potentially neglecting clinically impactful comorbidities. A comprehensive understanding of NVDS-associated comorbidities is crucial for precise diagnosis, treatment decision making, and quality of care assessment. The purpose of this study was to investigates the epidemiological patterns, healthcare burden, and pathophysiological interrelationships of comorbidities related to NVDS. **Material and Methods:** NVDS was defined as a composite diagnostic category encompassing idiopathic, neuromuscular, and syndromic scoliosis without vertebral malformations, with enrollment restricted to patients aged <50 years. A retrospective analysis was conducted to review the standard demographic information, radiographic data, and clinical records of 1,826 patients with NVDS from our Hospital. A multigroup comparative analysis was performed to evaluate the healthcare burden of the comorbidities. Univariate and multivariate logistic regression analyses were performed to identify the risk factors for various comorbidities and elucidate the interrelationships among different physiological systems. **Results:** Comorbidities were identified in 52.8% of patients with NVDS, with predominant involvement of the musculoskeletal (24.42%), cardiovascular (23.99%), and neurological (15.72%) systems. Rib anomalies (11.06%), vertebral number anomalies (8.11%), syringomyelia (5.70%), and neurofibromas (5.20%) were the most frequent comorbidities. Patients with comorbidities demonstrated a larger Cobb angle (p < 0.05) and longer hospitalization duration (p < 0.05) than patients without comorbidities. Female sex (p < 0.01) and large Cobb angles (p < 0.01) were independent risk factors for musculoskeletal and neurological comorbidities in NVDS, whereas reduced BMI (p = 0.002) was a key risk factor for cardiovascular comorbidities. Notably, NVDS patients with musculoskeletal comorbidities had an increased risk of respiratory comorbidities (p < 0.001). **Conclusion:** Our findings reveal that NVDS represents a complex multi-system disorder rather than an isolated spinal condition, with more than half of the patients exhibiting clinically significant comorbidities. The identified comorbidity predictors, including sex dimorphism, BMI, Cobb angle severity, and pre-existing system involvement, provide a prognostic framework for clinical management. These results underscore the need for a comprehensive multi-system evaluation in patients with NVDS to enable early comorbidity detection and personalized therapeutic interventions.

ID: AGS26/2948
P0543: Halo effect of prescribing guidelines for opioid naïve patients translates to opioid non-naïve patients undergoing lumbar decompression: a Michigan Spine Surgery Improvement Collaborative (MSSIC) Study

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Introduction: Chronic opioid dependency in spine surgery is an ongoing concern given the ongoing opioid epidemic. We have previously reported on our cohort of opioid-naïve patients, however the literature has shown that patients with opioid use at baseline are at higher risk of less favorable outcomes. Starting in 2022, MSSIC instituted state-wide prescribing guidelines for opioid naïve patients undergoing one- or two-level lumbar decompression surgery (laminectomy, laminotomy, foraminotomy, microdiscectomy) with performance goals of 80% compliance. The goal of this study was to evaluate whether there would be a form of a "halo" effect on prescribing patterns for patients with baseline opioid use, who were not subject to the performance measure. Our hypothesis was that the change in prescribing patterns for the opioid naïve population would also translate to the non-naïve population as well. **Material and Methods:** The MSSIC database was queried from January 2022 to December 2024 for patients across 29 hospitals and ASCs who underwent elective lumbar decompression surgery and had a pre-operative opioid use history. Patients were grouped based on compliance with the MSSIC morphine milli-equivalent (MME) post-operative prescribing cutoff for lumbar decompression: MME $\leq$ 225 (for a 7-day course). Outcomes analyzed at 90-days and 1-year included continued opioid use, post-operative complications, and patient reported outcomes (PROs) such as pain and functional scores. A multivariate analysis was conducted to control for confounders. **Results:** 9,240 patients were analyzed in this study. Prior to the study time frame, 59% of non-naïve patients were prescribed $\leq$ 225 MME, while after 74% patients were within this MME cutoff. Patients who were compliant with the MME cutoff were significantly less likely to have continued opioid use at 90 days and 1-year post-operative (OR 0.78; CI 0.62-0.98, p = 0.016 and OR 0.73; CI 0.56-0.95, p = 0.009, respectively). Those who were compliant with the MME cutoff were also significantly more likely to achieve a minimal clinically important difference (MCID) in back pain at 90 days and 1-year post-operative (OR 1.44; CI 1.08-1.93, p = 0.007 and OR 1.48; CI 1.08-2.04, p = 0.008, respectively). There were no significant differences in ED visits, readmissions, or any complication. **Conclusion:** We demonstrate that the implementation of a multi-institutional opioid prescribing guidelines for an opioid naïve population has additive benefits for the non-naïve population. We observed a reduction in total opiates prescribed which was associated with decreased long-term opioid use despite patients' pre-operative opioid use. Notably, this was achieved without deleterious effects realted to inadequate analgesia such as increased adverse events, ED visits, or worsened PROs.

ID: AGS26/3161
P0544: Patterns and outcomes of traumatic spinal injuries: a 5-year experience from a level i trauma center in Pakistan

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Introduction: Traumatic spinal injuries (TSIs) are a major cause of morbidity and mortality, particularly in low- and middle-income countries where prevention and trauma systems are underdeveloped. Understanding the demographics, mechanisms, anatomical distribution, and outcomes of TSIs is essential to guide policy and clinical practice. **Materials and Methods:** A retrospective observational study was conducted at a Level I trauma center in Pakistan between March 2020 and June 2025. Patients with radiologically confirmed spinal trauma were included. Data collected included age, sex, mechanism of injury, anatomical site, neurological status (ASIA scale), associated injuries, management strategy, ICU admission, length of stay (LOS), and outcomes. Logistic regression was applied to identify independent predictors of mortality. **Results:** A total of 1,050 patients were identified, representing 18.2% of all trauma admissions. The mean age was 38.9 years, with males comprising 74.1% of cases. Road traffic accidents (52.3%) and falls (35.7%) were the leading causes. Lumbar injuries (33.6%) were most common, followed by cervical (24.8%), thoracic (20.2%), and sacral (6.1%). Neurological deficits were present in 31.4%, particularly in cervical trauma. Nearly half (46.2%) underwent surgery, and 26.7% required ICU care. The mean LOS was 11.4 days. Overall mortality was 13.9%, highest among cervical injuries (17.2%). Independent predictors of mortality included neurological deficit (OR 1.89, p < 0.001), high Injury Severity Score (OR 1.06, p < 0.001), traumatic brain injury (OR 1.55, p = 0.008), and prolonged LOS (OR 1.02, p = 0.004). **Conclusion:** TSIs accounted for nearly one-fifth of trauma admissions, predominantly from road crashes and falls, with cervical injuries carrying the highest mortality. Preventive strategies, early

referral systems, and multidisciplinary trauma care are critical to reducing the burden of spinal trauma in Pakistan.

ID: AGS26/3254
P0545: Spinal dural arteriovenous fistulas: a single-center five-year experience

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Introduction: Spinal dural arteriovenous fistulas (sdAVFs) constitute the most common spinal vascular malformation in adults and a potentially reversible cause of progressive congestive myelopathy when recognized promptly. We summarize our department's experience in the past five years. **Material and Methods:** We performed a retrospective review of consecutive sdAVFs managed at a single tertiary neurosurgical center between 2020 and 2025. Variables included demographics, fistula level, surgical technique (laminectomy/hemilaminectomy, clip ligation, use of instrumentation), and immediate and long-term postoperative course. **Results:** Five patients were treated (median age 65.8 years [IQR 63.8-66.3]; 4 males, 1 female). Lesions were lumbar in three (L2-L3, L2, L5) and thoracic in two (T7, T12). Digital subtraction angiography (DSA) localized sdAVFs in the thoracolumbar/lumbosacral. All underwent microsurgical ligation of the arterialized intradural draining vein via laminectomy/hemilaminectomy with intraoperative Doppler confirmation. Intraoperative ICG was used in 3/5 cases. Early postoperative courses were uneventful with neurological stabilization or improvement; two patients were transferred to inpatient rehabilitation. Functional recovery was achieved in all cases with no relapses to date. **Conclusion:** Over five years, sdAVFs at our center were managed uniformly with microsurgical ligation, often with selective instrumentation, yielding early clinical stabilization or improvement and no recorded perioperative complications. The anatomical distribution (thoracolumbar predominance), frequent sacral-segment symptoms, and the centrality of prompt, definitive ligation are congruent with contemporary series and reviews, underscoring the need for early recognition and referral to optimize outcomes.

ID: AGS26/3476
P0546: The Impact of Perioperative Nutrition in Spine Surgery: A Systematic Review

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Introduction: Nutrition plays a key role in wound healing, immune function, and recovery from injury. In recent years, there is a growing interest in the role of nutrition and its relationship with spine surgery outcomes. However, the role and guidelines of individual nutrition components and their impact in spinal surgery have not been fully elucidated. **Objectives:** To review the current literature of the impact of different nutritional components in spinal surgery and suggest a comprehensive nutritional recommendations based on the current available literature. **Methods:** A PubMed , EBSCO and CINAHL database literature search was conducted from inception to 2025 following the PRISMA guidelines with the following keywords: "*nutrition", "nutritional status", "nutrition assessment","spine", "surgery"* using booleans AND or OR. **Results:** Forty-seven studies fit our inclusion criteria, including ten randomized controlled trials (RCTs), three prospective studies, and thirty-four retrospective analyses. Retrospective studies consistently showed that preoperative malnutrition is a significant risk factor for adverse outcomes, most commonly postoperative complications (n = 24), and increased length of stay (n = 15). Prospective and randomized trials demonstrated that targeted interventions could improve outcomes. High-protein supplements (e.g., 36 g/day + 1.2 g/kg or a fixed 60 g/day) was associated with reduced pain and disability scores, decreased infection rates, and preservation of paraspinal muscle area. For patients with vitamin D deficiency (< 20 ng/mL), supplementation with 3200 IU daily was found to reduce systemic inflammatory markers and improve early functional outcomes. In patients undergoing major spinal deformity or staged surgeries, compound nutrition formulas and/or postoperative total parenteral nutrition (TPN) helped preserve nutritional status, shorten hospital stays, and reduce the need for albumin transfusions. **Conclusion:** Based on the available evidence, we recommend perioperative nutritional optimization for patients undergoing spine surgery. Key recommendations include: 1) initiating high-protein supplementation preoperative and continuing for four weeks postoperatively; 2) correcting vitamin D deficiency with 3200 IU daily, beginning four weeks preoperatively and continuing postoperatively; and 3) utilizing tailored compounded nutrition or high-nitrogen TPN for patients undergoing complex reconstructive or staged procedures. Implementing these targeted strategies can help mitigate risks associated with malnutrition and improve surgical outcomes.

Imaging

ID: AGS26/190
P0547: Preoperative RVAD predicts curve correction in idiopathic early-onset scoliosis treated with traditional growing rods

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Introduction: Early-onset scoliosis (EOS) presents significant challenges for spine surgeons, particularly in balancing maximal deformity correction with minimal surgical risk. The rib vertebral angle difference (RVAD) is an established preoperative metric for EOS assessment, but its prognostic value for curve correction after traditional growing rod (TGR) surgery has not been previously defined. This study evaluates the predictive role of preoperative RVAD in idiopathic EOS (IEOS) patients undergoing TGR instrumentation. **Material and Methods:** A retrospective review was performed on 83 IEOS patients (35 males, 48 females; mean age 6.8 ± 1.06 years) treated with TGRs, biannual lengthening, and quarterly clinical follow-up until definitive fusion. Mean follow-up was 3.12 ± 1.06 years. Recorded parameters included Cobb's angle, preoperative RVAD, correction percentage, Early Onset Scoliosis Questionnaire 24 (EOSQ-24) scores, and complications. Correlations between preoperative RVAD and correction percentage were analyzed using Pearson's coefficient and linear regression. **Results:** Preoperative mean Cobb's angle was 72.2° ± 14.3, and mean preoperative RVAD was 37.2° ± 18.3. EOSQ-24 scores improved significantly postoperatively (35.0 ± 7.5 to 67.5 ± 5.2; $P < 0.001$). Preoperative RVAD demonstrated a strong negative correlation with correction percentage ($R = -0.821$, $P = 0.0317$), explaining 69.2% of variance ($R^2 = 0.6919$). Complications occurred in 17 patients (20%), including screw breakage (15%) and superficial wound infection (5%). **Conclusion:** Preoperative RVAD is a strong predictor of postoperative curve correction in IEOS patients treated with TGRs. TGR surgery yields substantial clinical and radiographic improvements with a low complication rate, supporting the inclusion of preoperative RVAD in preoperative planning.

ID: AGS26/252
P0548: MRI-based pedicle edema: a sign of segmental instability?

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Introduction: Degenerative spinal diseases, including degenerative disc disease, spondylolisthesis, and spinal stenosis, are prevalent conditions with increasing incidence in the aging adult population. Spinal pedicle edema (PE), a radiological finding seen on T2-weighted MRIs, may serve as a potential imaging biomarker for spinal instability and biomechanical segmental stress, and help guide clinical decision-making particularly in the context of surgical planning. The goals of this study are to evaluate the relationship between PE, long term clinical outcomes following surgery, and well-established markers of segmental instability. **Material and Methods:** A retrospective chart review was performed for patients undergoing elective 1 or 2 level fusion or decompression surgery for degenerative spondylosis with and without spondylolisthesis. The presence of PE was determined by identifying areas of hyperintense signal within the pedicles. Each MRI was independently reviewed by two investigators with confirmation by a board-certified orthopaedic spine surgeon. Spondylolisthesis was graded based on percent of vertebral slippage: Grade 0 (0%), Grade 1 (0-25%), and Grade 2 (25-50%). The association of spinal PE was evaluated against perioperative PROMIS and Oswestry Disability Index (ODI) outcome scores, spondylolisthesis grade, and type of surgical treatment. Descriptive and inferential statistics were performed. **Results:** A total of 145 (73 PE, 72 no-PE) patients were identified with no differences in distribution of gender, type of surgery, or preoperative outcome scores ($p>0.05$). Amongst the PE cohort, a similar degree of long-term clinical improvement was observed in patients who underwent isolated decompression versus decompression and fusion (ΔODI: -16.3 vs -17.3, $p = 0.875$, ΔPROMIS: -9.1 vs -1.7, $p = 0.125$). A relationship approaching significance was found between PE and facet cysts ($p = 0.089$), and grade of spondylolisthesis ($p = 0.053$). No other significant association was found between PE and established findings of spinal instability on MRIs (facet diastasis) and dynamic X-rays (Δ segmental angle and translation). **Conclusion:** MRI-based pedicle edema is found to be radiographically associated with the presence of lumbar facet cysts and grade of spondylolisthesis approaching significance, but did not in isolation affect clinical outcomes following decompression with and without fusion. Further higher-powered studies are warranted to provide surgically actionable insights on spinal instability.

ID: AGS26/361
P0549: Intra & inter-observer accuracy of Cobb's angle in scoliosis; six weeks apart

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Introduction: Cobb's angle is important for assessing the severity and progression of the curvature, as well as for monitoring and managing spine deformities. The reliability in the determination of Cobb's angle depends on the technical expertise of the observer, as well as on the correct

angle measurement and determination of the end vertebra. This study was aimed to find inter and intra observer variations while measuring cobb's angle on same radiographs 6 weeks apart. **Material and Methods:** A Reliability and Agreement study of total of 100 radiographs were studied and each observer with a different level of experience measured the same radiographs. Measurements were taken by trained observers at two time points, six weeks apart by five different readers with different years of experience, to check the accuracy in terms of years of experience at 6 weeks' interval at Dr. Ziauddin Hospital Karachi. **Results:** The mean differences in Inter-observer Cobb's angle recorded among raters ranged from 2.1° to 13.2° whereas the mean Intra-Observer Cobbs angle ranged from 2.31° to 10.15° when measuring on the same PA radiographs. **Conclusion:** The reliability in the determination of Cobb's angle depends on the technical expertise of the observer, as well as on the correct angle measurement and determination of the end vertebra. However, even with the same end vertebra used as a reference, Cobb's measurement may vary.

Keywords: Scoliosis, Cobbs Angle, Apex, End Vertebra, Risser sign

ID: AGS26/390
P0550: A Structured Ultrasound-Guided Workflow for Level Identification in Lumbar Spine Surgery

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Introduction: Despite the routine use of standard fluoroscopic verification, wrong-level spinal surgery continues to be a documented and concerning complication. Fluoroscopy exposes patients and staff to ionizing radiation and requires specialized personnel and infrastructure. Ultrasound (US) has been utilized for spinal level identification (SLI) in obstetric and anesthetic applications but remains underexplored in surgical workflows. **Material and Methods:** US imaging was performed on a series of fresh-frozen cadavers using a newly developed four-step protocol to identify lumbar intervertebral levels: (1) Midline localization, (2) Sacral surface tracing, (3) S1-Superior articular facet recognition, (4) Sequential interlaminar space enumeration. Five spinal needles were placed under US guidance in each specimen at lumbar levels L1-2 through L5-S1. Fluoroscopic imaging was used to confirm needle placement accuracy. **Results:** A total of 50 lumbar levels were assessed across ten cadaveric specimens using the four-step US workflow (with 25 procedures performed from the right side and 25 from the left). Fluoroscopic validation of US imaging demonstrated accurate level identification in 49 out of 50 cases, yielding an accuracy rate of 98%. The single misidentification occurred at the L5-S1 level during the third step of the workflow, where the S1 superior articular process was erroneously interpreted as the L5 inferior articular process. No additional misidentifications were observed in the subsequent procedures, and the four-step protocol proved reproducible across specimens. **Conclusion:** This cadaveric feasibility study establishes a high accuracy of US-guided lumbar level identification. A structured and reproducible workflow for level localization was established, integrating a novel four-step protocol. These findings represent a first step toward a radiation-free alternative for preoperative lumbar level identification in spinal surgery. Further investigations are warranted to validate these results in clinical settings.

ID: AGS26/473
P0551: Bertolotti syndrome

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Introduction: Lower back disorders are prevalent and a significant reason for emergency care visits. In 2020, 619 million people experienced low back pain, expected to rise to 843 million by 2050. A common cause is the presence of a lumbosacral transitional vertebra (LSTV). Objectives: This study evaluates the prevalence of Bertolotti Syndrome in patients with low back pain in an emergency setting and assesses interobserver reliability of LSTV classifications. **Methods:** A retrospective analysis of 1023 lumbar spine radiographs from patients presenting with low back pain from 2018 to 2020 was conducted. After exclusions, 469 radiographs were analyzed. Two orthopedists classified LSTVs using Tini and Castellvi's systems. Statistical analyses included the Kappa agreement index, two-proportion Z test, confidence interval for the mean, and p-value calculations. Results: The prevalence of Bertolotti Syndrome was 62.5% for observer A and 61.6% for observer B. Type I LSTV was the most common, with over 70% of cases, followed by type III at over 15%. The most frequent morphology was bilateral involvement of the transverse process, with more than 50% of cases exhibiting IB morphology according to both classifications. **Conclusion:** This study found a high incidence of

Bertolotti Syndrome (over 60%) in patients with low back pain seeking emergency care, suggesting that LSTV should be more frequently considered in differential diagnoses. Improved recognition of LSTV could lead to better management strategies for low back pain associated with this congenital anomaly. Level of evidence III; Retrospective Cohort Study.

ID: AGS26/565
P0552: Validation of an L1PA-based model for predicting 2-year postoperative pelvic tilt after adult spinal deformity surgery

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Introduction: Proper sagittal alignment is critical after adult spinal deformity (ASD) surgery, with pelvic tilt (PT) serving as a key parameter for long-term outcomes. The L1 pelvic angle (PA) and T4PA are valuable parameters for assessing sagittal balance. This study evaluates an L1PA-based model for predicting PT at 2 years postoperative in well aligned ASD patients. **Material and Methods:** Sagittal alignment of ASD patients fused from T1-T4 to the sacrum was assessed. A well-aligned training cohort (WA1) was defined by L1PA = 0.5*(Pelvic Incidence (PI)) - 19 ± 2 and a T4-L1PA mismatch of -3 to +1. We created a regression model to relate immediate postoperative radiographic parameters to 2-year postoperative PT. This model was validated on a separate cohort of aligned ASD patients fused from T5-12 to S1. Finally, we explored if broadening the criteria (WA2) to L1PA = 0.5*PI - 21 ± 5 would impact the model's accuracy. **Results:** A total of 6 ASD patients met our inclusion criteria for WA1, resulting in the following equation: $PT2Y=1.063\times L1PA+11.789$ ($R2=0.61$)**.** The model was validated on 21 ASD patients from our validation cohort, where it maintained predictive power with an R^2 of 0.59 and a mean squared error of ±5.55. However, relaxing the L1PA alignment criteria to L1PA = 0.5PI - 21±5 resulted in reduced accuracy, with the R^2 dropping to 0.44. **Conclusion:** This study validates an L1PA-based model for predicting PT at 2 years postoperatively in well aligned patients. Model testing revealed that stricter L1PA alignment criteria yielded more reliable PT predictions at 2 years. This relationship serves as a valuable tool for preoperative planning by accurately forecasting PT which could be used to better assess whether patients will achieve optimal sagittal alignment two years after surgery. Future research should explore larger cohorts and refine predictive models to enhance surgical planning and patient-specific alignment goals.

ID: AGS26/773
P0553: The cord-to-canal ratio as a radiographic tool in congenital cervical spinal stenosis

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Introduction: Congenital cervical spinal stenosis (CCS), defined by a reduced sagittal diameter of the cervical spinal canal, is a known risk factor for early onset degenerative cervical myelopathy (DCM). Traditional assessment using the Torg-Pavlov ratio (TPR) on radiographs is limited by its focus on osseous anatomy alone. MRI, the gold standard for DCM evaluation, enables assessment of both bony and soft tissue structures and has prompted development of more comprehensive metrics such as the Cord-to-Canal ratio (CCR) and the Spinal Cord Occupation Ratio (SCOR). While multiple advanced classifications now exist, there is no consensus on which MRI-based parameter best correlates with CCS clinical symptoms. This study evaluates the CCR, MRI TPR, and SCOR to determine their interrelationships and their diagnostic utility in identifying symptomatic CCS. **Material and Methods:** Ninety-seven cervical spine MRIs obtained at a single quaternary care center over a 12-month period, January 2024 - December 2024, were retrospectively reviewed. Measurements were taken at the C5 mid-vertebral level to calculate three MRI-based metrics: CCR (sagittal diameter of the cord/sac), MRI TPR (sagittal dural sac diameter/vertebral body diameter), and the SCOR (axial area of the cord/dural sac). Patient charts were reviewed for myelopathic presentations of signs/symptoms. Sensitivity, specificity, and area under the curve (AUC) were determined for each metric using receiver operating characteristic (ROC) analysis. Pearson correlation coefficients were computed to assess inter-metric relationships. The TPRs were inverted to ensure higher values corresponded with greater stenosis severity. **Results:** Of the 97 included patients, 56% (n = 54) exhibited myelopathic symptoms. The CCR demonstrated the highest sensitivity (80%) in detecting symptomatic myelopathy, compared to MRI TPR (62%) and SCOR (75%) but had the lowest specificity (44% vs. 76% and 65%, respectively). SCOR achieved the highest AUC (0.75), followed by Torg-Pavlov (0.69) and Cord-to-Canal (0.63). Correlation analysis showed a stronger relationship between CCR and TPR ($r = -0.52$) than between SCOR and inverted Torg-Pavlov ($r = 0.20$; $p < 0.0001$). No significant correlation differences were observed between symptomatic and asymptomatic groups. **Conclusion:** This study underscores the varying degrees of correlation between commonly used radiological indices for CCS. The CCR demonstrated a moderate inverse

correlation with the TPR, suggesting that while these measures are related, they assess distinct aspects of cervical canal stenosis. Conversely, the weak correlation between the Torg-Pavlov Inverted Ratio and SCOR suggests limited predictive value of SCOR in assessing CCS severity. CCR correlates with previously described measures of CCS, supporting its validity as an assessment tool. Given its high sensitivity and low specificity, the CCR may serve as an effective initial screening tool, particularly in clinical settings where early detection and minimizing missed diagnoses are critical.

ID: AGS26/782
P0554: Morphometric analysis of lumbar nerve root take-off in the lumbar spine

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Introduction: Although lateral recess and foraminal stenosis are known causes of radiculopathy, the vertical origin (takeoff height) of lumbar nerve roots has not been quantitatively assessed. A higher nerve root origin from the thecal sac, or root takeoff, may be of clinical relevance, as a more proximal takeoff will consequently result in a greater length of neural tissue traversing the lateral recess. This study aims to characterize variability in lumbar nerve root takeoff height using CT myelography in patients with lumbar spinal pathology. **Materials and Methods:** Retrospective review of CT myelograms from patients with lumbar pathology with measurements of the vertical origin (root takeoff height) of L4 and L5 nerve roots relative to total interpedicular height, producing a takeoff ratio (h/H). Clinical records were reviewed to categorize symptom distribution as leg-dominant, back-dominant, or mixed. Statistical analyses included inter-rater reliability (κ), intra-rater reliability, group comparisons, correlation testing between takeoff ratio and symptom type, and a priori power analysis. **Results:** A total of 75 patients were included. Nerve root takeoff height showed substantial interindividual variability at both L3-4 and L4-5 levels. **Conclusion:** Lumbar nerve root takeoff height demonstrates meaningful variability across patients, representing an anatomical parameter not typically considered in conventional imaging assessments. In this study, we observed that such variability may influence how nerve roots traverse the lateral recess. We speculate that a higher root takeoff could predispose patients to radicular symptoms; however, further investigation is needed to confirm this relationship.

ID: AGS26/786
P0555: Utility of the Goutallier classification and the Singapore Sarcopenia Index (SSI) in the assessment of paravertebral muscles as early predictors of sarcopenia.

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Introduction: Image based assessments of muscle quality and ectopic fat infiltration are increasingly recognised as relevant in assessing for sarcopenia. Computed Tomography (CT) is useful in quantifying muscle mass. The Singapore Sarcopenia Index (SSI) was recently proposed as an objective, quantitative assessment of muscle density by measuring Hounsfield Units (HU) on CT scans. However, CT based measures lack assessment of muscle fatty infiltration. The Goutallier Classification has been used to evaluate paravertebral muscle ectopic fat infiltration in sarcopenic adults. We investigate the relationship between the SSI and the Goutalier Classification and evaluate their utility as predictors of sarcopenia. **Material and Methods:** We group patients into 2 groups based on age (Group A: < 65 vs Group B: ≥ 65). CT and MRI lumbar spine scans were analysed retrospectively. HU of the psoas, erector spinae, multifidus and subcutaneous tissue were measured at the level of L3 The SSI was calculated for each muscle respectively. The Goutallier classification was utilised to evaluate the amount of ectopic fat infiltration of the same muscle groups on MRI scan. **Results:** 34 patients were assessed as part of this pilot study. The SSI was significantly different between groups A and B for the erector spinae and multifidus ($p=0.021$; $p=0.033$) but not the psoas. The Goutallier classification was significantly different between groups A and B for all muscles. Age had a significant positive correlation with Goutallier classification for all muscle groups ($p < 0.0001$). There was a significant correlation between the SSI and the Goutallier classification for the erector spinae and multifidus ($r = -0.59$; $p = 0.0002$ and $r = -0.583$; $p = 0.0003$ respectively) but not the psoas ($r = -0.289$; $p = 0.098$). **Conclusion:** The SSI is a reproducible and consistent tool in assessing muscle quality. This study has shown that it can be used in conjuncture with the Goutallier classification to provide more detailed assessment of the paravertebral muscles. This has the potential to streamline the early detection of sarcopenia and influence the timing of treatment.

ID: AGS26/3270
P0557 Reliability of Intraoperative pelvic inlet view to assess bicortical S1 pedicle screw placement

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Introduction: Bicortical S1 pedicle screw fixation is believed to offer biomechanical advantage, especially in the setting of low sacral bone density. However, screws that are too long can put neurovascular structures at risk including the L5 nerve root.6,7 The lateral sacral view is unreliable at determining the degree of anterior S1 pedicle screw perforation given the anterior recession of the sacral ala along which the L5 nerve root runs. The pelvic inlet view, however, is frequently used in pelvic trauma to evaluate the anterior border of the upper sacral segment in the settings of iliosacral and transiliac-transsacral screw fixation. In the study, we seek to assess the reliability of the pelvic inlet view to assess for the degree of anterior S1 pedicle screw penetration. **Material and Methods:** A retrospective radiographic review was performed of all patients who underwent S1 pedicle screw fixation in which pelvic inlet and lateral sacral fluoroscopic views were saved and either an intraoperative O-Arm or immediate postoperative CT scan was available as a reference standard. Fluoroscopic inlet views were independently evaluated by three fellowship-trained spine surgeons. For the pelvic inlet view, each observer classified screw position as: no bicortical perforation, <1 screw diameter perforation, or >1 screw diameter perforation. On the lateral, observers classified whether zero, one or two screws were bicrotical. Inter- and intra-rater reliability were calculated using the weighted kappa coefficient, in R (v 4.4.2). Observer assessments were compared with the true degree of perforation determined by axial CT imaging to calculate sensitivity and specificity. **Results:** Seventeen patients with 35 screws (1 revision surgery) were assessed by three spine fellowship-trained surgeons. Pelvic inlet intra-rater reliability was excellent for all observers (Observer 1: $\kappa = 0.90$, 95% CI 0.68-0.97; Observer 2: $\kappa = 0.89$, 95% CI 0.69-0.96; Observer 3: $\kappa = 0.95$, 95% CI 0.86-1.00). Pairwise inter-rater reliability was also excellent (Observers 1 vs 2: $\kappa = 0.86$, 95% CI 0.59-0.97; Observers 1 vs 3: $\kappa = 0.91$, 95% CI 0.73-0.98; Observers 2 vs 3: $\kappa = 0.88$, 95% CI 0.64-0.97). Overall inter-rater agreement across all three observers (Light's κ) was 0.84 (95% CI 0.58-0.93). Compared with CT/O-Arm, pelvic inlet demonstrated pooled accuracy across observers of 0.72 (95% CI 0.63-0.81) with sensitivity 0.67 and specificity 0.92. For lateral views, pooled accuracy was 0.68, sensitivity was 0.68, and specificity was 0.50. **Conclusion:** The pelvic inlet view demonstrated excellent inter- and intra-rater reliability for assessing the degree of bicortical S1 pedicle screw engagement and favorable sensitivity and specificity as compared to the pelvic lateral. The pelvic inlet view may serve as a more reliable alternative to assessing bicortical S1 pedicle purchase as compared to the sacral lateral, which has traditionally underestimated bicortical perforation.

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P0558: BMD in lumbar spine: a tool of underdiagnosis? Comparison of Lumbar Spine Hounsfield Units with dual-energy X-ray absorptiometry in diagnosing osteoporosis

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Introduction: Dual-energy X-ray absorptiometry (DXA) is the gold standard for osteoporosis diagnosis, yet it fails to capture crucial regional variations in trabecular bone quality within the vertebral body, a common site for osteoporotic fractures. Degenerative changes such as osteophytes in the facet joints can artificially inflate Bone Mineral Density (BMD) values, masking underlying bone fragility. This study evaluates the diagnostic sensitivity of vertebral body Hounsfield Units (HU) derived from computed tomography (CT) against DXR for osteoporosis, addressing the issue of false negatives in BMD testing. **Material and Methods:** We compared BMD T-scores from DXA and individual vertebral body HU values obtained from existing CT scans for 82 individual lumbar vertebrae. Regional HU for facet joints and spinous processes were evaluated as well. Vertebral body HU of 100 and below was considered to be osteoporotic, based on the existing literature. **Results:** The mean HU of the vertebral bodies were significantly lower than the HU of facet joints and spinous process ($p < 0.001$). Our data indicate that vertebral HU measurements offer superior sensitivity (97.6%) for detecting localized bone density deficits compared to global BMD scores (18.6%). Degenerative changes, as represented by facetal and spinous process average HU, was higher in the group with false negative BMD at 269 vs 204 in the group with true negative BMD ($p = 0.03$). **Conclusion:** Since vertebral HU assessment is a more sensitive tool that can reduce false negatives, we suggest a revamp of the DXA-based BMD to be done in the lateral view instead of anterior-posterior (AP). This would omit the interference from degenerative changes of the posterior elements. The reliance on current DXA-based BMD in the AP view for osteoporosis diagnosis may result in missed diagnoses, particularly in patients with spinal degenerative disease.

ID: AGS26/909
P0559: The impact of initial kyphosis and paravertebral muscle atrophy in thoracolumbar kyphosis progression

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Introduction: Osteoporotic vertebral fractures (OVF) are a significant cause of morbidity, often leading to progressive spinal deformity despite conservative treatment. The development of progressive kyphosis, particularly at the thoracolumbar junction, can result in persistent pain, reduced pulmonary function, and impaired physical mobility, severely impacting a patient's quality of life. Identifying early imaging markers that can predict this progression is crucial for guiding clinical decisions and implementing timely interventions to prevent long-term disability. **Objective:** This study aimed to identify and evaluate early imaging predictors of progressive thoracolumbar kyphosis (TLK) in patients with osteoporotic fractures of the T11 or T12 vertebrae who underwent conservative management. **Material and Methods:** This retrospective study reviewed a total of 343 patients diagnosed with vertebral fracture at our hospital between May 2014 and August 2023. From this cohort, we included 39 patients with T11 or T12 OVF who underwent conservative treatment and had a 2-year radiographic follow-up. Patients with initial TLK $\geq 40^{\circ}$, non-union, or surgical intervention were excluded. We measured initial TLK, local kyphosis (LK), L1 Hounsfield Unit (HU), and T10 paravertebral muscle cross-sectional area (CSA) and Goutallier classification (GC) on MRI. Patients were divided into a kyphosis group (K-group, 2-year TLK $\geq 40^{\circ}$) and a non-kyphosis group (NK-group, 2-year TLK $<40^{\circ}$) for comparative analysis. **Results:** The K-group consisted of 8 patients and the NK-group had 31. There were no significant differences in age, BMI, or L1 HU. The K-group had significantly larger initial LK ($p = 0.001$) and TLK ($p = 0.001$) compared to the NK-group. Although initial vertebral mobility was not significantly different ($p = 0.13$), the K-group showed a significantly smaller paravertebral muscle CSA ($p = 0.02$). In patients with initial LK mobility less than 10°, a smaller paravertebral muscle CSA ($p = 0.047$) and more severe fatty degeneration ($p = 0.04$) were associated with greater TLK progression. **Conclusion:** In osteoporotic vertebral fractures of the thoracolumbar junction, a larger initial kyphosis is a key risk factor for progression. Furthermore, limited vertebral mobility combined with muscle atrophy and severe fatty degeneration in the paravertebral muscles may also be a significant predictor of future kyphosis.

ID: AGS26/972
P0560: A similar PI can contribute to totally different patterns of lumbar lordosis in asympotmatic population

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Introduction: With the development of sagittal alignment restoration, GAP score has been proposed to overcome the disadvantage of classical Schwab's classification. Despite GAP score and its modified versions bring the conception of sagittal balance restoration from absolute numerical values to pelvic incidence (PI)-based proportional method, this score system mainly relies on the linear regression relationships between PI and other parameters derived from the asymptomatic population. However, the predictive effect of regression model between PI and other parameters is relatively low in Asian population, and this may be related to the phenomenon that a similar PI can refer to totally different lumbar lordosis (LL) and sacral slope (SS) in the asymptomatic population, which significantly influence the predictive effect of PI on other parameters. To better understand the deep mechanism of sagittal balance, this phenomenon needs to be further clarified. **Material and Methods:** The present study recruited 380 asymptomatic Chinese volunteers aged between 18 and 45 years. Sagittal parameters, including PI, pelvic tilt(PT), SS ,LL and segmental lordosis of the vertebrae and intervertebral discs from L1 to S1, were measured on full-spine X-rays. The volunteers were stratified into three groups according to PI ranges of 33.7°-41.9°(group 1), 42.0°-50.2°(group 2), and 50.3°-58.5°(group 3). Within each group, the sagittal parameters were compared between the maximum and minimum LL determined by the mean LL ± 0.5 standard deviation. **Results:** Among these volunteers, the average age was 26.4±7.0 years, with a mean PI of 46.1° ±8.3°. There were 103, 143, and 79 volunteers in group 1 to 3, respectively. After screening for extreme LL subgroups and controlling PI within the three groups, the extreme LL subgroups consisted of 56, 86, and 46 volunteers, respectively. From group 1 to 3, the mean LL of the maximum subgroups were 55.2° ± 3.4°, 61.3° ± 4.3°, and 62.5° ± 4.9°, and the mean SS were 35.0° ± 2.9°, 39.9° ± 3.3°, and 44.0° ± 4.0°, respectively. The corresponding minimum value groups had mean LL of 36.8° ± 4.5°, 41.2° ± 5.2°, and 46.7° ± 4.1°, and mean SS of 27.4° ± 3.8°, 31.5° ± 4.1°, and 36.4° ± 3.8°. From group 1 to 3, the differences in the total Cobb angle of the lumbar vertebrae between the maximum and corresponding minimum LL subgroups were 5.6° (6.0°-0.4°), 5.4° (10.2°-4.8°), and 6.2° (15.3°-9.1°), respectively. The differences in the total intervertebral Cobb angle (from L1/2 to the L5/S1) were 12.7° (49.1°-36.4°), 14.7° (51.1°-36.4°), and 9.6° (47.2°-37.6°), respectively. **Conclusion:** In group 1 and group 2, the difference in LL between the maximum and minimum subgroups mainly originates from the intervertebral disc spaces. However, with the increase of PI, the influence of vertebral bodies increases in group 3. Within the three groups, the maximum and minimum value groups exhibit a relationship of mean ΔLL- mean ΔSS≈ 10°,indicating that over-extension of lumbar curvature could be an important

reason for maximum LL, which could play am important role in the prevalence of lumbar degeneration.

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P0561: How reliable are our intraoperative X-rays? Predicting post-fusion sagittal alignment

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Introduction: Restoring sagittal balance and lumbopelvic alignment effectively is essential in treating lumbosacral degenerative disorders with instrumented fusion. The L1 pelvic angle (L1PA) has shown promise as a postoperative spinopelvic alignment target, demonstrating an association with health-related quality-of-life measures. While surgeons commonly rely on intraoperative X-rays to assess alignment quality, the precision of these measurements and their predictive value for postoperative standing alignment remain underexplored. This study aimed to analyze the correlation, predictive value, and agreement between intraoperative and postoperative X-ray measurements for lumbar lordosis (L1S1) and lumbopelvic alignment (L1PA) in patients undergoing lumbar spine fusion and instrumentation. **Material and Methods:** Forty-nine patients (69% female, mean age 43.6 years) undergoing lumbosacral fusion for degenerative conditions were included. Inclusion criteria were age 18-65 years and absence of thoracic/thoracolumbar deformity. Intraoperative C-arm fluoroscopy images, taken post-instrumentation from L1 to the femoral heads using the NuVasive Pulse Navigation platform, facilitated a single extended image. Pelvic incidence (PI), lumbar lordosis (L1S1), segmental lordosis (L4-S1), and L1PA angle (L1 centroid to hip axis to midpoint of S1 endplate) were recorded intraoperatively and on full-spine sagittal standing postoperative X-rays. Statistical analysis included mean comparisons of intraoperative and postoperative parameters, correlation and linear regression for predictive value, and Bland-Altman limits of agreement. **Results:** Intra- and postoperative L1S1 (56.6° vs 54.7°, p = 0.1) and L4S1 (41.9° vs 40.0°, p = 0.1) did not differ. Postoperative L1-S1 was related to intraoperative L1S1 (ρ = 0.70, p < .001), intraoperative L4S1 (ρ = 0.59, p < 0.001), PI (ρ = 0.52, p < .001), but no correlation was found with intraoperative L1PA. In a stepwise multiple linear regression analysis to predict postoperative L1S1, only intraoperative L1S1 was included in the model (β: 0.7, r2: 0.6, RMSE 7.7). Bland-Altman limits of agreement were -16.5° to 20.4°. Postoperative L1PA was statistically different from intraoperative L1PA (3.4° vs 6.0°, p=.002). Postoperative L1PA correlated with intraoperative L1PA (ρ: 0.66, p < .001) and PI (ρ: 0.54, p < .001), but not with intraoperative L1S1 nor intraoperative L4S1. In a stepwise multiple regression to predict postoperative L1PA, intraoperative L1PA (β: 0.7, p < .001) and intraoperative L1S1 (β: 0.1, p = .01) were included in the model with an R^2: 0.59 and RMSE: 3.4. Bland-Altman limits of agreement were -9.8° to 5.0°. **Conclusion:** While intraoperative radiographic measurements can estimate postoperative L1-S1 and L1-PA angles, their utility is limited. Intraoperative variables only account for 60% of the variance in postoperative outcomes, and the wide limits of agreement preclude interchangeable use of intraoperative and postoperative data.

ID: AGS26/1112
P0562: The utility of MRI for spinal clearance in blunt trauma: a retrospective cohort study of 539 blunt trauma patients in a level one trauma center in Singapore

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Introduction: The majority of spinal injuries occur secondary to blunt trauma and patients with significant blunt trauma must be assumed to have an unstable spinal injury until complete radiological and clinical assessment. MRI scans are highly sensitive but can be logistically difficult to perform in ICU patients and may prolong duration of spinal immobilization unnecessarily. In this study we investigated the efficacy of MRI scans in changing patient management in blunt trauma patients and the clinical and CT findings which would indicate an MRI spine. **Material and Methods:** This is a retrospective study of patients with significant blunt trauma who had MRI of the spine performed between 2018 to 2023 in the National University Hospital, Singapore. Indications for an MRI spine in our center include the presence of spinal fractures on CT scan, neurological deficits, obtunded patient (unable to co-operate with physical examination), tenderness/pain over the spine on physical examination and underlying ankylosing conditions of the spine. Significant blunt trauma is defined as per the Canadian C spine Rule criteria. Fracture morphology was classified based on the AO spine fracture classifications. Change in patient management was defined as MRI scan leading to decision to operate on patient or change from conservative to operative management. We defined a stable fracture as AO type A0 cervical or thoracolumbar fracture and other fractures as potentially unstable. Univariate and

Multivariate Analysis were performed. Number of days in which patients were kept on spinal nursing while awaiting MRI was also recorded. **Results:** In total 539 patients, 135 (25%) female and 404 (75%) males, were identified who had MRI spine performed for spinal clearance. Of these MRI scans performed, 234 (43.6%) led to change in patient management. On multivariate analysis, the presence of a potentially unstable fracture ($p < 0.01$) and the presence of a neurological deficit ($p < 0.01$) were found to be significant predictors of an MRI scan being indicted and leading to a change in patient management. Of note when using the presence of a potentially unstable fracture and/or neurological deficit as a criteria for performing an MRI, 234/419 (55.9%) of scans led to a change in patient management, while in patients who did not meet this criteria 0/110 (0.05) % of MRI scans led to a change in management. In patients who had MRI scans which did not change management, a mean of 2 (range 0-14) days was spent undergoing spinal nursing while awaiting MRI. **Conclusion:** In blunt trauma patients with no clear indication for MRI, an additional MRI scan may lead to unnecessary prolongation of spinal nursing with no additional benefit to the patient. Further study to clearly delineate the indications for an MRI as well as the additional costs and medical complications associated with un-indicated MRI scans are warranted.

ID: AGS26/1171
P0563: Coronary artery, thoracic aorta and cardiac valve calcifications in current and former smokers with diffuse idiopathic skeletal hyperostosis

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Introduction: Diffuse idiopathic skeletal hyperostosis (DISH) is a systemic condition characterized by new bony bridges around ligaments, tendons, and joint capsules, in particular of the spine. DISH is strongly associated with obesity, diabetes mellitus, and ischemic stroke. It is hypothesized that diffuse idiopathic skeletal hyperostosis (DISH) and cardiovascular events are causally related via vascular calcifications, but data are inconclusive. We aimed to assess the association between DISH and calcifications of the coronaries, thoracic aorta, aortic valve, and mitral annulus/valve. **Material and Methods:** Our study population is derived from the Dutch Belgian Lung cancer screening trial and included a total of 3514 male former and current smokers. Calcification volumes of each area of interest were obtained using in house developed automatic validated software from the chest computed tomography scans. Two observers evaluated DISH according to Resnick criteria. Relations between DISH and calcification volumes were evaluated with multivariate linear and logistic regression models. **Results:** A total of 241 subjects (6.7%) had DISH. Subjects with DISH had higher coronary (402 mm3 vs. 173 mm3), aorta (1158 mm3 vs. 486 mm3) calcification volumes, and a higher proportion of aortic (39.5% vs. 22.3%) and mitral valve/annulus calcifications (5.8% vs 2.8%). Aorta calcifications (OR:1.55;95%CI:1.09-2.20) and aortic valve calcifications (OR:1.52;95%CI:1.13-2.02) presence were associated with DISH in multivariate analyses. DISH was associated with more thoracic aorta (β:0.13; 95%CI:0.04, 0.26), and aortic valve calcification volumes per 500 mm3 (β:0.03; 95%CI:0.004, 0.06), but not coronary artery or mitral valve calcification volumes. **Conclusion:** In a population of male current and former smokers, the presence of DISH was associated with calcification volumes of the aorta and the aortic valve, but not with calcifications of the coronary arteries or mitral valve. These findings support the hypothesis that DISH and cardiovascular calcifications may share a common biological pathway.

ID: AGS26/1282
P0564: Metabolite and imaging biomarkers as predictors of postoperative recovery in cervical myelopathy

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Background: Cervical myelopathy presents a heterogeneous recovery profile following surgical intervention, with limited preoperative tools for prognostication. This study investigates the clinical, imaging, and magnetic resonance spectroscopy (MRS)-derived metabolite parameters associated with differential recovery outcomes in a stratified cohort. **Methods:** This is a prospective cohort study in which patients with cervical myelopathy who underwent surgical management were followed for 2 years. Patients were categorised into poor and good recovery groups based on postoperative mJOA recovery rate > 50% and < 50% respectively. Demographic, clinical, and imaging variables were compared, with a focus on metabolite ratios obtained via MRS. Statistical correlations and receiver operating characteristic (ROC) analyses were used to assess predictive accuracy. **Results:** The study included 69 patients, divided into poor (n = 34) and good (n = 35) recovery groups. Demographic factors such as age and gender showed no significant differences between groups. However, comorbidities-especially diabetes and hypertension-were more common in the poor recovery group (64.7% vs. 34.3%, p = 0.012). Preoperative mJOA scores were significantly lower in the poor recovery group (10.91 ± 1.64 vs. 14.31 ± 1.51, p = 0.001), indicating greater neurological impairment before surgery. Grade 3 stenosis was also more

frequent in the poor recovery group (82.4% vs. 48.6%, p = 0.003). MRS revealed elevated Cho/NAA, Cr/NAA, and MIn/NAA ratios in the poor recovery group, all of which showed strong inverse correlations with recovery rate (Cho/NAA: r = -0.522, p < 0.001). Conversely, NAA/Cr (r = 0.279, p = 0.020) and FA (r = 0.239, p = 0.048) correlated positively with recovery, while ADC values were negatively associated (r = -0.241, p = 0.042). These findings suggest that neuronal integrity and white matter preservation are favourable prognostic indicators, whereas glial activation and diffusion abnormalities reflect irreversible damage. ROC analysis demonstrated that Cho/NAA (AUC = 0.759), Cr/NAA (AUC = 0.750), and MIn/NAA (AUC = 0.686) had good discriminatory power in predicting recovery outcomes. Other metabolites such as glutathione, glutamate, glycine, and lactate showed no significant associations, indicating limited utility in this context. **Conclusion:** Metabolite ratios derived from MRS-particularly those involving NAA-serve as robust biomarkers for predicting postoperative recovery in cervical myelopathy. Elevated Cho/NAA, Cr/NAA, and MIn/NAA ratios are indicative of poor outcomes, likely reflecting glial proliferation and neuronal loss. These findings support the integration of metabolite profiling into preoperative assessment protocols, complementing clinical and imaging parameters to enhance prognostic accuracy.

ID: AGS26/1289

P0565: Optimizing diffusion tensor imaging and tractography for enhanced visualization and clinical assessment of cervical spinal cord pathologies

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Introduction: Spinal cord injuries (SCIs), affecting 250,000-500,000 people globally and 17,000 annually in the U.S., result from motor vehicle collisions (38%), falls (30%), violence (13%), sports injuries (9%), and medical errors (5%). Magnetic Resonance Imaging (MRI) is the gold standard for assessing spinal cord pathologies, providing detailed soft tissue visualization. However, conventional MRI lacks directional information on white matter tracts, limiting insights into neural fiber disruptions. Diffusion Tensor Imaging (DTI) measures water molecule diffusion to map axonal anisotropy via fractional anisotropy (FA) and mean diffusivity (MD), enabling tractography to visualize nerve fiber orientation. Despite its use in brain imaging, DTI is underutilized in spinal cord assessment due to acquisition and processing challenges. This study evaluates an optimized DTI protocol for cervical spine MRI in four pathology cases (cord contusion, metastasis, myelopathy, multiple sclerosis) and six controls to assess its ability to reveal fiber disruptions for enhanced diagnosis, surgical planning, and follow-up evaluation. **Material and Methods:** This retrospective, IRB-approved study integrated DTI into cervical spine MRI on a 3T scanner using spin-echo echo-planar imaging (TR 9,200 ms, TE 82 ms, 37 slices, 3 mm thickness, 128×128 matrix, b-values 0 and 1000 s/mm^2 across six directions, 2-minute scan). Six controls with normal MRIs and four pathology cases were selected from PACS: an 82-year-old male with C3-C4 contusion, a 62-year-old female with C2-C3 metastasis from breast cancer, a 51-year-old male with C5-C6 myelopathy from disc extrusion, and a 35-year-old female with multiple sclerosis (MS) flare showing multifocal demyelination. Images were anonymized, processed in DSI Studio (Chen May 17, 2024) with distortion correction, and segmented to the brainstem. Regions of interest (ROIs) were set at C2-C3, C5-C6, and C7-T1 for controls, and lesion-level plus cranial/caudal for pathologies. Fiber tracking used FA threshold 0.01914, 10-1000 mm length, with spurious tracts filtered. FA and MD were extracted, with Z-scores comparing pathology metrics to control baselines. **Results:** Tractography revealed fiber disruptions not visible on standard MRI. Controls showed uniform cranio-caudal tracts (FA 0.45-0.52, MD 0.75-0.85 × 10^{-3} mm^2/s). Contusion displayed posterior fiber reorientation at C3-C4 (low FA, Z-score -1.8; normal MD). Metastasis showed compressed fibers at C2-C3 (low FA, Z-score -2.1; high MD, Z-score +2.3). Myelopathy indicated poor C5-C6 connectivity (high MD, Z-score +1.9; normal FA). MS showed low lesion FA (Z-score -1.5). Reduced FA and elevated MD correlated with lesion severity, though six-direction acquisition introduced minor artifacts. **Conclusion:** DTI tractography enhances spinal cord lesion assessment by visualizing fiber disruptions and quantifying FA/MD changes, supporting diagnosis, surgical planning, and follow-up in a 2-minute, non-invasive scan. Limitations include small sample size, six-direction acquisition reducing precision, and eddy current artifacts. Future optimizations involve increasing directions (≥ 17), adding reverse phase encoding, and adopting multi-fiber resolution to improve accuracy for routine clinical use.

ID: AGS26/1364

P0566: Radiotherapy-induced basilar invagination: a case report and literature review

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Introduction: Basilar invagination (BI) is a rare craniovertebral junction anomaly characterized by abnormal prolapse of the odontoid process through the foramen magnum. While congenital causes predominate, BI can also develop secondary to inflammatory, degenerative, or post-radiotherapy changes. **Case Presentation:** A 64-year-old male with a history of radiotherapy for squamous cell carcinoma of the tongue developed progressive cervical pain and restricted motion. Imaging revealed odontoid process protrusion above Chamberlain's line, consistent with BI. The patient underwent occipitocervical stabilization, achieving symptom resolution. **Discussion:** This case underscores the potential for delayed craniovertebral instability following radiotherapy. The pathophysiology of radiation-induced BI remains poorly characterized and demands clinical awareness. Early imaging surveillance in post-radiotherapy patients with cervical symptoms is critical for timely diagnosis and intervention. **Conclusion:** Basilar invagination secondary to radiotherapy is a rare but serious complication that requires early recognition to prevent neurological compromise. This case highlights the need for vigilance in head and neck cancer survivors and contributes to the understanding of post-radiation craniovertebral junction pathology.

ID: AGS26/1456
P0567: Comparison of sagittal aligment metrics

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Introduction: Understanding a patient's sagittal alignment is essential for surgical planning and aligning expectations with patients. This study aimed to assess the reproducibility of several sagittal-alignment measurements and their applicability in a Brazilian outpatient setting. **Material and Methods:** Two raters independently measured sagittal vertical axis (SVA), spinopelvic sagittal angle (SSA), global tilt (GT), T1-spinopelvic inclination (T1-SPI), and occiput-to-C7 distance in horizontal alignment (ODHA). Reproducibility was analyzed with intraclass correlation coefficients (ICCs); p-values < 0.05 were considered significant. **Results:** Nine patients were evaluated. All measurement strategies showed excellent reproducibility (ICC > 0.9) except T1-SPI, which demonstrated low reproducibility (ICC ≈ 0.4). In addition, SVA could not be measured in one patient and ODHA could not be measured in another. **Conclusion:** The proposed measurements for assessing sagittal malalignment showed excellent reproducibility, except for T1-SPI, and a very low rate of non-applicability (two cases).

ID: AGS26/1460
P0568: Major vessel positions between prone and lateral lumbar interbody fusion a magnetic resonance study

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Introduction: Anatomical studies suggest that the aorta sits closer to the anterior vertebral body than the inferior vena cava, with vessel proximity increasing at more caudal levels. Whether patient repositioning from standard right-lateral decubitus to prone affects these relationships,and hence the vascular risk profile of single-position prone transpsoas (PTP) lumbar interbody fusion,remains unclear. This study compared the anterior-posterior ("vertical") and left-right ("horizontal") positions of the aorta and vena cava at L2-L3 and L3-L4 on magnetic-resonance imaging (MRI) obtained in lateral versus prone positions. **Material and Methods:** In this single-centre retrospective cohort, 25 consecutive adults undergoing clinically indicated lumbar MRI were scanned both in right-lateral decubitus (hips flexed) and prone (hips extended). Axial T2-weighted slices were acquired on a 3-T scanner. Two blinded raters measured (1) the perpendicular distance from the anterior vertebral cortex to the vessel centre (vertical) and (2) the transverse distance from the mid-sagittal line to the vessel centre (horizontal). Distances left or posterior to the reference lines were assigned negative values. Measurements were averaged, and trimmed-mean differences between positions were tested with a bootstrap Yuen-Welch t-test (trim = 10%); $\alpha = 0.05$. **Results:** Horizontal aortic displacement increased significantly in the prone position at both disc levels (mean ± SD: -4.8 ± 5.4 mm lateral vs -9.9 ± 2.9 mm prone at L2-L3; -2.8 ± 5.9 mm lateral vs -7.9 ± 2.7 mm prone at L3-L4; both $p < 0.01$), reflecting a medial shift toward the mid-line. No significant vertical shifts were detected for the aorta, and neither horizontal nor vertical distances for the vena cava changed meaningfully between positions (all $p \geq 0.2$). Effect sizes were small ($|d| \leq 0.8$), and 95% confidence intervals excluded clinically relevant forward migration. **Conclusion:** Prone positioning does not drive the major lumbar vessels anteriorly relative to lateral decubitus. The minor medial aortic migration observed is unlikely to increase vascular injury risk during PTP approaches. These findings support the anatomical safety equivalence of single-position prone

transpsoas lumbar interbody fusion to traditional lateral LLIF with respect to major-vessel proximity.

ID: AGS26/1531
P0569: Reliability of classical and emerging imaging modalities for fusion assessment after anterior cervical discectomy and fusion: a systematic review

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Introduction: Cervical Disc Degenerative Disease (CDDD) is a prevalent spinal disorder, frequently treated with Anterior Cervical Discectomy and Fusion (ACDF). Although this procedure has shown favorable clinical outcomes, a mayor postoperative complication remains the development of pseudoarthrosis, which may mimic the original clinical presentation and occasionally require revision surgery. Acute radiographic assessment of fusion status is therefore essential. However, no universal imaging criteria currently exist, and reported results vary depending on the modality employed. **Material and Methods:** A systematic review was conducted in accordance with PRISMA guidelines. Eligible studies included adult patients undergoing ACDF with a minimum follow-up of 12 months and postoperative radiographic evaluation of fusion status. Imaging modalities assessed included static radiographs, dynamic radiographs, dynamic flexion-extension radiographs, computed tomography (CT), functional CT radiostereometric analysis (RSA), magnetic resonance imaging (MRI), and advanced quantitative motion analysis. Primary outcomes included diagnostic accuracy (sensitivity, specificity, predictive values, and clinical outcomes such as revision rates. **Results:** Fifteen studies were included. Plain static radiographs consistently overestimated fusion rates compared to dynamic imaging and intraoperative exploration. Flexion-extension radiographs improved diagnostic performance, particularly with quantitative motion analysis (sensitivity up to 77%, specificity 100%), though results varied depending on motion thresholds. CT scans demonstrated the strongest correlation with intraoperative exploration (k = 0.81) and the highest interobserver reliability, yet several studies showed CT may overestimate fusion in early postoperative stages, with up to 23% of "fused" levels still demonstrating motion. Functional CT detected a higher rate of nonunion than radiographs, correlating with increased early postoperative neck pain. RSA provided highly accurate motion detection but is not practical for routine clinical use. Retrospective series demonstrated that although radiographs evidence of pseudoarthrosis is frequently reported, only surgically explored cases allow definitive confirmation, reinforcing the limitations of imaging alone in guiding clinical decisions. **Conclusion:** Current evidence highlights the absence of standardized radiographic criteria for assessing cervical fusion following ACDF. CT remains the most reliable noninvasive modality, though it may overestimate early fusion, whereas dynamic radiographs provide excellent negative predictive value to exclude clinically significant pseudoarthrosis. Functional CT and motion analysis techniques show promise but are limited by radiation exposure availability. Importantly, many radiographic pseudarthroses remain clinically silent, emphasizing the need to integrate imaging findings with patient reported/outcomes. Despite attempts to evaluate evidence is noy sufficiently robust, warranting further research to establish reliable and universally accepted imaging criteria.

ID: AGS26/2323
P0570: Correlation of advanced MRI parameters with postoperative neurological outcomes in spinal tumors

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Introduction: Magnetic resonance imaging (MRI) is essential for the diagnosis and surgical planning of spinal tumors. Beyond conventional sequences, advanced MRI parameters such as diffusion tensor imaging (DTI) and perfusion metrics may provide insights into tumor biology and spinal cord integrity. This study aimed to evaluate the correlation of advanced MRI parameters with postoperative neurological outcomes in patients undergoing spinal tumor surgery. **Materials and Methods:** We prospectively analyzed patients with intradural or intramedullary spinal tumors operated at our institution between 2020 and 2023. Preoperative MRI included DTI (fractional anisotropy [FA], apparent diffusion coefficient [ADC]) and dynamic susceptibility contrast perfusion. Neurological function was assessed using the modified

McCormick scale preoperatively and at 6-month follow-up. Correlations between imaging parameters and neurological outcomes were determined using multivariate regression analysis. **Results:** Thirty-six patients (mean age 46.2 years, 53% female) were included. Lower preoperative FA values in the peritumoral spinal cord were significantly associated with poorer neurological recovery ($p = 0.01$). Elevated ADC values correlated with greater postoperative motor deficits ($p = 0.03$). Higher tumor perfusion indices were linked to increased intraoperative blood loss but not to long-term functional outcomes. Multivariate analysis identified preoperative FA as the strongest independent predictor of postoperative neurological improvement (OR 2.8, 95% CI 1.3-6.1). **Conclusion:** Advanced MRI parameters, particularly DTI-derived FA, show significant correlation with postoperative neurological outcomes in spinal tumor surgery. Incorporating these imaging biomarkers into preoperative evaluation may enhance risk stratification and guide surgical decision-making.

ID: AGS26/2401
P0571: Thoracic deformity and lung function in scoliosis: idiopathic vs. congenital curves

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Introduction: Scoliosis alters thoracic cage geometry and may impair pulmonary mechanics. Both adolescent idiopathic scoliosis (AIS) and congenital scoliosis (CS) predispose patients to restrictive ventilatory defects, yet direct comparisons between these groups are limited. **Materials and Methods:** This cross-sectional study was conducted at the Orthopedic & Spine Center, Ghurki Trust Teaching Hospital, Lahore, from January to December 2022. A total of 40 patients (20 AIS, 20 CS) were included after ethical approval. Demographic data (age, sex, BMI), radiological parameters (Cobb's angle, curve location, thoracic kyphosis), and pulmonary function tests (FVC, FEV1, FEV1/FVC) were collected. Associations between curve magnitude and pulmonary indices were analyzed. **Results:** AIS patients demonstrated greater respiratory compromise. Mean FVC was significantly lower in AIS ($61.5 \pm 11.8\%$) compared to CS ($76.9 \pm 19.6\%$, $p < 0.05$). Mean FEV1 was also reduced in AIS ($63.7 \pm 12.9\%$) versus CS ($79.8 \pm 18.7\%$, $p < 0.05$). The FEV1/FVC ratio remained preserved (> 70%), consistent with restrictive impairment. Cobb's angle negatively correlated with FVC ($r = -0.39$). Thoracic curves were linked to greater reductions in lung volumes than thoracolumbar curves, while BMI showed no significant influence. **Conclusion:** Adolescents with scoliosis, particularly those with AIS, exhibit significant restrictive pulmonary changes. Curve severity and thoracic involvement are major predictors of impairment. Routine pulmonary function testing and early orthopedic intervention are recommended to minimize long-term respiratory morbidity.

ID: AGS26/2445
P0572: The prevalence of Schmorl's nodes in osteoporotic vs normal patients: a Middle Eastern population study

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Introduction: This study aims to identify the prevalence of Schmorls nodes (SNs) in a cohort of Omani nationals, and also to determine any relation between osteoporosis and Schmorl's nodes. **Material and Methods:** This retrospective observational study was carried out on Omani nationals. A total of 1,348 DEXA scan patients were included. Among these, 545 patients had complete X-rays and MRI scans that helped ascertain SN status. The X-rays and sagittal, coronal, and axial T2-weighted MRI images were used to identify the presence and exact location of Schmorl's nodes, by one orthopaedic trainee and confirmed by the senior author. The association of each parameter with the presence of SN was analysed using the independent-samples T-test and one-way ANOVA. **Results:** Prevalence of SN in this population sample appeared to be 41.1% and only 19.1% were of normal bone density. Close to 80% were either Osteopenia or frankly osteoporotic. Vast majority (87.1%) occurred in the lumbar spine and were central in location and mostly solitary occurring in L5. Age of patients differed significantly by their sex type ($t = 3.33$, $p < 0.001$). Male patients (Mean = 63) were older in age than female patients. The association between Schmorl's node status and bone status was significant ($\chi^2 = 97.93$, $p \leq 0.001$). **Conclusion:** The prevalence of SN in this sample of Omanis was 41.1%, most frequently observed in older men in the lumbar spine. It shows a strong association with osteoporosis/osteopenia (88.4%) and often presents as solitary, central lesions.

ID: AGS26/2500
P0573: Endplate vBMD versus EBQ for predicting cage subsidence after LLIF: a comparative study

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Introduction: Although cage subsidence following intervertebral fusion surgery is closely related to bone mineral density in the vertebral endplate region, comparative studies on the efficacy of vBMD and VBQ score-based assessment methods for predicting postoperative cage subsidence remain insufficient. Therefore, this study aims to compare the predictive efficacy of quantitative computed tomography (QCT)-based endplate volumetric bone mineral density (EP-vBMD) and magnetic resonance imaging (MRI)-based endplate vertebral bone quality score (EBQ) for cage subsidence (CS) after lateral lumbar interbody fusion (LLIF). **Material and Methods:** A retrospective study was conducted on patients underwent single level LLIF in conjunction with pedicle screw fixation (PSF) in our institution between January 2019 to April 2023. We measured the vBMD based on the preoperative CT using the Phantom-less QCT software. Measurement of the VBQ score was based on preoperative MRI. CS was defined as a decrease of more than 2mm in the midpoint height of the intervertebral space. The ROC curve of EP-vBMD and EBQ for predicting CS was drawn, and the predictive efficacy of the two methods was compared by Delong test. Clinical outcomes, including VAS-B, VAS-L, and ODI scores, were assessed preoperatively, postoperatively, and at 1-year follow-up. **Results:** A total of 97 patients who underwent LLIF were included in this study, including 31 patients with CS and 66 patients without CS. No significant differences were observed between the two groups in VAS-B, VAS-L, or ODI at preoperative, postoperative, and 1-year follow-up (all $p>0.05$). The EP-vBMD of the CS group was lower than that of the non-subsidence group (NCS), and EBQ was higher than that of the NCS group. The area under the ROC curve of EP-vBMD for predicting CS was larger than that of global and segmental vBMD. The area under the ROC curve of EBQ for predicting CS was larger than that of global and segmental VBQ, and the AUC of EP-vBMD was larger than that of EBQ. The combined prediction model of EP-vBMD and EBQ had the largest AUC value (0.899), but it was not significantly different from EP-vBMD ($p = 0.547$). **Conclusion:** The regional endplate BMD assessment based on QCT and MRI can effectively predict cage subsidence after LLIF, and it has better predictive efficiency than the global or surgical segmental vetebrae BMD measurement. EP-vBMD is superior to EBQ in predicting CS. The prediction efficiency of EP-vBMD combined with EBQ was better than EBQ, but not better than EB-vBMD.

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P0574: Selection of proximal fusion level in osteoporotic vertebral compression fracture (OVCF) with kyphosis: the guildence of Hounsfield Unit

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Introduction: The selection of the upper instrumented vertebra (UIV) in chronic Osteoporotic Vertebral Compression Fracture (OVCF) has been proven to be related to postoperative complications. For the first time, we defined the upper maximal vertebra (UMV) as the vertebra above the compressed section that had a higher Hounsfield Unit (HU) value than two vertebrae proximal to the fracture level. The upper sagittal reverse vertebra (USRV) was defined as the first vertebra that presented opposite HU value distribution from the anterior to posterior part of the vertebra compared to proximal vertebrae, counting from the compressed vertebra. In accordance with previous studies, we believe that the UMV and USRV might play an important role in the biomechanical stability of the spine. Therefore, this retrospective study aimed to verify whether locating UIV on UMV or USRV can decrease the risk of adjacent segment degeneration (ASD) and proximal junctional kyphosis (PJK). **Material and Methods:** This clinical research included 82 chronic OVCF patients (18 males and 64 females) with a mean age of 62.99 ± 8.29 years and mean follow-up of 48.13 ± 20.22 months. Whole spine CT were performed for each patient. The patients were divided into groups according to whether their UIV was below the UMV or USRV. The incidence of ASD and PJK was evaluated in each subgroup. **Results:** The average HU value of all patients was 94.98 ± 22.76. All sagittal parameters improved significantly after operation and at follow-up. For UMV, the UIV of 41chronic OVCF patients was located on or above the UMV, while that of 41 patients was not. There was a significant difference in PJK between the two groups (12.20% vs 46.34%; $p < 0.001$), whereas the difference in ASD was not significant (4.88% vs 14.63%; $p = 0.137$). 68 patients (82.93%) were identified to

have USRV. The UIV of 38 patients was located on or above the USRV while that of 30 patients was not. There were significant differences in both PJK and ASD between the two groups (PJK: 7.89% vs 63.33%; $p < 0.001$; ASD: 2.63% vs 23.33%; $p = 0.007$). **Conclusion:** HU values should be considered in the selection of UIV. Locating UIV on UMV might decrease the incidence of PJK and ASD, and taking USRV into the fusion level might reduce the occurrence of ASD.

ID: AGS26/2598
P0575: A three-dimensional morphological assessment for evaluating pre- and post-surgery in cervical laminoplasty

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Introduction: The efficacy of medical treatments and the changes in radiologic imaging before and after treatment have consistently remained pivotal factors. This is particularly critical for surgical procedures, where precise evaluation of disparities pre and post-surgery or the accuracy of implantation is paramount. Based on three-dimensional morphological interests, we provide an automatic quantification evaluation method that delivers an evident base for assessing the outcomes of a widely employed surgical technique, cervical laminoplasty. **Material and Methods:** The sample study included patients who underwent cervical laminoplasty for cervical spondylotic myelopathy/ossification of the longitudinal ligament. We present a superimposition method that facilitates a unique and precise assessment between pre and post-surgery. The degree of expansion was evaluated by the canal volume increase and canal expansion rate after surgery. **Results:** There were 31 patients with 112 vertebral segments measured. The target cervical's pre and post-operative canal areas were 122.63 ± 30.34 and 196.50 ± 37.10 mm2, respectively ($p < 0.001$). The average cervical canal expansion rate was 64.42%. The expansion effect of C5 cervical laminoplasty was the maximum (71.01%), and the canal volume of other segments expanded by approximately 60%. The functional outcomes demonstrated significant improvements in symptoms. **Conclusion:** The quantification evaluation method can be utilized for any morphology changes before and after laminoplasty, as it does not lead to errors or variations from different inspection machines or human factors. The automatic method delivers an evident base for assessing the outcomes of a widely employed surgical technique.

ID: AGS26/3104
P0576: Spinal level localisation techniques in spine surgery: a literature review and UK regional practice survey

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Introduction: Wrong-level spinal surgery is a significant patient-safety concern and carries substantial medicolegal implications for surgeons, hospitals, and the healthcare system as a whole. Spinal level localisation (level-check) is routinely performed peri-operatively by surgeons to ensure this is avoided. While a review of the literature describes various localisation techniques, the extent to which these are applied in routine practice is less clear. This study aims to review current localisation techniques, evaluate supporting evidence, and compare these findings with a South-West regional survey of spinal surgeons in the United Kingdom. **Material and Methods:** A review of the literature was conducted to identify studies detailing techniques for spinal-level localisation, categorising them into:

- **Traditional methods** (e.g., fluoroscopic counting),
- **Preoperative marking** (e.g., fiducial markers),
- **Advanced intraoperative imaging** (e.g., navigation),
- **Emerging modalities** (e.g., AI-based algorithms, ultrasound, augmented reality).

Focus was placed on accuracy, practicality, and **consensus guidelines**. Additionally, a concurrent regional survey among spinal surgeons in South West UK examined spinal-level localisation practices for primary lumbar surgery, including prevalence and methodology of intraoperative spinal level verification protocols utilising fluoroscopy across three critical surgical phases: pre-incision level marking, pre-decompression verification, and post-decompression confirmation. We also surveyed awareness of national and international guidance and the presence of local Standard Operating Procedures (SOPs) or policies. **Results:**

Fluoroscopy remains the most widely used method globally but is susceptible to error in challenging cases (e.g., anatomical variations such as transitional vertebrae, difficult body habitus such as obesity, and thoracic levels), with reported accuracy of 75-80%. Surgical practice varies on the frequency and method of fluoroscopic verification. Consensus guidelines (Spinal Deformity Study Group; North American Spine Society SMaX Initiative) recommend multiple verification steps and independent radiographic review. The Cleveland Clinic protocol further proposes intraoperative independent radiologist verification.

Preoperative gold fiducial markers demonstrate superior accuracy, achieving near-perfect reliability, especially in high-risk thoracic cases.

3D imaging and navigation significantly improve accuracy over 2D fluoroscopy for complex and multilevel cases.
AI-driven image registration and **real-time ultrasound** are promising emerging modalities but are not yet widely adopted or validated outside specialist centres.
South West UK Regional Survey (n = 16) revealed: • 69% of respondents perform two fluoroscopic level checks per case. • Pre-incision marking is predominantly performed using a needle inserted through skin and subcutaneous tissues rather than a metal skin marker. • Level confirmation immediately before decompression most often uses a Watson Cheyne dissector on bone (75%). • Post-decompression checks are not routinely performed by half of respondents. • 15 out of 16 surgeons reported having no formal local SOP for level checking. • Awareness of national and international guidelines was low among respondents. **Conclusion:** While the literature strongly favours advanced, technology-driven localisation for optimal accuracy especially in complex cases, widespread implementation is limited by cost and resource constraints. Routine practice in the majority of centres still relies on multiple fluoroscopic checks, and our survey demonstrates wide variation in practices amongst spinal surgeons. Developing and implementing standardised SOPs based on consensus guidelines can improve localisation consistency and patient safety without necessitating universal adoption of high-cost modalities.

ID: AGS26/3203
P0577: Aneurysmal bone cyst of the spine: about four cases and review of the literature

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Introduction: Aneurysmal bone cysts (ABC) are benign, tumor-like bone lesions characterized by blood-filled channels expanding the osseous architecture. They account for approximately 1.5% of spinal bone tumors and occur mainly in young patients. We report four cases of spinal ABCs treated surgically in our department and provide a review of the literature. **Material and Methods:** Between 2009 and 2024, four patients (2 males, 2 females) underwent surgery for spinal ABCs. Ages were 16, 18, 26, and 52 years. Clinical, radiological, and surgical data were retrospectively analyzed. **Results:** The presenting symptoms were gait disturbance in two patients (one of whom presented with paraplegia) and lumbar radiculopathy in two others. The tumors were located in the dorsal spine (2 cases) and the lumbar spine (2 cases). Involvement was limited to the posterior elements in two patients, while intra-canal extension and vertebral body invasion were observed in the other two. Complete tumor excision was achieved in two cases, while the remaining two underwent decompressive laminectomy limited to the site of compression. Postoperatively, neurological symptoms improved in all patients. One patient experienced a large local recurrence requiring a second surgery with instrumented stabilization. **Conclusion:** Spinal ABCs are rare, benign lesions that can cause severe neurological impairment. Complete surgical excision remains the gold standard, associated with low recurrence rates and favorable outcomes. Instrumented stabilization may be required in selected cases to address postoperative instability. Our series supports the importance of radical resection whenever feasible, while highlighting the risk of recurrence in incomplete excisions.

ID: AGS26/3242
P0578: A rare case of spinal dural AVF presenting as Foix-Alajouanine syndrome

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Introduction: Spinal dural arteriovenous fistulas (sdAVFs) are an uncommon cause of venous hypertensive myelopathy (Foix-Alajouanine syndrome). Diagnosis relies on MRI and digital subtraction angiography (DSA); timely fistula occlusion improves neurological outcomes. **Material and Methods:** A 61-year-old man presented with 24 hours of low-back pain, rapidly progressive symmetric paraparesis, and urinary retention. Physical examination showed distal-predominant weakness, hyporeflexia with absent Achilles reflexes, and a T12 sensory level. CT was significant for spinal degenerative disease; however, MRI suggested vascular malformation. Selective DSA demonstrated a Type I sdAVF supplied by the left iliolumbar artery. **Results:** Microsurgical ligation via L4-L5 laminectomy with clip ligation of the arterialized draining vein at L5-S1 achieved Doppler-confirmed occlusion. Postoperatively, hip flexion and knee extension improved to 3/5 and ankle plantarflexion and dorsiflexion to 2/5, enabling assisted sitting and transfer to inpatient rehabilitation. **Conclusion:** sdAVF should be suspected in acute-subacute paraparesis with sphincter dysfunction despite degenerative imaging. Prompt DSA and definitive ligation can reverse venous congestive myelopathy and facilitate functional recovery.

ID: AGS26/3277
P0579: Rare sporadic cavernomatosis involving brain, spine, and radicular lesions: from misdiagnosis to surgical management

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Introduction: Cavernomas are rare cerebrovascular malformations, typically occurring as sporadic solitary lesions, most commonly in the cerebral hemispheric white matter, but also in infratentorial or spinal locations. Multiple lesions affecting different levels of the central nervous system are typically associated with familial forms, making sporadic cases with widespread involvement exceptionally rare. **Material and Methods:** A 66-year-old man with no prior medical history presented with acute-onset gait disturbances over two months, gradually improving. Examination revealed paraparesis. Initial spinal MRI revealed a right anterolateral intramedullary lesion at T6-T7 with multiple nodular lesions along the cauda equina roots from L1 to L5, leading to a preliminary diagnosis of intramedullary ependymoma with spinal metastases. **Results:** Subsequent multimodal MRI of the brain and spine revealed multiple supratentorial and infratentorial cavernomas, a solitary intramedullary spinal lesion, and radicular involvement, establishing the diagnosis of multiple cavernomatosis. The patient underwent complete surgical resection of the spinal lesion, resulting in significant improvement of motor deficits. Histopathological examination confirmed the diagnosis of cavernoma. **Conclusion:** Sporadic multiple cavernomatosis involving both brain and spinal cord is exceedingly rare and may mimic metastatic or neoplastic disease, as illustrated by this case. MRI is essential for detecting both cerebral and spinal lesions. Surgical management should be reserved for symptomatic lesions to optimize neurological outcomes.

ID: AGS26/3341
P0580: The accuracy and reliability of ChatGPT in identifying and classifying L5-S1 spondylolisthesis

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Introduction: Chat Generative Pre-trained Transformer (ChatGPT), released in the fall of 2022, made large language models accessible worldwide. Since then, ChatGPT's capabilities have expanded to areas including imaging and analysis across multiple various models, including the advanced reasoning o-models. The aim of this study was to determine whether ChatGPT and its o-models, across three different models, would be able to identify and classify single-level spondylolisthesis cases when presented with imaging. **Material and Methods:** This study utilized 30 images classified under spondylolisthesis from the VinDr-SpineXR database. These images were uploaded into ChatGPT 4o, o4 mini, and o4 mini high. Radiographic measurements of spondylolisthesis were used to grade severity by Meyerding classification. Three questions were asked to each model, all in temporary mode with memory reset after each question was prompted: 1) Can you identify the pathology in this image? 2) Can you identify where the spondylolisthesis is in this image? 3) Can you grade the level of L5-S1 spondylolisthesis in the image? **Results:** When given these 30 radiographs without regards to grade of spondylolisthesis, GPT 4o performed the best in correctly identifying the images at the highest rate of 30% and correct Meyerding Grading Scale at 53.3%. GPT o4-mini, however, outperformed GPT 4o in identifying the level of spondylolisthesis at 96.7% ± 18% vs 80.0% ± 41% ($p = 0.045$). With only Grade I spondylolisthesis, GPT 4o performed the best in initially identifying (Question 1) the image at 35.7%. When only considering Grade II spondylolisthesis, all models performed similarly when initially identifying the images (12.5% - 25%) (Question 1). GPT o4-mini correctly identified the level of spondylolisthesis for all images, while GPT 4o and o4-mini-high had a success rate of 81.3% (Question 2). ChatGPT 4o (35.7% ± 50%) was significantly outperformed when compared to GPT o4-mini in classifying Grade I spondylolisthesis (92.9% ± 27%, $p < 0.001$) and GPT o4-mini-high (92.9% ± 27%, $p < 0.001$). However, GPT 4o (68.8% ± 48%) significantly outperformed GPT o4-mini (6.3% ± 25%, $p < 0.001$) and GPT o4-mini-high (12.5% ± 34%, $p < 0.001$) in Grade II spondylolisthesis. **Conclusion:** In conclusion, the findings from this study are heterogeneous without any conclusive evidence to determine a superior model. Despite GPT 4o outperforming GPT o4-mini and GPT o4-mini high in the classification of Meyerding Grade II spondylolisthesis, GPT 4o was outperformed by the latter two models in the classification of Meyerding Grade I spondylolisthesis. Of note, there was a large increase in accuracy from 10%-30% to 80%-96.7% from question 1 to question 2, possibly due to learning that spondylolisthesis was in the image. Further

studies should be performed looking into higher grades of spondylolisthesis, allowing the GPT models to access memory, and other spinal pathologies such as burst and compression fractures.

ID: AGS26/3368
P0581: A systematic review of the prevalence of degenerative thoracic spinal pathology on magnetic resonance imaging in healthy individuals

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Introduction: Degenerative thoracic myelopathy (DTM) encompasses a spectrum of degenerative spinal pathologies that result in symptomatic thoracic spinal cord compression. Whilst the widespread availability of magnetic resonance imaging (MRI) is beneficial for diagnosis, clinical history and examination remain as important as ever in localising neurological problems. This is particularly essential in the distinction between symptomatic pathology and the increasing burden of incidental findings that result from large volumes of imaging. The prevalence and spectrum of degenerative thoracic spinal pathology in healthy individuals is currently largely uncharacterised. The aim of this systematic review was therefore to synthesise available evidence on degenerative thoracic spinal pathologies on MRI in healthy individuals and to improve understanding of the natural history of DTM. **Materals and Methods:** A systematic review was registered with PROSPERO (CRD42023484442) and performed following PRISMA guidelines. MEDLINE and Embase were searched from inception to March 2025. All studies investigating degenerative thoracic spinal pathologies on MRI in healthy adults were eligible for inclusion. Duplicate title and abstract screening, data extraction and risk of bias assessments were conducted. **Results:** Of 3574 records screened, 11 studies satisfied eligibility criteria for inclusion in the final synthesis. There were seven cross-sectional studies, three case-control studies and one cohort study. A total of 3805 individuals were included: 40.3% (1533/3805) were male, with a mean age was 58.2 years. The most prevalent degenerative pathologies identified on MRI were multilevel disc degeneration (two studies; mean prevalence of 54.2%; range 50%-55%), single level disc degeneration (four studies; mean prevalence of 29.7%; range 7%-72.5%), ossification of the ligamentum flavum (two studies; mean prevalence of 7.2%; range 2.1%-11.9%), inflammatory end-plate changes (two studies; mean prevalence of 4.5%; range 3%-20%), and disc herniation (three studies; mean prevalence of 2.5%; range 0.8%-40%). In individuals with multilevel disc pathology the affected discs were most frequently adjacent. Overall, disc degeneration increased with age and findings were more frequently seen in the lower than the upper thoracic spine. **Conclusion:** Degenerative disc disease is the most prevalent form of degenerative thoracic spinal pathology in healthy individuals. It increases with age and occurs most frequently in the lower thoracic spine. However, data on degenerative spinal pathology in healthy individuals is currently sparse, limiting understanding of the natural history of symptomatic disease. There was significant heterogeneity between studies and a lack of standardised terminology. Future work should include large-scale cross-sectional MRI studies of healthy individuals across wider populations and should seek to promote the use of standardised terminology by researchers and medical professionals.

ID: AGS26/3371
P0582: Symptomatic spinal subdural hygroma emerging decades after pediatric hydrocephalus treatment: a case report and review of the litterature

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Introduction: Spinal subdural hygroma is a rare condition characterized by cerebrospinal fluid accumulation in the spinal subdural space. Its pathophysiology, natural history, and optimal management remain poorly defined. **Material and Methods:** A 44-year-old female, operated at age six for presumed hydrocephalus, remained asymptomatic until one year ago, when she developed progressive quadriparesis, dorsal spinal pain, and bladder dysfunction. MRI revealed a dorsal subdural hygroma with a calcified membrane causing spinal cord compression. **Results:** The patient was initially managed conservatively, but due to worsening pain and progressive quadriparesis, surgical resection was indicated. **Conclusion:** Spinal subdural hygroma is a rare, poorly

understood entity. In this case, a delayed postoperative complication of childhood ventriculoperitoneal shunting is the most likely etiology. Early recognition and timely, individualized surgical intervention are essential to prevent permanent neurological deficits.

ID: AGS26/3372
P0583: MRI-guided femoral nerve localization: interobserver reliability study for preoperative LLIF planning

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Introduction: Pre-operative planning for an L4-5 lateral lumbar interbody fusion (LLIF) relies heavily on MRI to characterize disc pathology, delineate the severity of stenosis, map regional vasculature, and define lumbar plexus anatomy. At our institution, femoral nerve localization is achieved by tracing the L2, L3, and L4 ventral rami on axial T2-weighted images, following each root from cranial to caudal until they converge within the psoas. This study aims to quantify the interobserver reliability of this MRI-based nerve-tracing method. **Material and Methods:** Fifteen patients undergoing LLIF at L4-5 were randomly selected from a prospective spine registry. Preoperative lumbar MRIs were retrospectively analyzed using Picture Archiving and Communication System (PACS). Four observers: a fellowship trained spine surgeon, neuroradiologist, PGY-3 resident orthopedic surgery resident, and postdoctoral clinical research fellow independently traced the L2-4 ventral rami on T2-weighted axial images. Reference lines were established on the most caudal axial slice intersecting the L4-5 disc: a vertical line normalized midline orientation, and a perpendicular horizontal line served as the zero-reference for anteroposterior measurements. Nerve tracing followed L2-4 fascicles from their foramina into the psoas. Interobserver reliability was calculated using intraclass correlation coefficients. **Results:** Interobserver reliability at L4-5 was consistently good. The anteroposterior disc-space width yielded an intraclass correlation coefficient (ICC) of 0.86 (95% CI 0.82-0.97). Localization of the left femoral nerve/L2-3 bundle showed a comparable ICC of 0.85 (95 % CI 0.75-0.96), while the right-sided measurement produced an ICC of 0.83 (95% CI 0.69-0.94). According to conventional thresholds (poor < 0.50, moderate 0.50-0.75, good 0.75-0.90, excellent > 0.90), all three values fall within the good-reliability category. **Conclusion:** Tracing the L2-4 ventral rami on axial T2-weighted MRI provides a reproducible method for localizing the femoral nerve within the psoas at L4-5. Interobserver reliability was consistently good across four observers. This technique enables consistent identification of plexus anatomy and estimation of the femoral nerve's anterior trajectory, supporting its use in preoperative planning for LLIF.

ID: AGS26/3374
P0584: Accuracy of ChatGPT 4o, o4-mini, and o4-mini-high in identifying and quantifying lumbar spine compression fractures

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Introduction: Chat Generative Pre-trained Transformer (ChatGPT) is a large language model that has expeditiously developed upon its abilities since its release in 2022. OpenAI expanded upon its line of generative pre-trained transformers with the release of complex-reasoning o-models in 2024. Newer models have been refined in their ability to assess images, including within the realm of medicine and radiological sciences. The aim of this study was to evaluate ChatGPT and OpenAI's o-models' ability to identify and quantify compression fractures in the lumbar spine via radiograph. **Material and Methods:** This study utilized 24 radiographs classified under vertebral collapse from the VinDr-SpineXR database. Using the temporary chat option to avoid any machine learning throughout the study, these images were directly input into ChatGPT 4o, o4-mini, and o4-mini-high. Three questions were asked to each model, with memory reset before each inquiry: 1) "Can you find the pathology in this image?" 2) "At which segment in the lumbar spine is there a compression fracture?" 3) "Can you identify the percentage of compression in the affected vertebra?" Responses were recorded as either yes or no, depending on the accuracy of the response. **Results:** Overall, models ChatGPT 4o, o4-mini, and o4-mini-high performed at similar levels, correctly identifying lumbar vertebral compression fractures in 42%, 46%, and 58% of proposed images, respectively. Once prompted that there was a compression fracture, ChatGPT 4o significantly outperformed model o4-mini-high at identifying which level was affected 75% ± 44% vs 58% ± 51% ($p = 0.02$). Once prompted for the location of the compression fracture and comparing the percentage of compression, o4-mini-high demonstrated the highest accuracy at L1 (10/17, 59%), whereas models 4o and o4-mini displayed higher accuracy at level L2 relative to o4-mini-high (67% vs 67% vs 50%). **Conclusion:** In conclusion, despite having slight observable differences between the

models in identifying and classifying vertebral compression fractures, there was no conclusive evidence as to the superiority of the ChatGPT model after the level of L1. While GPT 4o outperformed when prompted to identify the segment in which there was a compression fracture at the level of L1, further studies should be conducted comparing other accessible large language models, as well as the performance of ChatGPT when trained with radiographic data while accessing memory.

ID: AGS26/3416
P0585: Surgical management of a giant spinal aneurysmal bone cyst: a case report and literature review

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Introduction: Aneurysmal bone cysts (ABCs) are benign, blood-filled lesions that typically arise in the metaphysis of long bones. Spinal involvement is exceedingly rare, and most cases are either untreated or managed conservatively. **Material and Methods:** We report the case of a 35-year-old patient presenting with refractory back pain due to a giant, locally aggressive ABC of the L1 vertebra. Previously reported spinal ABC cases were also reviewed. **Results:** Imaging revealed an osteolytic, expansile lesion involving the posterior arches of L1 and L2, with multiple fluid-fluid levels. The lesion extended into the spinal canal, compressing the right-sided nerve roots, and anteriorly into the right renal compartment. The patient underwent two sclerotherapy sessions to minimize operative bleeding, followed by a posterior lumbar approach for extensive excision of the posterior portion of the lesion and pedicle screw fixation. The anterior portion of the tumor was inaccessible. Histopathology confirmed the diagnosis of ABC. Postoperatively, the patient experienced complete resolution of pain and neurological deficits. **Conclusion:** In cases of spinal ABC causing neurological involvement or analgesic dependence, decompressive surgery is indicated to improve prognosis and quality of life. Preoperative sclerotherapy is recommended to reduce intraoperative blood loss, and spinal stabilization should be considered when instability is present.

ID: AGS26/3436
P0586: Autonomous, CT-only cervical stenosis triage via interpretable APD and cross-modal dual-transfer learning: a pilot study

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Introduction: Cervical canal stenosis is a frequent cause of radiculopathy and myelopathy and a critical concern in trauma evaluation. Although MRI is preferred for soft-tissue and cord assessment, CT is the most accessible modality in acute and resource-limited settings. CT morphometrics such as anteroposterior canal diameter (APD) (< 10 mm = severe; 10-13 mm = moderate) and the Torg-Pavlov ratio remain widely accepted, interpretable thresholds. Yet, no autonomous pipeline exists that ties CT-only analysis to these deterministic metrics, and existing AI approaches often require MRI labels or operate as opaque classifiers. We sought to develop a CT-only, fully autonomous pipeline aligned to APD thresholds and to evaluate a cross-modal, cross-region dual-transfer (MRI to CT, lumbar to cervical) learning strategy. **Material and Methods:** We used RSNA-2022 Cervical CT (public vertebral segmentations; no stenosis labels). The pipeline automatically localized disc levels C4/5-C6/7, established a midline corridor on the axial disc plane, and measured APD from posterior vertebral-body cortex to anterior laminar cortex. A deterministic silver standard labeled each level as moderate/severe if APD < 13 mm (severe < 10 mm). For the classifier, a ConvNeXt-Tiny backbone (initialized from RSNA-2024 Lumbar MRI when available, otherwise ImageNet) was frozen and a small head trained on CT patches to predict {moderate/severe vs none/mild}. A brief last-stage unfreeze provided a light fine-tune. Evaluation on a held-out subset (n = 32 levels) reported ROC-AUC, average precision (AP), Youden-tuned threshold performance, and Brier score. We generated publication-quality full-slice axial figures with midline APD overlays. Robustness of APD was tested to HU threshold changes (220 to 280 HU). **Results:** Against the silver standard (APD < 13 mm), the classifier achieved AUC = 0.801 (bootstrap 95% CI 0.571-0.968) and AP = 0.809 (95% CI 0.572-0.962). At the tuned operating point (t* = 0.794), sensitivity = 0.636, specificity = 1.000, accuracy = 0.875; Brier = 0.264. Deterministic APD was robust to HU-threshold variation with median |ΔAPD| = 0.00 mm and maximum 0.38 mm. Representative axial figures show correct level localization and midline-centric APD overlays on full slices. **Conclusion:** An autonomous, CT-only, APD-aligned pipeline can triage cervical canal stenosis with transparent, threshold-based outputs. Incorporating cross-modal dual-transfer learning provides a robust feasibility baseline for trauma and MRI-limited environments. External validation against expert labels and integration of the Torg-Pavlov ratio are planned.

Infections

ID: AGS26/38
P0587: Primary cervical spine osteomyelitis and spondylodiscitis due to cutibacterium

acnes: a literature review and implications for clinical practice

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Introduction: Cutibacterium acnes (C. acnes) is an anaerobic Gram-positive bacterium gaining notoriety for spinal osteomyelitis and spondylodiscitis. Exiting evidence suggested that this microbe shows a prevalence rate ranging from 13% to 44% for colonising intervertebral discs. Most C. acnes spinal infections reported in literature occur following invasive interventions, with presence of bioimplants a significant risk factor. There is however paucity of evidence of primary spondylodiscitis or osteomyelitis from P. acnes. Given that this cutaneous commensal is more common in upper torso and head-neck region, we conducted a literature review of primary cervical spine osteomyelitis and spondylodiscitis from C. acnes. The objectives were to understand risk factors, clinical presentation, disease identification and management for the benefit of spinal surgeons. **Methods:** PubMed database was searched for all articles till date in English language dealing with human population for cervical spine primary infections associated with C. acnes anaerobe. All reports of such infection after any invasive intervention on the spine were excluded. Full text of relevant articles was then read to identify additional publications on this condition. **Results:** Literature search revealed only few case series and case reports totalling 12 cases of non-surgery related primary cervical spine infection from C. acnes suggesting an extremely rare condition. All cervical spine levels including atlanto-axial spine, and all age groups including adolescent patient were reported. Unlike post-operative C. acnes spinal infections, primary infections are more likely in immunocompromised patients. Delay in diagnosis is common due to atypical indolent clinical presentation, non-specific imaging features and absence of significant elevation of biochemical markers of inflammation/infection. More severe bony destruction is a possibility due to these factors; with reports in literature of cervical infection associated with synovitis, acne, pustulosis, hyperostosis, and osteitis (SAPHO syndrome) described. Cutibacterium is reported to cause intervertebral disc cell apoptosis of nucleus pulposus, and hence lesser associated tissue inflammation. Paravertebral and epidural inflammation are not typically seen on imaging. Enrichment broth extended-period (14 days) cultures and polymerase chain reaction (PCR) tests are necessary to confirm the diagnosis. Anti-microbial therapy is required for longer period (8-12 weeks), and surgical intervention is often (75%) necessary to address spinal pathology due to the sequelae of infection. **Conclusion:** Cutibacterium acnes is often under-recognised and surgeons must be vigilant due to its potential as a differential cause of spinal infections. Unlike other aerobic pathogens commonly associated with vertebral osteomyelitis, patients with C. acnes may manifest atypical clinical presentation and investigations. Due to the rarity of spontaneous-onset C. acnes spondylodiscitis, further large prospective multi-centre studies may give more evidence of epidemiology, optimal diagnosis and management measures.

ID: AGS26/65
P0588: The SIE score: a diagnostic tool for infective endocarditis in patients with spondylodiscitis

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Introduction: Concomitant spondylodiscitis and infective endocarditis (IE) can complicate diagnosis and delay treatment. The SIE Score offers a structured diagnostic framework to estimate IE probability in spinal infection cases. **Material and Methods:** In a retrospective study of 97 patients (8 with IE), clinical, laboratory, and radiologic data were evaluated. A scoring system with major (2 points) and minor (1 point) criteria was developed based on statistically significant predictors. Diagnostic performance was assessed via ROC analysis. **Results:** The SIE Score is composed of the following statistically significant criteria: Major criteria (2 points each): - Radiological evidence of spinal infection ($p < 0.001$), - Cardiac history ($p = 0.005$), - Persistent CRP elevation post-op (> 10 days) ($p = 0.018$), - Renal insufficiency (creatinine > 1.5 mg/dL) ($p = 0.035$). Minor criteria (1 point each): - Positive blood cultures, - Multisegmental involvement, - Thoracic localization. A cut-off score ≥ 6 demonstrated 83% sensitivity and 90% specificity (AUC 0.87). **Conclusion:** The SIE Score enhances early detection of IE in spondylodiscitis patients and complements the Duke criteria. It is especially useful when cardiological diagnostics are delayed or limited. Ethics Committee Approval: 2021-702-f-S

ID: AGS26/123
P0589: Outbreak of enterobacter kobei infections linked with a collagen-based adhesion barrier following lumbar disc surgery: an epidemiological and molecular study

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Introduction: Postoperative infections following spine surgeries are typically caused by skin flora or hospital-acquired pathogens. We report a novel outbreak of Enterobacter kobei infections linked to a collagen-based adhesion barrier. The goal of this study was to identify the source of increased surgical site infections in lumbar disc herniation (LDH) surgeries and to describe the outbreak investigation and containment measures implemented. **Material and Methods:** A multidisciplinary outbreak team conducted epidemiological, environmental, and microbiological investigations at a secondary care hospital in Turkey. Molecular typing using Pulsed-Field Gel Electrophoresis (PFGE) was employed to assess the clonal relationships of the isolates. **Results:** Between May 19 and June 9, 2023, 10 out of 12 patients who underwent LDH surgery developed surgical site infections. Environmental cultures tested negative. Enterobacter cloacae was isolated from wound samples, blood, and collagen-based adhesion barrier samples. Isolates sent to the National Public Health Laboratory were identified as Enterobacter kobei. PFGE analysis revealed two distinct but clonally related groups. The outbreak was contained following a nationwide recall of the adhesion barrier. **Conclusion:** This incident marks the first reported outbreak of Enterobacter kobei associated with a surgical adhesion barrier. This highlights the need for vigilant infection control and careful monitoring of non-sterilized surgical materials to prevent similar events in the future.

ID: AGS26/197
P0590: Impact of comorbidities, demographic factors and antibiotic use on survival outcomes in patients with hematogenous spinal osteomyelitis: a cox proportional Hazards model analysis

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Introduction: Hematogenous spinal osteomyelitis presents significant challenges in clinical management due to its complex pathology and variable patient outcomes. This study aims to assess the impact of comorbidities, demographics, and the length of antibiotic usage on survival rates in patients with hematogenous spinal osteomyelitis. We hypothesize that the presence of comorbidities, Body Mass Index (BMI)and extended antibiotic treatment positively correlate with improved survival outcomes in these patients, whereas male gender may be associated with increased mortality. **Material and Methods:** Data from patients treated for hematogenous spinal osteomyelitis were analyzed using a Cox Proportional Hazards Model. BMI, sex, antibiotic usage post-operation, and the presence of comorbidities were collected. Survival curves were generated using Kaplan-Meier estimates, and differences between groups were assessed with log-rank tests. The study further examined survival impact by gender and BMI through stratified and multivariable analyses. The model's assumptions were verified using time-dependent covariate tests, and the fit was evaluated using concordance index and partial AIC. **Results:** The study included 88 patients, with a median follow-up of 60 days. Of these, 6 events (deaths) were observed. The survival analysis revealed significant survival differences based on the length of post-operative antibiotic use and the presence of comorbidities. The cohort's survival probability was robust, with a median survival time reported as infinite, signaling a high long-term survival rate. By day 30, the survival probability stood at approximately 79.7%, and this figure remained consistent through day 60, indicating stability in patient survival post the initial treatment month. The Cox model adjusted for age and sex showed that male patients had a higher risk of mortality (HR: 18.58; 95% CI: 0.74, 467.84; $p = 0.08$), while longer antibiotic usage was associated with reduced mortality (HR: 0.92; $p = 0.03$) suggesting an 8% reduction in risk per unit increase in treatment duration. The model's concordance index was 0.85, indicating a good predictive ability. BMI presented a protective trend, albeit non-significantly (HR = 0.92, $p = 0.29$), suggesting a potential but uncertain protective effect. **Conclusion:** The study confirms the critical role of post-operative antibiotic treatment duration and the presence of comorbidities in influencing survival outcomes in patients with hematogenous spinal osteomyelitis. Effective management of these factors within the first 30 days is crucial for improving patient survival. While BMI showed a non-significant protective trend, the pronounced risk associated with male gender highlights a need for targeted interventions during the critical initial treatment phase. Tailored management strategies that extend beyond standard protocols and consider individual patient profiles - particularly antibiotic duration, gender, and BMI - are crucial in optimizing treatment outcomes in hematogenous spinal osteomyelitis. This approach not only addresses immediate survival but also improves long-term patient prognosis.

ID: AGS26/254
P0591: Changes in the microbial spectrum of pyogenic spondylodiscitis in Germany: a nationwide analysis from 2005 to 2023

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Introduction: Pyogenic spondylodiscitis is a rare but potentially life-threatening spinal infection. Understanding national trends in pathogen distribution and resistance patterns is essential for optimizing diagnosis, therapy, and infection control strategies. **Material and Methods:** We conducted a retrospective analysis of nationwide hospital discharge data in Germany from 2005 to 2023. The study included all inpatient cases with a primary diagnosis of ICD-10 codes M46.2*, M46.3*, or M46.4*, in combination with secondary codes (A49, B95-B98, U80-U83) indicating identified pathogens classified as follows: 1) *Staphylococcus aureus, 2) Other/unspecified Staphylococci*, 3) *Streptococci*, 4) *Escherichia coli* and *other Enterobacterales*, 5) *Pseudomonas* and other non-fermenters, 6) *Other gram-positive pathogens*, 7) *Others*. The data were sourced from the DRG statistics, comprising all fully hospitalized cases reimbursed via diagnosis-related groups. **Results:** A total of 150,598 patients were identified. Annual case numbers of pyogenic spondylodiscitis with a documented pathogen increased steadily from 4,393 in 2005 to 9,923 in 2023, corresponding to a mean annual growth rate of 4.47% (range: 1.16-12.41%). Incidence increased from 6.67 to 14.62 per 100,000 inhabitants, with an average annual increase of 4.6%. Mortality rose from 3.4% to 6.9%, with an average annual increase of 4.3%. Over the 19-year period, the relative proportion of *Staphylococcus aureus* declined from 31.4% to 16.0% (mean annual decline rate: 3.6%, range: 0.7-12.5%), while proportions of *Streptococci* (from 9.2% to 14.4%; mean annual rate of increase: 2.91%, range 2.7-25%), *Other/unspecified Staphylococci* (from 20.5% to 24.2%; mean annual rate of increase: 1.1%, range 0-10.1%), and *Other gram-positive pathogens* (from 1.2% to 4.4%; mean annual rate of increase 8.8%, range 5.4-58.3%) increased. Consequently, whereas *S. aureus* was the most prevalent pathogen in 2005, *Other/unspecified Staphylococci* predominated in 2023. Analysis of resistance-associated pathogens (ICD U80* and U81*) revealed a marked decrease in MRSA prevalence from 7.3% to 1.6% (mean annual decline rate: 6.9%, range 2.2-28.8%), but an increase in multidrug-resistant gram-negative pathogens (i.e. 3MRGN/4MRGN and ESBL-producing *Escherichia coli*) from 0.5% to 2.4% (mean annual rate of increase: 16.4%, range 10.3-100%) and vancomycin-resistant *Enterococci* (VRE) from 0.6% to 1.8%d (mean annual increase 24.8%, range 12.5-250%). **Conclusion:** In patients hospitalized with pyogenic spondylodiscitis, the relative *Staphylococcus aureus* and MRSA prevalence declined markedly over time, while the relative prevalence of *Other/unspecified Staphylococci* and multidrug-resistant gram-negative pathogens and VRE increased in the past two decades in Germany. These trends reflect a shift in resistance patterns that complicate empirical therapy and underline the need for ongoing microbiological surveillance.

ID: AGS26/467
P0592: CT-guided percutaneous needle-biopsy sampling in suspected spondylodiscitis: microbiological yield, consequent antimicrobial treatment and relationship with outcome

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Introduction: Spondylodiscitis is an infection affecting the vertebral endplates and intervertebral discs, potentially causing severe neurological deficits, debilitating pain, or death. It may extend to paravertebral, epidural, and posterior spinal elements. Elevated inflammatory markers such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) often support suspicion of infection. Imaging-particularly contrast-enhanced MRI, which has high sensitivity and specificity-plays a key role in diagnosis, though histological and microbiological sampling remains the gold standard. Pathogen identification enables targeted antimicrobial therapy, potentially avoiding surgery. However, recent studies have questioned the diagnostic yield of image-guided percutaneous biopsies, even with strong clinical suspicion. **Materials and Methods:** Eighteen patients with suspected spondylodiscitis underwent CT-guided percutaneous biopsy. Pre-biopsy MRI scans were evaluated for disc, vertebral, epidural, and paravertebral inflammatory changes. CT images were assessed for endplate erosion and disc height loss. Blood cultures were collected before biopsy. Microbiological analysis was performed on all biopsy samples, and histological analysis in three cases. Positive biopsy and blood culture rates were calculated, and correlation between the two-particularly pathogen concordance-was analyzed. The presence of other infections was noted. Inflammatory markers were tracked before and after antimicrobial therapy. Following treatment, the number of patients requiring surgery was recorded, and MRI features were evaluated for their predictive value in determining surgical need. **Results:** Biopsy sampling was standardized, with each patient providing three specimens (~2 cm each) via needle biopsy.

• **Biopsy cultures** were positive in 9 of 18 patients (50%), with 5 (55.5%) yielding gram-positive *Staphylococcus* species.
• **Blood cultures** were positive in 11 of 18 patients (61.1%), of which only 3 (27.3%) showed concordant pathogens with biopsy results.
• Among positive blood cultures, 9 patients (81.8%) had *Staphylococcus* species; 8 of these (72.7%) had additional concurrent infections.

• Seventeen patients received antimicrobial therapy, leading to marked reductions in inflammatory markers. Despite treatment, 6 patients (33.3%) required surgical intervention, half of whom had paravertebral infiltration on pre-treatment MRI. **Conclusion:** Spondylodiscitis, though rare, is increasingly recognized and carries significant clinical risk. Diagnosis relies on clinical, laboratory, and imaging findings. While blood cultures are frequently used, they may be unreliable due to low concordance with biopsy results and frequent concurrent infections. In our study, only 27.3% of positive blood cultures matched biopsy organisms. Despite a moderate microbiological yield, CT-guided percutaneous biopsy remains preferable to open biopsy due to its safety and cost-effectiveness. Some patients had concurrent infections, and withholding antibiotics prior to biopsy-typically recommended to improve culture yield-was not feasible in all cases. Biopsies performed during ongoing antibiotic therapy may have lowered diagnostic yield. The impact of suspending antibiotics or increasing tissue volume for sampling remains uncertain.

ID: AGS26/589
P0593: Cervical epidural abscess: a systematic review

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Introduction: Cervical spinal epidural abscess (CSEA) is rare but potentially devastating, accounting for 15-20% of all spinal epidural abscesses. Compared with thoracic or lumbar locations, CSEA is associated with a narrower therapeutic window and greater risk of rapid neurological decline. While surgical intervention is the predominant management strategy reported in the literature, the optimal approach, timing, and outcomes remain incompletely defined. **Material and Methods:** We systematically searched PubMed and Embase (January 1995-June 2025) using terms related to *cervical spinal epidural abscess* and *surgical management*. Retrospective or prospective cohort studies and case series involving adults with surgically treated CSEA were included. Single case reports, pediatric cohorts, non-English studies, and spondylodiscitis without epidural extension were excluded. Fourteen studies encompassing 298 patients met inclusion. Data on demographics, comorbidities, microbiology, surgical techniques, timing, outcomes, and complications were extracted and synthesized descriptively. **Results:** The weighted mean age was 56.7 years, with 66.2% male. Common comorbidities included diabetes (23%), intravenous drug use (26%), chronic kidney disease/hemodialysis (38%), and immunosuppression/malignancy (11%). The most frequent symptoms were neck pain (85%) and neurological deficit (79%). Abscesses were ventral in 67%, dorsal in 22%, and circumferential in 12%. *Staphylococcus aureus* was the predominant organism (MSSA 31%, MRSA 17%), followed by streptococci (8%), gram-negative bacilli (5%), and *Brucella* (3%); cultures were negative in 4%. Anterior decompression and fusion was the most common surgical approach, with posterior or combined procedures used selectively. Across studies reporting timing, 52 patients underwent urgent decompression ≤48 h, 4 within 48-72 h, and 18 >72 h (often after failed medical therapy). Neurological improvement was observed in most cohorts, with complete recovery rates ranging from 50-93%. Complications were infrequent: surgical-site infection (∼1-2%), hardware failure (∼1%), postoperative kyphosis (∼3%), and dysphagia (2 cases). Mortality was ∼1.7% (5/298), largely in older or comorbid patients. **Conclusion:** CSEA remains a surgical disease, with anterior decompression and fusion most frequently performed. Early surgery (≤ 48 h) is associated with favorable neurological outcomes, while delayed intervention carries higher risk of persistent deficits. Compared with thoracic and lumbar SEA, cervical cases appear to have slightly lower mortality but demand prompt recognition and urgent treatment due to rapid neurologic deterioration. Larger multicenter studies are needed to better define timing thresholds and refine surgical decision-making, particularly in elderly or medically complex patients.

ID: AGS26/666
P0594: Beyond the hunch: navigating the landscape of post TB - Kyphosis

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Introduction: Kyphosis is one of the most common complications of spinal tuberculosis. Patients: are never satisfied with the residual kyphosis even If the disease is cured or arrested. Patients with hunchback live secluded lives both mentally & socially. To achieve correction & prevention surgery is desirable. Nonetheless, satisfactory surgical correction is very difficult & dangerous as well. **Material and Methods:** This prospective case series was conducted in a tertiary level hospital & in private hospital from January 2003 to July 2025. Most of the patients operated posteriorly to achieve correction. Correction of deformity was easier in wet TB than the dry TB. Global reconstruction was done using single posterior approach. **Results:** This study comprises 107 cases (M = 40, F = 67), with an average age of 17 years. Mean

kyphosis angle was 85+9° preoperatively which came down to 13‡7° finally. There was no major complication. None of the patients develop or worsened neurologically after surgery. Finally patient achieved satisfactory cosmetic appearance. **Conclusion:** Prevention of deformity should be the primary aim. Long standing severe kyphosis produces painful costopelvic impingement, reduced vital capacity, lumbar canal stenosis & late onset paraplegia. With improved surgical technique & rigid spinal instrumentation involving three column - posterior approach is gold standard for prevention & correction of kyphosis

ID: AGS26/744
P0595: Spinal hydatidosis in Southern Chile: clinical experience from an endemic region

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Introduction: Hydatidosis, a parasitic infection caused by Echinococcus granulosusis, is endemic in regions with abundant livestock. Due to its presence in the entrails of farm animals it is often consumed by farm dogs which then in turn facilitates transmission to humans. This parasite can affect virtually any organ in humans, though it is predominantly found in the liver and lungs. Although the most frequent osseous manifestation is located in the spine, there has been limited documentation of this in clinical settings. Southern Chile is known for having a high epidemiology level of hydatidosis making it ideal for this study. Even though the spine is frequently infected there is a noticeable lack of publications regarding hydatidosis in this area. The objective of this study is to describe a series of vertebral hydatidosis cases in order to characterize the clinical manifestations, findings in imaging, and outcomes of surgical intervention in southern Chile. **Material and Methods:** A retrospective observational study was conducted with patients that had histological confirmation of vertebral hydatidosis. These patients were treated at the Neurosurgery Unit of Dr. Hernán Henríquez Aravena Hospital in the city of Temuco, Chile. The information collected included demographic data (age and sex), affected vertebral level, clinical presentation, magnetic resonance imaging findings, surgical technique employed, and pharmacological treatment. **Results:** Four patients were identified 2 of which were female with a mean age 67 years. It was found that thoracolumbar involvement was present in every patient. The initial symptom in 50% of cases was axial pain, while neurological deficit was present in all patients. Computed tomography revealed cystic lesions with spinal canal invasion and bone erosion, whereas magnetic resonance imaging demonstrated multilocular lesions, hypointense on T1, hyperintense on T2, with peripheral enhancement. All patients underwent decompressive laminectomy with excision of multiple hydatid cysts, but two required spinal instrumentation. All patients received perioperative albendazole. Definitive analysis of recurrence and functional outcomes is ongoing, with one patient showing complete remission after 13 years of follow-up since the initial surgery. **Conclusion:** Although rare worldwide, vertebral hydatidosis remains a therapeutic challenge in contemporary neurosurgical practice. The systematic collection of cases over thirteen years allowed the establishment of a nationally relevant series in Chile. This allowed the refinement of diagnostic and therapeutic protocols, and the contribution of evidence that complements the limited international literature already present. The experiences presented here extends beyond the local context and represents a meaningful contribution to the global scientific community, providing clinical and surgical insights into a rare condition whose accumulated knowledge is essential for improving early diagnosis, complex surgical management, and recurrence prevention.

ID: AGS26/807
P0596: Composite diagnostic approach in spinal tuberculosis

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Introduction: Spinal tuberculosis (STB) accounts for ~50% of skeletal TB and 10-15% of extrapulmonary TB cases. Diagnosis remains challenging due to nonspecific symptoms, imaging findings that overlap with pyogenic infections, and the paucibacillary nature of extrapulmonary TB that limits diagnostic yields from smear, culture, and even PCR. Best practice requires a composite diagnostic approach integrating clinical context, imaging, histopathology, mycobacterial culture, and molecular assays, as no single negative test can reliably exclude STB. Moreover, Interferon-Gamma Release Assays (IGRAs) provide supportive evidence of M. tuberculosis infection but are not site-specific and should be interpreted alongside lesion-based testing. When clinical suspicion remains high, negative nucleic acid amplification tests (NAATs) or culture results should not rule out disease, and management should be guided by the totality of clinical-radiologic findings and, when necessary, a therapeutic trial. **Material and Methods:** A 72-year-old male with prior lumbar spinal fusion performed 10 years earlier presented with a two-month history of progressive lumbar pain and bilateral lower extremity weakness. Physical examination revealed intermittent paresthesias and 4/5 motor strength bilaterally in

L3-S1 distributions. Lumbar spine MRI demonstrated spondylodiscitis at L3-L4 with associated posterior epidural empyema. The patient underwent surgical debridement including hardware removal, L3-L4 laminectomy extension with bilateral foraminotomy, and partial L3-L4 discectomy. Tissue biopsies were obtained from both L3 and L4 vertebral bodies for microbiological analysis. The infectious diseases team initiated empirical treatment for pyogenic spondylodiscitis pending culture results. Initial laboratory studies including Gram stain, KOH preparation, Ziehl-Neelsen staining, and bacterial cultures were negative. Interestingly, tuberculosis PCR from tissue samples was also negative, despite a positive QuantiFERON assay. Based on clinical presentation, imaging findings, and positive QuantiFERON results, tuberculous spondylodiscitis was diagnosed and anti-tuberculous therapy was initiated. **Results:** The patient was discharged on postoperative day 4 for outpatient management. At the 2-week follow-up, he reported persistent but improved back pain, likely related to spinal instability following hardware removal, and mild residual radicular symptoms from the surgical procedure. Despite these expected postoperative symptoms, the patient demonstrated overall clinical improvement with resolution of neurological deficits. Anti-tuberculous therapy was continued with planned reassessment for spinal reconstruction after completion of at least 3 months of antimicrobial treatment. **Conclusion:** This case illustrates the value of composite diagnostic strategies for STB. Because extrapulmonary TB is characteristically paucibacillary and tissue sampling may be suboptimal, negative NAAT, smear, or culture results cannot reliably exclude STB. Evidence-based practice integrates clinical and radiological features with histopathology, mycobacterial culture, and molecular assays, wherein positive NAAT/culture supports confirmation, but negative results require cautious interpretation. Emerging evidence indicates that combined approaches enhance diagnostic sensitivity and reduce time-to-diagnosis compared to culture alone. In our patient, the convergence of characteristic MRI findings, clinical context, positive IGRA, and objective clinical improvement with anti-tuberculous therapy substantiated the diagnosis of STB. Clinicians should therefore prioritize composite diagnostic standards and timely treatment initiation over deferring therapy while pursuing definitive single-test confirmation in this disease context.

ID: AGS26/810

P0597: Posterior approach with preservation of posterior spinal structures for vertebral subtotal resection in thoracolumbar tuberculosis with spinal cord injury: a retrospective clinical study

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Introduction: Surgical management of thoracolumbar tuberculosis with spinal cord injury remains challenging due to the risks of spinal instability and inadequate decompression. Anterior and combined approaches are associated with significant morbidity, while traditional posterior methods often compromise posterior spinal integrity. This study evaluates the clinical efficacy of a modified posterior approach that preserves posterior spinal structures while enabling thorough decompression and reconstruction. **Material and Methods:** A retrospective analysis was conducted on 21 patients (13 male, 8 female; mean age 49.7 years) with thoracolumbar tuberculosis and spinal cord injury treated between 2013 and 2019. All patients underwent vertebral subtotal resection and anterior decompression via a posterior approach while preserving the posterior ligamentous complex, laminae, and facet joints. Preoperative and postoperative spinal canal dimensions (anteroposterior diameter and cross-sectional area), ASIA impairment scale, and JOA scores were compared. Statistical analysis was performed using paired t-tests with SPSS 17.0. **Results:** All patients were followed for an average of 2.4 years (range: 2-4 years). Significant improvement was observed in spinal canal dimensions: the anteroposterior diameter ratio increased from 75.37 ± 4.16% to 98.45 ± 1.55% ($p < 0.001$), and the cross-sectional area ratio improved from 77.26 ± 2.93% to 98.67 ± 0.48% ($p < 0.001$). JOA scores improved from 6.01 ± 4.32 preoperatively to 10.2 ± 0.77 at 6 months postoperatively ($p < 0.001$). All 21 patients improved to ASIA grade E by 6 months. One case of pleural rupture leading to pneumothorax was successfully managed with drainage, and one case of delayed wound healing resolved with dressing changes. **Conclusion:** The posterior approach with preservation of posterior spinal structures allows for effective decompression, debridement, and reconstruction in thoracolumbar tuberculosis with spinal cord injury, while maintaining spinal stability. This technique significantly improves neurological outcomes and reduces complications, offering a viable alternative to conventional anterior or combined approaches.

Keywords: Spinal tuberculosis, posterior approach, vertebral subtotal resection, spinal cord injury, decompression, posterior structure preservation, ASIA score, JOA score

ID: AGS26/969

P0598: The use of 18F FDG PET - Computed tomography in the diagnosis and management of spinal implant infection

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Introduction: Spinal implant infection can be a cause of post-operative back pain in the presence of a well healed wound. 2-deoxy-2-[18F]fluoro-D-glucose positron emission tomography (18F FDG PET) (PET CT) has been shown to be useful in diagnosing spinal implant infection. If results are indeterminate however, a magnetic resonance imaging (MRI) with gadolinium (GAD) can be useful. **Material and Methods:** Retrospective case series of patients who underwent PET CT to investigate for spinal implant infection between 1/1/2020 - 15/9/2024. Imaging reports, clinic letters, biochemistry and case notes were reviewed. All PET CT scans were reported by a Consultant Radiologist and patients clinically reviewed by a Spinal Consultant. **Results:** Total of 150 PET CT scans were performed. 117 patients had scans demonstrating no active infection. 16 patients had confirmed infection on PET CT, for which 6 patients underwent surgery; 3 wound washout, debridement and implant retention, 2 implant exchange and 1 implant removal. The rest received long term antibiotics.17 patients had non-conclusive PET CT. Of these, 16 had a further MRI with Gadolinium. 3 patients had confirmed infection on MRI with GAD, for which 1 patient underwent surgery for washout, debridement and implant retention. The rest received long term antibiotics. All patients that underwent surgery also received antibiotics and there were no cases of missed spinal implant infection when using PET CT combined with MRI. **Conclusion:** PET CT is useful imaging modality for suspected spinal implant infection. In cases where it is inconclusive then MRI with GAD is a useful next line investigation.

ID: AGS26/1004
P0599: Carbon fiber-reinforced polyetheretherketone implants versus titanium implants for the surgical management of cervical spondylodiscitis

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Introduction: cervical spondylodiscitis associated with high mortality. Through evaluate new technologies we have nowdasy different materials to use in spine stabilization. The study performed to evaluate and compare the clinical, radiological outcomes, savety and diagnostic imaging quality of Titanium Plates with PEEK or Titanium Cages (Ti-PEEK) versus Carbon Fiber-Reinforced Polyetheretherketone (CFR-PEEK) Plates and Cages in the surgical management of cervical spondylodiscitis. **Material and Methods:** A retrospective analysis was conducted by patients who underwent anterior cervical debridement and stabilization from 2013 to 2024. Patient records, pre- and postoperative imaging, repeat surgeries and complications were retrospectively anlyzed. **Results:** Thirty patients met the inclusion criteria: 15 patients were operated with Ti-PEEK and 15 patients with CFR-PEEK impalnats. The mean age of the patients was 64.5 ± 10.8 years. The most primary symptom was neck pain in 28 patients (93.3%), focal neurological symptoms observed in 14 patients (43.3%). Preoperative assessment classified the severity of the condition as ASA II in 16 patients (53.3%), ASA III in 9 patients (30%) and ASA IV in 5 patients (16.7%). There was no significant differences between groups ($p > 0.05$). In most cases (24/30) Spondylodiscitis was observed in one segment, a prevertebral abscess was detected in 8/30 cases (27%) and epidural empyema in 24/30 patients (80%). Preoperative CT scans revealed vertebral destruction in 4/30 patients (13.3%) and endplate erosion in 10/30 patients (33.3%). No difference between gropus ($p > 0.05$). The mean duration from admission to surgery was 1.63 ± 1.94 days. Surgical interventions using Plate and Cage (ACDF + CP) were performed on 27 patients, while 3 patients underwent ACCF + CP. The plate was used in all cases to achieve the stability. The most frequently identified pathogen was Staphylococcus aureus. Three reoperations were performed on the operated segment or in the region of the previous surgical approach, all in the CFR-PEEK group. Patients remained in the clinic until their condition stabilized. After treatment, 10 patients were discharged to outpatient care, 19 were transferred for further therapy to local hospitals or rehabilitation clinics, and one patient had an exitus letalis. The average hospital stay was 15.3 ± 20 days, with the longest stay being 120 days due to the adjustment of antibiotic therapy and a second surgery. Follow-up after discharge was available for 19 patients. Overall, radiological assessments after the operation with cervical spine CT were available for 18 patients (60%), and cervical spine MRI for 21 patients (70%). In T1 modes with contrast enhancement in the Ti-PEEK group the informational value was low in the prevertebral are, disc space, and ventral subarachnoid space due to artifacts from the titanium plate. Assessment of the spinal cord was also impossible in one patient. The dorsal subarachnoid space and posterior structures of the cervical spine were sufficiently well-represented for analysis. The CFR-PEEK group achieved the maximum score in each zone, demonstrating high informational value in T1-weighted MRI with contrast enhancement. The T2-weighted MRI in the Ti-PEEK group was not informative in the prevertebral and disc space areas. However, the examination of the ventral subarachnoid space was just as informative as in the CFR-PEEK group. Examination of all other areas in both groups was possible with high diagnostic value. In the follow-up, cervical spine MRI was available for 17 patients (56.67%). The average timing for MRI was 76.12 ± 48.56 days. Cervical spine CT was available in follow-up for 11 patients (36.67%), and another 8 patients (26.67%) had X-ray examinations. Both implant groups showed similar clinical outcomes, in Ti-PEEK

7/8 and CFR-PEEK 10/11 achieving an Odom Score of 1 and 2 at the first follow-up (p = 0.715). **Conclusion:** While clinical outcomes were comparable, CFR-PEEK implants yielded higher MRI informational value, enhancing postoperative diagnostics and follow-up in cervical spondylodiscitis patients. The presence of reoperations in the CFR-PEEK group highlights the need for careful monitoring in this patient population.

ID: AGS26/1015
P0600: Initial bone destruction status and quality of fusion after surgical repair in inaugural spinal tuberculosis

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Introduction: Early tuberculous spondylodiscitis sometimes causes significant bone damage from the outset, which can lead to serious complications such as instability, paralysis, and deformity. Medication alone is not always enough to guarantee a cure. The aim of this study is to assess the healing based on the extent of the initial lesion, within the context of surgery. **Materials and Methods:** A prospective study was conducted on a series of 21 patients. There were 19 women and 2 men. The average age was 42 years (19-67 years). There were 2 cervical locations, 8 thoracic, 7 thoracolumbar and 4 lumbar. There were 14 neurological cases including 7 complicated by a gibbosity, 2 non-deficient kyphosis and 5 unstable spines with risk of worsening. Instrumentation and arthrodesis were systematic and all were previously under specific medical treatment administered after anatomopathological confirmation of the affection. A complete radiological assessment was the rule for all patients. Each had standard radiographs, telemetry, a CT scan and an MRI. The evaluation focused on the number of destroyed vertebrae, the affected column in the anteroposterior plane, the extent of the vertebral body damage, the signs of spine at risk as described by Rajasekaran, as well as the existence of contiguous and skip lesions. Time and rate of fusion according to Bridwell grade were calculated. **Results:** The mean follow-up was 32.7 months ± 19.7 (7 to 72 months). 52.4% of patients, or 11 cases, had 2 or 3 destroyed vertebrae, and 42.9%, or 9 cases, had more than 3. In 57.1% of the cases, or 12 patients, there was mainly combined anterior and middle column involvement. More than half of the vertebral body was destroyed in 13 patients, or 61.9% of cases. 15 cases (71.4%) had two radiographic criteria of destabilization, and 5 cases (23.8%) had three. Lesions were contiguous in 20 patients (95.2%). They were also found non-contiguous in 8 cases (38.1%). Consolidation was complete for 18 patients (85.7%). The mean fusion time was 10.1 months ± 2.9 (5 months -15 months). 66.7% of patients, or 14 cases, fused between 6 months and one year. **Conclusion:** Involvement of multiple vertebrae was common, as were initially destructive forms. Instability was often evident and significant. CT and MRI were crucial for diagnosis and treatment strategy. Healing was generally the rule in our patients thanks to surgery and anti-tuberculosis drugs. Indeed, the time and rate of fusion were in accordance with what is reported in the literature.

ID: AGS26/1018
P0601: Sagittal tilt in T9 and T1 pre and postoperatively in acute Pott's disease

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Introduction: The deformity observed in early spinal tuberculosis is sometimes severe from the outset. It can thus alter the harmony of the spine profile. This can manifest clinically as an anteflexion of the trunk or even a forward bending of the head and neck. The objective of this study was to examine the sagittal inclination angle in T9 and T1 before and after internal fixation at the beginning of the affection. **Materials and Methods:** This was a prospective study involving 21 patients. They were distributed as follows: 19 women and 2 men. The mean age was 42 years (range: 19 to 67 years). According to location, there were 2 cervical, 8 thoracic, 7 thoracolumbar, and 4 lumbar. All underwent instrumentation with fusion after having prior histological proof of the lesion and initiating appropriate medical treatment. The analysis was based on telemetry of the entire spine, in lateral and frontal views. Sagittal tilt was studied, particularly at T9 and T1. **Results:** The mean follow-up was 32.7 months ± 19.7 (7 to 72 months). The mean T9 tilt angle preoperatively was 12.4° ± 4.8 (-4°-20°), 12.4° ± 3.1 (6°-18°) postoperatively, and 12.9° ± 2.9 (6°-18°) at 6 months and at the final follow-up. The mean T1 tilt angle preoperatively was 4.1° ± 6.0 (-14°-10°), 4.5° ± 4.5 (-6°-10°) postoperatively, and 4.3° ± 3.8 (-6°-10°) at 6 months and at the final follow-up. **Conclusion:** The normal sagittal tilt of T9 is 10°+/-3. The vast majority maintained a value between 10° and 20°, or 95.2% of patients (20 cases). Normal T1 sagittal tilt is between 0° and 10°. It was initially beyond this value for 19.0% of patients, or 4 cases, and ultimately normal for 85.7% of patients, or 18 cases. Finally,

instrumented arthrodesis effectively maintains an acceptable sagittal tilt in T9 and T1 in active tuberculous spondylitis.

ID: AGS26/1028
P0602: Assessment of functional change using the Oswestry Disability Index in patients with hematogenous spondylodiscitis undergoing spinal fusion by minimally invasive surgery

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Introduction: Currently, spondylodiscitis has an annual incidence of between 0.5 and 2.5 cases per 100,000 inhabitants, with older adults (> 55 years) being the patients most at risk due to their multiple comorbidities such as diabetes, obesity, urinary tract infections, among others. In Colombia, a reported incidence of 1.07 per 100,000 inhabitants has been reported, a value that is within the global figures; however, there is no literature reporting the functional outcomes of the population with this pathology, especially in the Caribbean region. Therefore, the objective of this study is to characterize the population with hematogenous spondylodiscitis in our service, as well as to evaluate the functional change after surgical treatment with minimally invasive surgery and identify risk factors and complications. **Material and Methods:** A retrospective, cross-sectional, descriptive study was conducted, analyzing patients over 18 years of age, with a confirmed diagnosis of hematogenous spondylodiscitis by symptomatic and imaging criteria, who were treated with spinal arthrodesis by means of MIS at the Hospital Universitario del Caribe in Cartagena, Colombia, between January 1, 2021, and May 31, 2025, and who had their functionality evaluated preoperatively and postoperatively with the Oswestry Disability Index. **Results:** As preliminary results, a total of 18 patients who presented hematogenous spondylodiscitis between the years 2021 to 2025 were identified at our institution, all patients had a score < 12 points in the Spinal Infection Treatment Evaluation (SITE score), of which 11% died (N = 2), and 11% are hospitalized for a long time. Within the functional results, preoperatively the patients had scores > 40 indicating severe to extreme functional limitation, mainly due to pain and walking limitations. Postoperatively, significant changes were observed in the score, achieving figures < 20 indicating minimal or moderate functional limitation. **Conclusion:** It is highlighted that patients with hematogenous spondylodiscitis who received comprehensive treatment with antibiotic therapy and spinal fusion through MIS, showed an improvement in functionality evaluated by ODI, this highlights the importance of considering these minimally invasive techniques for the management of this pathology, in order to reduce complications associated with the surgical procedure and the improvement of both clinical and functional outcomes such as pain and walking ability.

ID: AGS26/1031
P0603: Early outcome of decompression and fixation for complicated Pott's disease Sudan experience

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Background: The spine is a common location for osseous tuberculosis, accounting for 50%-60% of cases. Spinal TB is challenging to diagnose and frequently presented at an advanced stage. Delays in determining the diagnosis and course of treatment lead to problems such as spinal cord compression and deformity. **Patients and Methods:** Observational, hospital-based study, it was conducted during the period from January 2021- May 2022. In many hospitals in Khartoum state, included fifty-two patients underwent surgical decompression for Pott's disease; with more than 6 months follow up, patients assessment performed using ASIA score. Data analysis was performed by SPSS. (v. 26th). **Results:** Out of 52 patients, male 28 (53.8%), and female were 24 (46.2%). the mean patient age was 52.13 ± 13.0 years. Within range (30-75 years old). The Half of patients 26 (50%) were completely return to daily life activity, while 19 (36.5%) had some function lost, and 7 (13.5%) unable to return. Most of patients 45 (86.5%) were improved, and 7 (13.5%) had unfavourable outcome. Function outcome, in 15 (28.8%) was excellent, 16 (30.8%) was good, and 14 (26.9%) was fair, and 7 (13.5%) was poor. Age group was significantly associated with function outcome (p value = 0.025) while gender, and chronic illness have insignificant association with function outcome (p value > 0.05). Preoperative neurological status was significant

predictor of function outcome (p value = 0.00). **Conclusion:** Surgical options involving decompression of spine TB followed by stabilization are utilized in most patients with neurological deficits. It is very effective, and the results are good.

ID: AGS26/1147
P0604: Impact of enhanced infection prevention protocols on postoperative infection rates in full endoscopic lumbar discectomy: a 10-year single-centre experience

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Introduction: Full endoscopic lumbar discectomy is a well-established minimally invasive technique for managing lumbar disc herniation, offering advantages such as reduced hospital stay and faster recovery. Nevertheless, postoperative infection remains a critical concern, particularly during the early learning curve. Over the last two years, we implemented targeted infection prevention measures-continuous irrigation pump, single-use RF probe in every case, and Vancomycin added to irrigation fluid-to further minimize infection risk. This study evaluates their impact on infection rates. **Materials and Methods:** We retrospectively analysed 699 adult patients who underwent full endoscopic lumbar discectomy between 2014 and 2025 at a single centre. The cohort was divided into two groups: 578 cases (2014-2023) operated without the enhanced protocol and 121 consecutive cases (2023-2025) performed after its introduction. Postoperative infection was defined by clinical signs (fever, wound discharge), radiological evidence, or culture-positive spondylodiscitis requiring intervention, assessed within 30 and 90 days. **Results:** The infection rate in the initial cohort was 1.38%, predominantly due to spondylodiscitis contributing to readmissions. Following implementation of the enhanced protocol, no infections were observed in the recent 121 cases. No spondylodiscitis, wound infection, or other infection-related complications occurred during this period. **Conclusion:** Enhanced infection prevention measures in full endoscopic lumbar discectomy-continuous irrigation pump, single-use RF probe, and Vancomycin in irrigation fluid-effectively reduced postoperative infection rates to zero. These findings underscore the importance of rigorous infection control protocols and suggest that their routine incorporation can significantly improve patient safety and surgical outcomes.

ID: AGS26/1152
P0605: Surgical site infection after lumbar spine surgery: an umbrella review

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Introduction: Surgical site infection (SSI) is a serious complication following lumbar spine surgery, with reported rates ranging from 0.2% to 16.1%. Multiple patient, clinical, and surgical factors contribute to infection risk, yet findings across systematic reviews remain fragmented. The aim of this review is to consolidate evidence from published systematic reviews and meta-analyses to clarify SSI incidence and risk factors across lumbar spine procedures. **Material and Methods:** This umbrella review was conducted in accordance with the Preferred Reporting Items for Overviews of Reviews (PRIOR) framework and was prospectively registered with PROSPERO (CRD42024602543). A comprehensive search of PubMed, MEDLINE, CINAHL, SPORTDiscus, EMBASE, Cochrane Library, and Web of Science was performed from database inception to December 2024. Search strategies combined terms relating to lumbar spine surgery, surgical site infection, and systematic review/meta-analysis. Eligibility criteria included systematic reviews and meta-analyses that reported SSI incidence, risk factors, or preventive strategies in patients undergoing lumbar spine surgery. Non-systematic narrative reviews, single primary studies, and reviews without extractable SSI data were excluded. Two independent reviewers screened titles, abstracts, and full texts, with discrepancies resolved by consensus. Data extracted included study design, number of primary studies, patient population, surgical procedures (fusion vs. decompression; open vs. minimally invasive), SSI definitions, reported incidence, risk factors, and prophylactic measures. Methodological quality of included reviews was appraised using AMSTAR 2. A narrative synthesis was performed, with quantitative pooling of SSI incidence where possible. Subgroup analyses explored variation by surgical approach, patient characteristics, and use of prophylactic interventions. **Results:** Fifty-nine systematic reviews were included, representing 648 primary studies and 1,248,463 patients. The pooled cumulative incidence of SSI across all lumbar spine procedures was **3.56%**. Rates varied substantially by surgical technique and patient subgroup. Fusion procedures

consistently demonstrated the highest risk of infection compared to decompression-only procedures. Minimally invasive approaches, despite smaller incisions, were paradoxically associated with a greater risk of SSI than open procedures, likely reflecting longer operative times, limited exposure, and technical challenges. Patient-related risk factors such as diabetes, obesity, smoking, and advanced age were repeatedly associated with elevated SSI incidence across reviews. Intraoperative strategies showed marked effect sizes. Intrawound vancomycin reduced SSI incidence from **7.17% to 1.66%**, demonstrating strong prophylactic benefit. The role of systemic antibiotics was more variable, with evidence supporting standard perioperative use but limited clarity regarding extended prophylaxis. Use of drains, length of hospital stay, and revision surgery were also linked with increased infection risk. **Conclusion:** Fusions and minimally invasive approaches are associated with increased SSI risk, though prophylactic intrawound vancomycin provides substantial protective benefit. Heterogeneity and limited reporting of surgical characteristics constrain subgroup analyses, underscoring the need for higher-quality, procedure-specific data.

ID: AGS26/1157
P0606: The impact of location on de novo spondylodiscitis: regions matter but are secondary to comorbidities

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Introduction: Primary spondylodiscitis (SD) cases surging in incidence globally remain a diagnostic and therapeutic challenge for physicians. The effect of lesion location on outcomes remains unclear. This study aims to assess the 90-day all-cause readmission rate in patients suffering from spondylodiscitis in different regions of the spine, with a secondary objective of comparing in-hospital mortality rates. **Material and Methods:** Utilizing the 2020 Nationwide Readmissions Database (NRD), USA, adult patients (> 18 years) were selected by diagnosis with ICD-10 codes for primary spondylodiscitis. Patients were categorized by localization into eight groups, excluding multifocal patients. Comparative analysis and logistic regressions were performed. **Results:** Among 5547 patients, lumbar SD was most prevalent, followed by thoracic and lumbo-sacral regions. Cervical SD had the lowest readmission rate (31.3%) and lower odds versus lumbar SD (adjusted OR = 0.73; $p = 0.007$). Other regions showed no significant differences. In-hospital mortality varied by location. The sacral region, renal failure, and advanced age were the strongest mortality predictors. **Conclusion:** While the incidence of spondylodiscitis varies by location on the spine, we found no significant differences in readmission rates across regions. However, there were substantial differences in in-hospital mortality rates. Comorbidities, particularly renal failure and advanced age, appear to outweigh spinal localization as risk factors for mortality and readmission.

ID: AGS26/1353
P0607: Spondylodiscitis in child: case report

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Introduction: Discit, an inflammation of the intervertebral disc space, is a pathology that can lead to disc erosion. Knowledge of its manifestation in the pediatric age group remains limited, largely due to the low incidence of documented cases. The most widely accepted etiology is bacterial, particularly in cases of pediatric spondylodiscitis. The mean age for diagnosis in children is between two and eight years. Although any segment of the vertebral column can be affected, the lumbar region is the most frequently involved, accounting for the majority of cases, approximately 75% of patients, with a higher prevalence in children under five years of age. **Material and Methods:** A 4-year-old female patient, with a previously healthy medical history, presented with sudden lower back pain, frequent falls, and difficulty walking. The symptoms, which included diffuse fever peaks, began 30 days prior. The child was initially diagnosed with viral myositis and treated with analgesics and antipyretics, with no improvement. Seven days after the onset of symptoms, she lost the ability to walk and had a 5% weight loss, which led to a new medical evaluation.Initial imaging studies revealed a decreased intervertebral disc space between L1 and L2. A computed tomography (CT) scan confirmed these findings, also showing lytic lesions in the L2 vertebral body and a rupture of the adjacent bone cortex. Laboratory tests upon admission showed a C-reactive protein level of 22.8 mg/L, suggesting a significant inflammatory process. Based on the clinical presentation and radiological findings, a diagnostic hypothesis of acute spondylodiscitis was raised. **Results:** Based on the patient's age and the common bacterial etiology in young children (*Kingella kingae*), empirical intravenous antibiotic therapy with Cefazolin was initiated. After two weeks, the patient was discharged from

the hospital, showing significant clinical and laboratory improvement, which obviated the need for a biopsy. Ambulation was restored within 72 hours with the use of an orthopedic brace (OTLS), and painful complaints were completely resolved within seven days of treatment initiation. Outpatient follow-up consisted of oral Cefadroxil therapy for an additional four weeks, with continued use of the brace during ambulation and rest. In subsequent follow-up, the patient remained asymptomatic, with no recurrence of symptoms or complications. **Conclusion:** This case report highlights the importance of early diagnosis and prompt treatment of spondylodiscitis in the pediatric population. It emphasizes the need for a high degree of clinical suspicion, particularly when children present with atypical lumbar pain that is refractory to initial symptomatic treatment. The timely intervention allowed for a complete recovery without sequelae, reinforcing the positive impact of an assertive diagnostic and therapeutic approach.

References

1. Fucs PMB, Meves R, Yamada HH (2012) Spinal infections in children: a review. International Orthopaedics (SICOT) 36: 387-395
2. Fernandez M, Carrol CL, Baker CJ (2000) Discitis and vertebral osteomyelitis in children: an 18-year review. Pediatrics 105 (6):1299-1304
3. Chandrasenan J, Klezl Z, Bommireddy R, Calthorpe D (2011) Spondylodiscitis in children: a retrospective series. J Bone Joint Surg Br 93(8):1122-1125
4. Brown R, Hussain M, McHugh K, Novelli V, Jones D (2001) Discitis in young children. J Bone Joint Surg Br 83(1): 106-111
5. Crawford AH, Kucharzyk DW, Ruda R, Smitherman HC Jr (1991) Diskitis in children. Clin Orthop Relat Res 266:70-79
6. Waizy H, Heckel M, Seller K, Schroten H, Wild A (2007) Remodeling of the spine in spondylodiscitis of children at the age of 3 years or younger. Arch Orthop Trauma Surg 127(6): 403-407

ID: AGS26/1408
P0608: Necrotizing orchiepididymitis with testicular rupture following catheter-associated UTI and spondylodiscitis: a rare urological emergency

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Introduction: Urinary tract infections (UTIs) are common hospital-acquired complications that can progress to severe systemic infections when not promptly recognized and treated. We describe a rare case of a complicated UTI that progressed to bacterial pyelonephritis, hematogenous spondylodiscitis, and ultimately necrotizing orchiepididymitis with testicular rupture. **Case Description:** A 58-year-old man with a recent history of lumbar decompression and arthrodesis developed a catheter-associated UTI, with E. coli and P. aeruginosa isolated. Despite initial antibiotic treatment, he subsequently presented with worsening lumbar pain, neurological deficits, and scrotal swelling. Imaging confirmed spondylodiscitis with epidural abscesses and left-sided testicular necrosis. He underwent emergency orchiectomy, followed by staged anterior L5 corpectomy and posterior instrumentation. Multidrug-resistant E. coli was isolated from both spinal and scrotal specimens. Targeted intravenous antibiotic therapy, debridement, and wound management effectively controlled the infection. At one-year follow-up, the patient remained afebrile with neurological improvement and no recurrence. **Conclusion:** This case highlights the potential for catheter-associated UTIs to evolve into life-threatening systemic infections with multi-organ involvement. The unique combination of spondylodiscitis and necrotizing orchiepididymitis highlights the need for high clinical suspicion, rapid diagnostic workup, and multidisciplinary management in high-risk postoperative patients. Preventive strategies and early intervention are critical in minimizing morbidity and long-term sequelae.

ID: AGS26/1440
P0609: Novel antimicrobial strategy in the treatment of spondylodiscitis

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Introduction: Bioactive Glass (BAG) has high utility in orthopedic surgery due to its pharmacological activity, which promotes tissue regeneration and bone fusion. Furthermore, it optimizes systemic antibiotic treatment by improving pharmacokinetic parameters and exhibiting strong bacteriostatic activity at the application site. This case report presents a patient with spondylodiscitis that required surgical treatment with discectomy and placement of BAG in the intervertebral space. **Case presentation:** A 71-year-old male patient with a history of a psoas abscess, from which a beta-lactamase-producing Staphylococcus capitis was isolated, and received antibiotic treatment. He subsequently presented with spondylodiscitis at the T11-T12 level, requiring surgery. During the procedure, a discectomy, irrigation, BAG placement in the intervertebral space, and spinal fusion from T8 to L3 were performed. Following surgery and intravenous

antibiotic therapy, the patient's symptoms improved, and the infection resolved without recurrence at the 6-month follow-up. **Discussion:** The most common and well-established treatment for spondylodiscitis is posterior spinal fusion and arthrodesis, and anterior corpectomy for patients with vertebral body involvement, instability, epidural abscesses, and conjunction with intravenous antibiotics. This is a complex, invasive, and highly challenging surgical approach. BAG has demonstrated a high bone fusion rate, as well as bacteriostatic activity against both Gram-positive and Gram-negative bacteria, including methicillin-resistant *Staphylococcus aureus.* Therefore, this new proposed technique's goal isto avoid such extensive surgery, aiming to eliminate the infection and stimulate localized bone fusion at the affected segment. **Conclusion:** The use of BAG in the intervertebral space is recommended for patients with spondylodiscitis, given the high bacteriostatic capacity of the glass and its bone-fusing properties. Therefore, this new technique is proposed to reduce intraoperative time, thus avoiding the need for such extensive surgical procedures, while still effectively eliminating the infection and stimulating localized bone fusion in the affected segment.

ID: AGS26/1450
P0610: Percutaneous multilevel drainage: a less invasive treatment of massive spinal tuberculosis

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Introduction: Tuberculosis (TB) is a disease that can be debilitating without specific treatment. Developing countries have successfully implemented vaccination campaigns, leading to eradication. However, isolated cases continue to exist. Chile is a developing country, with rising TB rates despite government healthcare efforts. Spinal TB should always be considered as secondary dissemination, even though its rare presentation. **Material and Methods:** Case report and literature review. A 21 year-old-woman, without comorbidities known, evaluated during COVID-19 pandemic. She manifested severe low and middle back pain for about 6 months, occasional fever, malaise and unexpected weight-loss. X-Rays, CT and MRI were performed, with multiple prevertebral and vertebral body abscesses from T6 to L2. CT biopsy was performed, resulting positive for *M. tuberculosis.* It was decided by the Infectology specialists to complete 12 months of antibiotic treatment. However, the patient did not improve, presenting a kyphotic thoracic deformity and neural intermittent claudication. Hence, we decided to perform a percutaneous multi pedicular drainage treatment, evacuating about 2 litres of caseum abscess from all affected levels. The patient performed well after the treatment, with minimum pain, capable of daily life activities. Six months post operative X-rays showed marked reduction of abscesses and fusion of some of the segments involved. Also, she was treated by Infectology with a secondary line antibiotic therapy for another 9 months after the surgery. After doing a literature review, we did not find any publication showing a similar treatment technique, therefore we thought of documenting the case. **Results:** The technique described resulted to be a safe, reproducible and useful technique for this kind of unusual case. We did not find published scientific literature related to this subject. However, there is vastly described performing open surgical techniques to drain these types of massive abscesses. This percutaneous technique can offer the advantages of avoiding a posterior open approach, giving the chance of a quicker recovery and less risk of postoperative infection. **Conclusion:** Kyphosis in the context of spinal TB presents significant challenges for the spine surgeon, given the potential for generating significant imbalances in the context of osteoporotic bones and secondary contamination. Antibiotic treatment can be reviewed as adjuvant and preventive treatments. This case is of interest due to its rarity in our country, in addition to describing the percutaneous drainage technique, the context of the patient and the severity of her spinal damage is unusual.

ID: AGS26/1549
P0611: Microbiological profile of surgical site infections in spine surgery: a retrospective analysis at an orthopedic hospital in Mexico

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Introduction: Surgical site infections (SSIs) in orthopedic surgery represent a significant public health concern due to their economic impact on healthcare systems and the psychosocial burden on patients. Postoperative spinal infections are particularly devastating, as they can result in chronic pain, repeated surgical interventions, prolonged hospital stays, and increased morbidity and mortality. Therefore, timely diagnosis and accurate identification of causative organisms are essential to establish appropriate treatment and reduce complications. **Material and Methods:** We conducted a descriptive, retrospective, cross-sectional study of patients diagnosed with SSIs at the Orthopedic Hospital in Mexico City between January 1, 2022, and December 31, 2023. A targeted search was performed using ICD-10 codes to identify patients with spinal SSIs. Descriptive statistics were applied, including frequencies, measures of central tendency, and standard deviations for quantitative variables. **Results:** A total of 277 patients with nosocomial infections were identified. The patients mean age was 60.02 years, and female patients represented 50.1% (n = 139) of the sample. Among them, 246 patients (89.16%) were diagnosed with SSIs, and of these, 48 cases (19.51%) involved spinal surgery. The most prevalent surgical procedure associated with infection was lumbar fusion (12.19%), followed by lumbar decompression/discectomy (7.31%). For etiological diagnosis, 6.5% of cases (n=16) underwent biopsy culture, 8.9% (n = 22) swab culture, while in 4.06% (n = 10) the type of culture was not reported. The most frequently isolated pathogen was Escherichia coli (16.32%, n = 8), followed by Enterococcus spp. (16.32%, n = 8), Staphylococcus epidermidis (10.41%, n = 5), and less commonly Staphylococcus aureus, Enterobacter cloacae, and Klebsiella spp. (4.16% each, n = 2). Negative results accounted for 14.58%, and the same proportion was reported as inadequate samples (n = 7). In three cases (6.25%), beta-lactamase-resistant organisms were detected. **Conclusion:** Spinal SSIs accounted for 19.51% of all SSIs reported at our institution, with lumbar fusion being the procedure most frequently associated with infection. The most commonly isolated pathogen was E. coli, a finding that contrasts with the international literature, where Staphylococcus aureus is generally reported as the predominant organism. This discrepancy may reflect local epidemiological differences that should be considered when selecting prophylactic antibiotics and empirical therapeutic strategies. The high proportion of negative or inadequate cultures (12.5%) highlights the need to optimize sampling techniques, transport, and laboratory processing to reduce false negatives and improve diagnostic accuracy. The detection of beta-lactamase-resistant organisms emphasizes the importance of continuous microbiological surveillance and the implementation of antibiotic stewardship programs to mitigate resistance. Overall, spinal SSIs represent a clinically and epidemiologically significant problem, associated with prolonged hospitalization, increased healthcare costs, and a substantial impact on patient quality of life. These findings underscore the urgent need for multicenter prospective studies to validate our results and contribute to the development of evidence-based preventive strategies and management protocols tailored to the local epidemiological profile.

ID: AGS26/1598
P0612: Surgical treatment strategy for chronic infectious spondylitis: cohort analysys with a minimum 3 years follow-up

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Introduction: Chronic infectious spondylitis of the cervicothoracic spine represents an etiologically heterogeneous group of diseases characterized by vertebral destruction within the C6-T3 region. There is no common strategy for the surgical treatment of this cohort of patients. **Material and Methods:** The cohort included 21 patients treated between 2018 and 2022. Considering the etiology, long-term outcomes were analyzed in 14 patients with chronic nonspecific spondylitis and 7 patients with tuberculous spondylitis. Clinical, radiological, and surgical parameters were assessed. Follow-up results were evaluated at list 3 years. **Results:** Chronic infectious spondylitis in the cohort was classified according to E. Pola (2017) as types B.3 (n = 10), C.2 (n = 4), C.3 (n = 1), and C.4 (n = 6). The mean age at the time of surgery was 48 years and 3 months (range 20-71). The groups were comparable in gender, age, and degree of local sagittal balance impairment. The etiology of chronic spondylitis influenced the extent of the destructive process (p = 0.009) and the severity of back pain syndrome (p = 0.028). Health-related quality-of-life analysis revealed a greater degree of social maladaptation in tuberculous spondylitis group according to the NDI (p = 0.018) and SF-12 (p = 0.002). Indications for various techniques of cervicothoracic reconstruction, including isolated ventral, isolated dorsal, and combined approaches, were determined. **Conclusion:** The etiology of spondylitis affects the clinical course of the disease and the incidence of postoperative complications. The results of our study allowed for the development of several tactical tools for planning surgical reconstruction, including an algorithm for selecting the surgical approach and determining the need for manubriotomy.

Follow-up results of the proposed surgical algorithm confirm its effectiveness and potential for further application.

ID: AGS26/1611
P0613: TB spine in paediatric population; decision making, choice of treatment and surgical approaches

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Introduction: Spinal TB in children is relatively uncommon which are roughly 4-5% of pediatric TB cases. Surgical intervention is often required, with 40-50% of pediatric spinal TB cases needing corrective surgery. However the small size of paediatric patient make corrective surgery with instrumentation very challenging. Timely diagnosis is crucial to prevent severe outcomes like kyphotic deformity or neurological deficits. **Material and Methods:** We have 2 cases with same diagnosis but treated differently in view of different age and body size. The first case is a 3 years old boy which initially presented with right lower limb weakness and abnormal gait since May 2024, progressively worsening to paraparesis over 2 months. Serial investigation done and was diagnosed with disseminated TB with tuberculous spondylodiscitis with bony destruction T3- T6, pulmonary TB and TB tuberculoma. We proceeded with T4 corpectomy, interbody cage placement, and T1-T7 Posterior fixation via posterolateral approach. The second case is 9 months old baby girl, born preterm via SVD at 33weeks 5days presented with bilateral lower limb weakness for 2 months. Mother noticed that child unable to roll as usual and unable to stand with support. Prior to this event, she had history of chicken pox. MRI done noted multiple hypodense areas seen over the right paravertebrae region, extending into vertebrae body, suggestive of paraspinal abscess or bacterial spondylitis with adjacent lung collapse which consistent with TB Spine. This patient was treated with anti-TB medications and spine brace. **Conclusion:** For very small baby with spine deformity it is very challenging to do spine correction surgery not just because the baby size but no spine instrument can fit the small vertebra. In the second case where the baby is only 9 months old, we unable to do corrective surgery thus we fit a thoracolumbar brace to her to stabilize the spine. In the first case with the 3 years old boy, we managed to do corrective surgery by modifying cervical cage and screws to fit the thoracic level.

ID: AGS26/1671
P0614: Spondylodiscitis after vertebroplasty caused by *Streptococcus sanguinis* - Case report

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Introduction: In our case report we present a case of spondylodiscitis after vertebroplasty of L1 caused by S. sanguinis, complicated by sepsis, endocarditis and status epilepticus. **Materials and Methods:** 70-year-old female patient presented to the emergency department after a fall from standing height with pain in the lumbar spine. Conventional X-rays showed no obvious fracture in the thoracolumbar spine, and she was discharged with instructions and a prescription for analgesics. In the following days she presented to the ED with persistent back pain and elevated inflammatory markers, for which no obvious source of infection was discovered, she received Amoxicillin/clavulanic acid after consultation with infectious disease physicians. Follow-up X-rays showed a stable fracture of L1, and she was referred for an MRI, which confirmed the L1 fracture without other obvious pathology. Due to increasing back pain vertebroplasty of L1 was recommended and performed 3 weeks after the initial injury. At first follow-up, 3 weeks after the procedure the patient reported persistent pain, localized at L4/L5, for which she received analgesics and dexamethasone. 5 weeks after the vertebroplasty the patient presented again to the ED with severe back pain, no neurological deficits, hemodynamically unstable, with highly elevated inflammatory markers, urgent MRI showed spondylodiscitis at L1/L2 with a small abscess in the left psoas and the patient was admitted to the ICU for further treatment. Vancomycin and ceftriaxone were prescribed empirically after blood cultures were taken. Streptococcus sanguinis was isolated from the blood cultures and cefepime was prescribed as per the antibiogram. Follow-up MRI showed reduction of the abscess with persistent spondylodiscitis in L1/L2. CT of the lumbar spine showed destruction of L1 around the vertebral cement with signs of instability, therefore posterior stabilization was indicated. During the ICU hospitalization the patient suffered endocarditis of the mitral valve, status epilepticus caused by administration of Cefepime and nosocomial pneumonia. Due to the complication

of status epilepticus cefepime was exchanged for ceftriaxone. These conditions responded well to medical therapy and 27 days after being admitted the patient could be operated on. Percutaneous posterior fixation from TH11 to L3 was performed, after the procedure the patient was transferred to the trauma department and rehabilitation was initiated. The patient was neurologically intact and ambulatory on the 3rd post op day. **Results:** The patient responded well to antibiotic therapy and after stabilization of the lumbar spine was able to ambulate independently with minimum back pain. **Conclusion:** Spondylodiscitis after vertebroplasty is a rare complication, which in our case was complicated by sepsis, endocarditis, pneumonia and status epilepticus which was treated successfully with antibiotics, intensive care and surgical stabilization of the unstable lumbar spine.

ID: AGS26/1803
P0615: Clinical and microbiological characteristics of pyogenic vertebral osteomyelitis (changes from 2006 to 2022)

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Introduction: Since the beginning of the COVID-19 pandemic, a significant increase in purulent-inflammatory diseases, including vertebral osteomyelitis, has been noted. Mass inpatient treatment of the population, invasive treatment and diagnostic procedures, as well as the use of antibiotics, and steroids all lead to a change in the microbiological profile of vertebral osteomyelitis. The ratio of gram positive and gram-negative pathogens, acute and chronic forms and severity of the disease changes. Statistical analysis has been performed. **Material and Methods:** During the period from 2006 to 2022, 421 patients with pyogenic vertebral osteomyelitis were treated in the Regional Clinical Hospital No. 2, Tyumen, Russia: 2006-2019 - 264, 2020-2022 - 157 patients. There is a significant increase in the incidence rate, which amounted to 1.27 per 100 000 people per year in 2010 and 3.69 in 2022, with acute osteomyelitis predominating. Microbiological examination was performed on 295 patients (70.0%). The assessed factors were: gender, age, type of lesion according to the E. Pola 2017 classification, form of the disease, presence of complications, and number of microbiological samples and their result. **Results:** The number of female patients significantly increased from 26.7% to 37.6% ($p = 0.017$) and the age of patients of both genders from 48.9 ± 15.0 to 56.5 ± 15.3 ($p < 0.001$). Type A lesions decreased from 62 (23.5%) to 9 (5.7%) $p < 0.001$; type B from 124 (47.0%) to 60 (38.2%) $p = 0.078$; type C increased from 71 (26.9%) to 73 (46.5%) $p < 0.001$; posterior column lesions - type "0" - from 7 (2.6%) to 15 (9.6%) $p = 0.002$. There has been an increase in sepsis from 23 (8.7%) to 31 (19.7%) $p < 0.001$; and in neurological complications from 54 (20.5%) to 49 (31.2%) $p = 0.014$. Hospital mortality rose from 16 (6.1%) to 26 (16.6%) $p = 0.001$. A positive result of microbiological examination from the lesion focus was obtained in 129 and 90 (48.9% and 57.3%), blood cultures [out of 27 and 23 (10.2% and 14.6%), respectively, in the time periods. An increase in positive results was noted in the lesion focus for Klebsiella pneumoniae $p = 0.016$; Proteus mirabilis $p = 0.002$; Enterobacter cloacae $p = 0.007$; Enterobacter aerogens $p = 0.019$; MRSA $p = 0.064$. In general, an increase in gram-negative pathogens was noted from 3.8 to 9.6% $p = 0.015$; polymicrobial lesions from 3.0% to 9.6% $p = 0.004$. In blood cultures, there is an increase in polymicrobial lesions to 2.5% $p = 0.01$; an increase in Staphylococcus Aureus $p = 0.034$; Klebsiella pneumoniae $p = 0.029$; Escherichia Coli $p = 0.066$. **Conclusion:** With the onset of the pandemic, the clinical characteristics of the vertebral osteomyelitis changed significantly with an increase in acute forms by 1.7 times, sepsis by 2.3 times and epidural abscess by 2.1 times. A significant increase in posterior column lesions ($p = 0.002$) and type C lesions ($p < 0.001$) was also noted. There is a significant increase in gram-negative pathogens from the focus of inflammation ($p = 0.015$) and blood cultures ($p = 0.029$), as well as from polymicrobial lesions from the focus ($p = 0.004$).

ID: AGS26/1808
P0616: Emphysematous spondylitis, a rare complication of vertebral osteomyelitis

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Introduction: Emphysematous spondylitis is an extremely rare complication of vertebral osteomyelitis. Its characteristic feature is the formation of gas bubbles in the bones, paravertebral tissues and spinal canal. Often, publications note a combination of diabetes mellitus, emphysematous pyelonephritis and emphysematous spondylitis. Typical pathogens are Klebsiella pneumoniae, Escherichia coli, Proteus and Pseudomonas spp., Enterobacter aerogenes. Most publications are presented as descriptions of isolated cases. In case of late diagnosis and lack of timely surgical treatment, the risk of death is extremely high. **Material and Methods:** During the period 2019-2025, 189 patients with hematogenous vertebral osteomyelitis were treated at the Tyumen Regional Clinical Hospital No. 2 and the Clinical Hospital No. 71 of the Federal Medical and Biological Agency of the Chelyabinsk Region, Russia, 15 of whom had emphysematous spondylitis. Conservative treatment was received by 4 patients, and 11 underwent

surgery. The study assessed descriptive statistics, severity of the condition, main symptoms, concomitant pathology, microbiological test results, and treatment outcome, including in-hospital mortality. **Results:** The ratio of men and women was 1:2, the predominance of women is not observed in other types of vertebral osteomyelitis, the average age was 63 ± 13 years. The average time of diagnosis was 0.7 [0.25; 1.00] months, and was two times less, compared to the main group without emphysematous spondylitis which was 1.5 [0.75; 3.00] months. Sepsis was diagnosed in 11 (68.7%), epidural abscess in 10 (62.5%). The cervical spine was affected in 1 (13.3%) case, thoracic in 4 (26.7%), lumbar in 9 (60.0%) cases. Acute osteomyelitis was predominant and amounted to 81.3%. Concomitant pathology includes: diabetes mellitus in 9 (60.0%) cases, coronary heart disease in 10 (66.7%), pyelonephritis - 5 (33.3%), and obesity - 4 (26.7%). Previous purulent diseases were detected in 3 (20.0%) cases. 12 patients noted back or neck pain (80.0%), 5 - fever (33.3%). There were monovertebral and monosegmental lesions in 9 (60.0%) cases, and polysegmental and multilevel in 6 (40.0%). Staphylococcus Aureus - 6, MRSA -1, Klebsiella pneumoniae - 5, Escherichia Coli - 4, Proteus mirabilis - 1, were isolated from the focus of lesion and blood. 10 patients were operated on, all underwent drainage and debridement due to the severity of the condition. 6 (40.0%) patients died within 7 days after admission. Hospital mortality was 11 (73.3%). **Conclusion:** Emphysematous spondylitis as a form of vertebral osteomyelitis is characterized by the most severe condition, with the formation of sepsis and fatal outcomes for most patients. In most cases, it is associated with gram-negative pathogens. Surgical treatment is ineffective due to the severity of the condition on the day of admission to the hospital. Initial antibacterial therapy regimens should be targeted at gram-negative and resistant pathogens.

ID: AGS26/2001
P0617: Minimal invasive percutaneous fixation with biopsy without debridement for the treatment of pyogenic spondylodiscitis

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Introduction: Spinal infection (SI) is a challenging disease that requires immediate diagnosis and treatment. It can be treated non-surgically with antibiotics and Immobilization with an external orthosis for several weeks to months. If surgical intervention is required, a combined anterior and posterior approach is usually performed. We report here on our experience with the use of minimally invasive percutaneous transpedicular fixation (PTPF) combined with biopsy for microbiology and histopathology without debridement for the treatment in patients with SI. **Material and Methods:** We reviewed data of 54 patients, between 2014 and 2022, treated for hematogenous SI in the thoracolumbar spine without extensive bone destruction or significant neurological deficit, with biopsy and PTPF. Demographic, operative, and perioperative data were collected and analysed. **Results:** The study included 24 women and 30 men with mean age of 73.6 years (47-90). Renal insufficiency found in 32 and DM in 29 cases. 10 cases were class II ASA-Score und 44 were class III&IV. The lumbar spine was affected in 16 patients, 19 thoracic, 25 thoracolumbar, cervical in 4 and 6 patients had multifocal SI. All patients were operated minimally invasive and one patient hybrid dorsal Approach. In 52 patients, ≥ 3 segments were fixed. Mean operative time of 70 minutes. Mean blood loss was 300 ml. Intraop. biopsy for microbiological and histopathological examination in 52 patients; organism could be isolated in 45 cases. There were no intraop. surgical complications, one patient died two days postop. due to caradiac infarction. 35 patients had been reoperated for shortening of the fixation (mainly lumbar) after autofusion of the infected segments; occured in 47 patients within 6 months. Preop. VAS of 7/10 reduced to 2 at the last FU. 18 cases had ASIA-D, 15 improved postop. to ASIA-E. Preop. CRP and WBC were 118 and 12.7 reduced to 23.5 and 8.8 at the last FU respectively. Coagulase negative organisms were the commonest isolated organism. Polymicrobial SI in 3 patients. Two patients with specific infections. Antibiotic were given according to culture and sensitivity in culture positive cases. Antibiotic combination therapy is all of cases. **Conclusion:** Long-term Immobilization is critical, especially in elderly patients because of severe comorbidities. We present a minimally invasive surgical procedure to avoid immobilization and to overcome the disadvantages of ventrodorsal procedure in patients without significant neurological deficit or extensive bone destruction. The internal immobilization and antibiotic therapy without touching the infected tissue is sufficient to completely resolve the spondylodiscitis. The outcomes of this minimally invasive treatment in such multimorbid patients are promising.

ID: AGS26/2050
P0618: Postoperative infection in sacroiliac joint arthrodesis and association with the timing of intra-articular corticosteroid injection: a scoping review

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Introduction: The definitive surgical management of sacroiliac joint (SIJ) pain and dysfunction is arthrodesis, and is usually performed after trial of conservative treatment that includes intra-articular corticosteroid injections (CSI) in the SIJ which has diagnostic and therapeutic purposes. In many instances these steroid injections are performed multiple times, before the final

decision is made to offer arthrodesis. Whilst literature reviews have enumerated the safe time interval between steroid injections and subsequent cervical or lumbar spinal surgery, to our knowledge no such evidence exists for SIJ fusion. The literature around timing of CSI prior to lumbar surgery, although varied, suggests a duration of < 1 month increases the risk of infection significantly but ideally should be > 3 months. This study aims to review the available literature for optimal timing of CSI before SIJ fusion for risk reduction postoperatively and symptom control. **Material and Methods:** A systematic review was conducted using the PRISMA (Preferred Reporting Items for Systematic review and Meta-Analyses) guidelines of PubMed, ScienceDirect, National Institute for Health and Care Excellence (NICE), and Cochrane databases using the search strategy of "infection AND fusion AND sacroiliac AND injection". Prospective or retrospective clinical studies depicting either open or minimal-invasive surgery (MIS)/ percutaneous SIJ arthrodesis, fusion for all clinical indications including degenerative, inflammatory, instability in adult human population were included. Case reports, review articles, only non-surgical treatment studies and SIJ fusion for trauma were excluded. **Results:** A total of 1674 results were screened with 34 having their abstracts read for relevance, of which none were found to be looking at the complication rates post SIJ fusion in relation to the proximity of the last CSI to the surgical date. However, three studies looking at surgical management compared to conservative management of SIJ dysfunction showed 64-94% of participants had used CSI prior to SIJ fusion. **Conclusion:** Our scoping review failed to identify any evidence directly looking at how the timing of CSI may affect postoperative outcome in SIJ fusion however rates of infection ranged from 0.1% to 4%. As well, the studies with more participants previously having used CSI had higher rates of infection postoperatively, regardless of the time of follow-up. Given the particularly frequent utilisation of CSI in SIJ pain and dysfunction, there is a strong need for further research into this area. Similar to existent evidence in other spinal surgery, we believe that CSIs should be limited and where possible avoided in the 3 months preceding SIJ fusion.

ID: AGS26/2416

P0619: Percutaneous transforaminal endoscopic surgery (PTES) combined with anterolateral mini-incision surgery for the treatment of thoracic or lumbar tuberculosis with neurologic compression

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Introduction: The surgical strategies of thoracic or lumbar tuberculosis (TB) mainly include anterior, anterior combined posterior, and posterior approach for debridement, bone graft fusion and internal fixation. These surgeries may lead to significant morbidity because of extensive dissection and massive blood loss. The purpose of this study is to evaluate the feasibility, efficacy and safety of percutaneous transforaminal endoscopic surgery (PTES) combined with anterolateral mini-incision debridement and short-segment fusion for the treatment of thoracic or lumbar TB with neurologic compression. **Material and Methods:** 18 patients of single segment thoracic or lumbar TB with neurologic compression were included. PTES under local anesthesia was performed to remove the abscess and necrotic tissue compressing the neurologic elements for neurologic decompression in the prone position. Then, the abscess, infected and necrotic tissue were completely removed through anterolateral mini-access under direct vision in the lateral position. Through the same approach the short-segment fusion using 3D printed titanium cage or artificial vertebral body was performed, and the screws and rod fixation were undertaken with the pedicle screws inserted into involved vertebrae. The transthoracic approach was used for T8-L1, transdiaphragmatic approach for T11-L1, retroperitoneal approach for L1-S1. Operative duration, blood loss, incision length and hospital stay were recorded. Pre- and postoperative visual analog scale (VAS) pain scores of back and leg, Oswestry disability index (ODI), ASIA (American Spinal Injury Association) scale, complications and images were also recorded. **Results:** There were operative duration of 63 (52-75) min for PTES and 176 (98-210) min for anterolateral mini-incision surgery, blood loss of 290 (40-460) ml, incision length of 9.5 ± 2.3 mm for PTES and 54 ± 12 mm for anterolateral mini-incision surgery, and hospital stay of 6 (4-9) days. VAS scores significantly dropped postoperatively ($p < 0.001$) and ODI significantly decreased 2 years after surgery ($p < 0.001$). At the 3-month follow-up, all of 9 patients improved from ASIA scale D to E. All of 18 patients reached ASIA scale E at the 2-year follow-up. Fusion has been achieved in 18 cases. No internal fixation failure and other complication were found. **Conclusion:** PTES combined with anterolateral mini-incision debridement and short-segment fusion is a feasible, efficient and safe method in treating single segment thoracic or lumbar TB with neurologic compression. It shows advantages of less surgical trauma and faster postoperative recovery.

Key words: Thoracic or lumbar tuberculosis; Minimally invasive spine surgery; Transforaminal endoscopic surgery; Anterolateral mini-incision; Debridement and fusion

ID: AGS26/2450
P0620: No difference in surgical site infection rates between cefazolin and alternative antibiotics following spine surgery

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Introduction: Surgical site infections (SSIs) occur at a rate of 0.7-10% following spinal surgery with deep infections reported at 1-2% despite preoperative antibiotic prophylaxis. Cefazolin is the most commonly used antibiotic for surgical prophylaxis due to broad coverage against skin flora, however superiority of one antibiotic over others is debated. The current North American Spine Society (NASS) 2013 guidelines on antibiotic prophylaxis in spine surgery state the superiority of one antibiotic has not been clearly demonstrated, while recent studies reported prophylactic vancomycin had a higher risk of infection. This study aims to compare rates of SSIs, deep infections, and superficial wound infections between prophylactic cefazolin and other antibiotics following spine surgery. **Material and Methods:** All patients who underwent spine surgery at a single academic university hospital between 2015 and 2021 with at least 3 month follow-up were identified from electronic medical records. Patients were excluded if they had indications of trauma or malignancy, evidence of infection prior to admission, prior incision and drainage of an abscess, prior posterior instrumentation within 1 year, or prior surgery with absence of posterior instrumentation within 3 months. Patients who received a different antibiotic postoperatively were excluded. Patients were grouped based on preoperative antibiotic (cefazolin vs alternative). Primary outcomes were rates of SSIs, either superficial or deep, which necessitated irrigation and debridement in the operating room. Potential confounding covariables were measured including age, gender, comorbidities, operative time, and topical antibiotic or drain use. Chi-squared tests were performed for infection rates between groups given cefazolin vs alternative antibiotic. Associations between demographic, comorbidity, operative time, and topical antibiotic or drain use covariables were assessed through multivariable logistic regression. **Results:** 3055 patients with mean follow-up time of 699 days were identified. Of those, 2603 (85.2%) patients received preoperative cefazolin, while 452 (14.8%) patients received an alternate antibiotic. Compared to patients who received an alternate antibiotic, patients who received cefazolin did not experience different rates of SSIs (2.19% vs 1.77%), superficial wound infections (1.31% vs 0.88%), or deep wound infections (0.96% vs 0.88%) (all $p > 0.05$). With this sample size, the study had 80% power to find a minimal detectable effect size of 1.76% for SSIs, 1.35% for superficial infection, and 1.18% for deep infection. Of the alternate antibiotic group, 234 patients received vancomycin and 213 received clindamycin. Multivariate logistic regression demonstrated that operative time was associated with rates of SSIs (OR: 1.004 [1.002-1.006], $p = 0.003$). **Conclusion:** In this large, single-institution study, pooled rates of SSIs, superficial wound infections, or deep wound infections were not found to be significantly different between preoperative cefazolin and alternative antibiotics. These findings align with current NASS guidelines denying the superiority of any one antibiotic in spine surgery. The only independent risk factor for SSIs identified was operative time, consistent with prior literature linking longer procedures to higher infection risk. The study suggests there may not be a difference between cefazolin and alternative antibiotics when used prophylactically for spine surgery. Additionally, results suggest that efforts in reducing operative time may reduce SSI rates.

ID: AGS26/2474
P0621: Clinical outcomes and surgical technique of full-endoscopic debridement and drainage in thoracolumbar infectious spondylodiscitis: a prospective series

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Introduction: Thoracolumbar infectious spondylodiscitis presents significant therapeutic challenges due to spinal instability and neurological risks. Tuberculosis is the predominant pathogen in endemic regions, alongside pyogenic organisms. Full-endoscopic debridement and drainage (FEDD) offers a minimally invasive surgical alternative to conventional open procedures. **Material and Methods:** A prospective series of 50 adult patients with thoracolumbar infectious spondylodiscitis refractory to medical therapy or with abscess formation underwent FEDD. Diagnosis was confirmed through clinical, laboratory, imaging, and microbiological data. Surgical technique included transforaminal endoscopic debridement, irrigation, abscess drainage, and adjunctive posterior percutaneous stabilization when indicated. Outcomes were assessed via pain (VAS), disability (ODI), infection status, radiographic fusion, and complications over a 24-month follow-up. **Results:** Infection resolution occurred in 86% of cases, with tuberculosis identified in 56% and pyogenic bacteria in the remainder. Recurrence requiring reoperation occurred in 14%. Mean VAS improved from 8.72 to 2.52 and ODI from 73.19 to 22.34. Operative metrics included mean surgery duration of 97.6 minutes, blood loss of

136.8 ml, and hospital stay of 9.7 days. Complications were infrequent, with transient neurological symptoms and minor infections predominant. Radiographic fusion was documented as complete or partial in 64% of patients. **Conclusion:** FEDD is a safe, effective minimally invasive technique for thoracolumbar infectious spondylodiscitis, achieving high infection control rates and functional recovery, particularly in tuberculosis-predominant populations. This approach minimizes surgical morbidity and facilitates rapid rehabilitation, supporting its incorporation into standard management protocols for complex spinal infections.

ID: AGS26/2506
P0622: Whole-body PET/CT reveals systemic dissemination in spinal tuberculosis: findings from the Spinal TB X cohort

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Introduction: Spinal tuberculosis (STB) is a severe form of extrapulmonary tuberculosis associated with diagnostic delay and substantial morbidity. The extent of disease - isolated versus disseminated STB - remains poorly defined. We applied whole-body 18F-FDG-PET/CT to characterise the clinical and radiographic phenotype of STB. **Material and Methods:** The Spinal TB X cohort (NCT05610098) is a prospective study of HIV-infected and uninfected patients with suspected STB in Cape Town, South Africa. We analysed the first ten patients with microbiologically confirmed STB. Demographic, clinical, microbiological, histological, and PET/CT data were collected. Isolated STB was defined as spinal involvement only, while disseminated STB was defined as additional organ involvement confirmed by microbiology and/or PET/CT. The study was approved by the Human Research Ethics Committee of the University of Cape Town (HREC 243/2022). Written informed consent was obtained from all participants. **Results:** Ten patients (median age 44 years [IQR 26], 80% male, 30% HIV-positive) were included. A total of 14 spinal lesions involving 44 vertebrae were detected; psoas abscesses were present in six patients. Mean SUVmax and SUVmean of spinal lesions were 15.2 (SD 4.6) and 6.9 (SD 1.5), respectively; mean total lesion glycolysis (TLG) was 363.2 SUVbw*mL (SD 341.9). Based on microbiology alone, 40% had disseminated STB; combining microbiology with PET/CT findings, 60% had disseminated disease. **Conclusion:** Whole-body PET/CT revealed a high frequency of disseminated disease, underscoring the systemic nature of TB even when clinical presentation is spinal. Isolated STB may represent a distinct phenotype. PET/CT shows promise for assessing disease burden and warrants further evaluation.

ID: AGS26/2570
P0623: Diabetes mellitus as a risk factor for infection after a degenerative posterior lumbar fusion: multivariate analysis of 356 cases

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Introduction: Lumbar spinal fusion is a widely used technique in the treatment of conditions such as lumbar stenosis and degenerative spondylolisthesis. However, acute postoperative infection remains a significant complication. The aim of this study was to identify risk factors associated with a higher incidence of acute infection following posterior lumbar fusion for degenerative pathology. **Material and Methods:** We conducted an observational, retrospective, and analytical study at a single hospital center. Patients over 18 years of age who underwent instrumented lumbar fusion for lumbar stenosis or degenerative spondylolisthesis between 2017 and 2022 were included. Demographic, clinical, and surgical variables were analyzed. Demographic variables included age, sex, and body mass index (BMI). Clinical variables included history of prior surgery (including microdiscectomy, foraminotomy, and previous spinal surgery without instrumentation), diabetes mellitus, hypertension, chronic corticosteroid use, smoking, and ASA (American Society of Anesthesiologists) classification. Surgical variables analyzed included indication for surgery (lumbar stenosis vs. degenerative spondylolisthesis), type of procedure (posterior arthrodesis with foraminotomy, posterior arthrodesis with laminectomy, circumferential arthrodesis with foraminotomy, circumferential arthrodesis with laminectomy), number of operated levels, surgical duration, postoperative transfusion, and use of postoperative drains. A descriptive statistical analysis of all variables was performed. Subsequently, a bivariate analysis and a multivariate logistic regression model were conducted to identify independent risk factors for acute postoperative infection. **Results:** A total of 356 patients were analyzed, with a mean age of 60.4 years (SD 12.4); 55.6% were male. Lumbar stenosis was the surgical indication in 73.0% of cases. The overall incidence of acute postoperative infection was 5.9%

(21 cases). The most frequently isolated microorganism was *Staphylococcus epidermidis* (38%), followed by *Staphylococcus aureus* (34%) and polymicrobial infections (34%). In the bivariate analysis, the following factors were significantly associated with a higher risk of infection: diabetes mellitus ($p = 0.010$), hypertension ($p = 0.042$), chronic corticosteroid use ($p = 0.001$), and surgical duration greater than 3 hours ($p = 0.028$). BMI ≥ 30 showed a non-significant trend ($p = 0.078$). In the multivariate logistic regression model, only diabetes mellitus remained an independent and significant risk factor for acute postoperative infection (OR: 3.36; 95% CI: 1.22-9.31; $p = 0.019$). Although corticosteroid use (OR: 2.95; $p = 0.233$) and surgical duration greater than 3 hours (OR: 2.37; $p = 0.092$) showed trends, they did not reach statistical significance in this analysis. **Conclusion:** Diabetes mellitus was identified as the only independent risk factor for acute postoperative infection following instrumented lumbar arthrodesis for degenerative pathology, with a threefold increased risk. These findings reinforce the importance of a thorough preoperative surgical risk assessment, as well as clear and specific patient counseling in diabetic individuals within the context of informed consent, particularly regarding the increased risk of infection.

ID: AGS26/2577
P0624: Unlocking the predictive value of preoperative blood parameters in acute post-spinal surgery infection

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Introduction: Acute postoperative infection is one of the most serious complications in instrumented spine surgery. Hematological parameters have been recognized as useful prognostic markers in patients, including those with postoperative infections. The aim of this study was to assess the potential of these parameters in predicting acute postoperative infection after instrumented lumbar surgery. In addition, we evaluated their diagnostic accuracy according to patient sex. **Material and Methods:** We conducted a retrospective study of patients who consecutively underwent instrumented lumbar surgery between 2015 and 2023. Demographic data and preoperative hematological parameters, as well as derived ratios, were collected for analysis. The hematological parameters included white blood cell count (WBC), neutrophil count, lymphocyte count, monocyte count, platelet count, hemoglobin (Hb), hematocrit (Hct), and red blood cell count (RBC). Derived ratios included the neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), monocyte-to-lymphocyte ratio (MLR), and platelet-to-volume ratio (PVR). The study population was stratified by sex. Receiver operating characteristic (ROC) curves were generated to determine the area under the curve (AUC) and optimal cutoff thresholds using Youden's J statistic. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated, and statistical significance was assessed. **Results:** A total of 557 patients were analyzed, of whom 30 (5.4%) developed acute postoperative infections. All hematological parameter values were higher in the infected group. When stratified by sex, statistically significant differences were observed in neutrophils ($p = 0.005$), PVR ($p = 0.006$), and PLR ($p < 0.001$). To rule out infection, the parameters with the highest AUC values were MLR (AUC = 0.65) and neutrophil count (AUC = 0.64). In sex-specific analyses, neutrophil count showed the highest AUC in women (0.66), while MLR reached the highest AUC in men (0.69). Sensitivity and specificity varied among parameters and between sexes, but high NPVs were consistently observed, indicating their usefulness in excluding infection. However, no parameter achieved an AUC > 0.7, suggesting only moderate predictive performance. **Conclusion:** Neutrophil count and MLR were the most consistent predictors in both sexes; however, they demonstrated only moderate predictive value for acute postoperative infection following instrumented lumbar surgery, with slight sex-related variations. While high NPVs suggest their utility for excluding infection, their overall diagnostic accuracy remains limited.

ID: AGS26/2605
P0625: Microbiology and surgical outcome of native spinal infections: a retrospective study of 85 cases

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Introduction: Incidence of spinal infections shows an increasing trend worldwide due to the increase of older, multimorbid or immunocompromised patients. Infections caused by multidrug-resistant (MDR) bacterial pathogens often become therapy-resistant and require long-term antibiotic therapy and multiple surgeries. **Material and Methods:** A total of 85 patients (68% male - 32% female; average age: 65 y) with cervical/thoracic/lumbar spinal infections who underwent surgical treatment were included between January 2014 and June 2025. The organisms detected by this procedure were investigated, and microbiological cultures and surgical outcomes were retrospectively analyzed. **Results:** Cultures of specimens obtained by surgical procedures were positive in 72 patients (84.7%). The most frequent site of spinal infection was the lumbar spine (58%), followed by the thoracic spine

(37%) and the cervical tract (4%). 87% of the patients underwent decompression and stabilization. Reoperation was necessary in 29% of cases after primary surgical treatment due to progression of septic condition. 3 patients died in the early postoperative period after surgical treatment. 48% of the bacteria were Gram-positive pathogens. Methicillin-susceptible Staphylococcus aureus (MSSA) was the most frequently isolated strain in the cohort (28%). MDR was confirmed in 10 cases (N% = 11.76%), in 6 cases Gram-negative bacteria (4 Extended-spectrum beta-lactamases species, 2 Multidrug-resistant Acinetobacter baumannii), and in 4 cases Gram-positive bacteria Methicillin-resistant Staphylococcus aureus (MRSA). **Conclusion:** In our study cohort, we observed the dominance of Gram-positive bacteria and the emergence of multidrug-resistant bacteria, as well as an increase in their proportion during the study period. Spinal infections, especially caused by MDR bacteria, are often difficult to treat. Further investigations are needed to understand the risk factors for MDR infections for early and appropriate therapeutic intervention.

ID: AGS26/2614
P0626: Multidisciplinary management model of espondilodiscitis treatment (TEAM-espondilodiscitis)

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Introduction: Pyogenic spondylodiscitis is a rare but increasingly prevalent spinal infection associated with high morbidity, prolonged hospital stays, and substantial healthcare costs. Diagnosis is often delayed due to non-specific symptoms and the frequent absence of fever, which increases the risk of chronic pain, vertebral instability, and neurological deficits. Multidisciplinary care has been proposed to improve early recognition, optimize treatment, and reduce complications. **Material and Methods:** A multidisciplinary management model-**TEAM-Espondilodiscitis**-was developed to standardize the diagnosis, treatment, and follow-up of patients with spontaneous infectious spondylodiscitis. The protocol integrates internal medicine, infectious diseases, spine neurosurgery, radiology, microbiology, rehabilitation, and specialized nursing. Key elements include: (1) early clinical and imaging evaluation in the emergency department; (2) prompt initiation of targeted intravenous antibiotics with transition to oral therapy when appropriate; (3) surgical decision-making guided by the Spinal Instability Spondylodiscitis Score (SISS) and Pola classification; and (4) structured outpatient follow-up with prioritized clinic visits. **Results:** Implementation of this coordinated model is supported by contemporary literature demonstrating significant benefits of multidisciplinary infection teams. Reported outcomes include earlier diagnosis, improved adherence to evidence-based antibiotic regimens, reduced hospital length of stay, lower rates of re-operation and relapse, and decreased overall mortality compared with conventional single-specialist management. **Conclusion:** A structured multidisciplinary approach is essential for optimal care of pyogenic spondylodiscitis. The TEAM-Espondilodiscitis protocol aligns with current international guidelines, promotes antibiotic stewardship, and incorporates emerging strategies such as telemedicine and artificial intelligence for early detection and risk stratification, ultimately improving patient outcomes and resource utilization.

ID: AGS26/2627
P0627: Microbiological resistance in surgical site infections in pediatric patients undergoing scoliosis correction at a specialized center

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Introduction: Scoliosis is a three-dimensional deformity of the spine and one of the most common spinal disorders in children. In severe cases, surgical treatment is necessary, but this carries significant risks, with surgical site infections (SSIs) being one of the most challenging complications. These infections can be classified as early (≤ 90 days postoperatively) and late (> 90 days), and they affect morbidity and treatment costs. The most common microorganisms vary depending on the type of infection, with Staphylococcus aureus and Gram-negative bacilli in early infections, and Cutibacterium acnes and coagulase-negative staphylococci in late infections. The incidence of SSIs varies according to the etiology of scoliosis, being higher in cases of neuromuscular scoliosis. The management of these infections is complicated by antimicrobial resistance, and the literature on the microbiological profile in these patients is limited. **Material and Methods:** A retrospective study was conducted at a national referral center between 2017 and 2023, reviewing the clinical records and culture results of 24 pediatric patients who underwent scoliosis correction surgery. Patients with a confirmed diagnosis of SSIs through tissue or secretion cultures were included. Definitions for early and late infections were established according to the Colombian National Institute of Health and the Centers for Disease Control and Prevention (CDC). Sociodemographic, surgical, and infectious data were collected and analyzed using the REDCap® platform, RStudio® and Excel® software.

Analyses included a Kaplan-Meier survival curve to estimate the time between surgery and SSIs diagnosis. **Results:** An analysis of 24 patients with a median surgical time of 279 minutes and 10.5 levels operated on revealed that the median time to diagnose a surgical site infection (SSI) was 50 days, although most infections occurred within the first 30 days. Intraoperative prophylactic antibiotics were administered to most patients. Of the 28 cultures analyzed, microorganisms were isolated in 91.67% of cases, with Staphylococcus aureus being the dominant pathogen, accounting for 50% of all isolates. A significant finding was that 21.4% of the S. aureus isolates were methicillin-resistant (MRSA). The analysis also showed other worrying resistance profiles, including extended-spectrum beta-lactamase (ESBL) resistance in Proteus mirabilis and Escherichia coli, and complete methicillin resistance (MRSE) in all Staphylococcus epidermidis cases. This highlights the high prevalence of S. aureus and the significant challenge posed by its antimicrobial resistance, which complicates treatment. **Conclusion:** The results showed significant heterogeneity in microbial etiology, with a predominance of Staphylococcus aureus in late infections, especially MSSA strains, and a high incidence of polymicrobial infections. This highlights the need for an individualized diagnostic approach. The infection rate varied according to the etiology of scoliosis, being higher in neuromuscular cases, which is consistent with the literature. Unlike other studies, no late infections due to Cutibacterium acnes were identified, underscoring the importance of adjusting antibiotic protocols to the local context. Limitations of the study include the small sample size and the lack of socioeconomic variables that could influence the occurrence of SSI. In conclusion, surgical site infections have a significant clinical and economic impact, especially in cases involving spinal instrumentation. Microbial diversity and antimicrobial resistance highlight the need to improve preventive and diagnostic strategies to optimize long-term outcomes.

ID: AGS26/2849
P0628: Pathologic and microbiologic evidence of multifactorial failure in cervical total disc replacements

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Introduction: Cervical total disc replacement (cTDR) has evolved over the years with newer models incorporating materials such as PEEK on ceramic, titanium plasma-spray coatings, and zirconia-toughened alumina ceramic cores. These designs were developed to preserve physiologic motion, minimize metal wear, and reduce postoperative imaging artifacts. Despite these advancements, failures of cTDRs have been reported. In three surgical cases, device failures were observed, with biomechanical dysfunction, abnormal motion, and associated infections identified. **Material and Methods:** Six cTDRs from three surgical cases, treated by two surgeons at a single institution, were retrieved during revision procedures converting cTDRs to anterior cervical discectomy and fusions (ACDFs). Surrounding soft tissue from the failed cTDR sites was also collected. All explanted cTDRs underwent microbiological analysis using swab sampling and culture, followed by microscopic examination. Pathology reports were generated, and biomechanical wear and material degradation were assessed. **Results:** Within the six cTDRs recorded across three surgical cases, all explants received both microbiology and pathology reports. In the first case, 5 of 9 swabs (55.6%) were positive for infection, including 2 of 5 (40%) that grew *Staphylococcus epidermidis* resistant to antibiotics and 3 of 5 (60%) that grew rare *Staphylococcus epidermidis*; pathology showed that soft tissue was collected and explant debris was identified on it. In the second case, 10 of 20 swabs (50%) were positive, with broth-only *Cutibacterium (Propionibacterium) acnes* identified in 9 of 10 (90%) and broth-only Gram-variable rods in 1 of 10 (10%); pathology revealed soft tissue changes with metallic, polyethylene, and ceramic particulate debris. In the third case, 5 of 8 swabs (62.5%) were positive, including broth-only *Cutibacterium (Propionibacterium) acnes* in 3 of 8 (37.5%), broth-only Gram-positive rods in 1 of 8 (12.5%), and broth-only *Staphylococcus epidermidis* in 1 of 8 (12.5%); pathology reported soft tissue alterations with hardware debris fragments. All explants underwent pathology evaluation and were subsequently referred for biomechanics or hardware review. **Conclusion:** Cervical total disc replacement failures in three surgical cases demonstrated both infectious involvement and soft tissue debris from metallic, polyethylene, ceramic, and hardware sources. When compared to traditional cTDRs, the findings were not consistent with prior retrievals; instead, they revealed unique hydrophobic behavior and peeling phenomena specific to this design. Further studies will be required to clarify these mechanisms, improve patient outcomes, and inform future device design.

ID: AGS26/2919
P0629: Hybrid minimally invasive transforaminal lumbar interbody fusion for non-tubercular spondylodiscitis. Role of compartmentalization in infection control

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Introduction: Conventional open debridement with transforaminal lumbar interbody fusion (TLIF) remains the gold

standard for lumbar spondylodiscitis (SD) but is associated with problems of extensive soft-tissue dissection, creation of dead space, biofilm formation, implant loosening, tissue necrosis and recurrent infections. Although minimally invasive (MI) procedures reduce tissue trauma and accelerate rehabilitation, their exact role in addressing infection-related concerns remains poorly defined. We adopted a hybrid technique-Contained Minimally Invasive TLIF (Contained MI-TLIF)-which integrates midline microscopic transforaminal decompression with percutaneous pedicle screw fixation through separate intramuscular compartments. The aim was to evaluate whether this strategy compartmentalizes infection, preserves implant safety, and improves outcomes in non-tubercular SD. **Material and Methods:** Fifty-two patients (29 males, 23 females) with biopsy-proven non-tubercular SD underwent midline microscopic TLIF with percutaneous pedicle screw fixation under fluoroscopy. Pain and disability were assessed pre- and postoperatively using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI). Functional outcome was graded by Kirkaldy-Willis criteria, neurological recovery by ASIA scale, and fusion by Bridwell criteria. Infection control was monitored through serial C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), leukocyte counts, and MRI. **Results:** Fixation was performed at the diseased level in 34 patients and adjacent levels in 18. VAS and ODI demonstrated significant improvement postoperatively. Functional outcomes were excellent/good in 90% of patients. Radiological fusion was achieved in 98% (Grade 1-2). CRP and ESR normalized within a mean of 8 weeks, correlating with clinical improvement. Complications included two cases of superficial midline wound necrosis and one delayed screw-tract infection secondary to bronchopneumonia at 8 months. Importantly, the infection remained localized to the screw tract without spreading to the interbody fusion site, confirming effective compartmentalization. One patient required revision for implant failure which was a significantly low percentage. **Conclusion:** The hybrid Contained MI-TLIF technique is a safe and effective option for managing non-tubercular SD. By placing implants in a separate, uninfected myofascial compartment, it limits the risks of biofilm formation, implant loosening, tissue necrosis and recurrent infection, while providing reliable fusion, pain relief, and early rehabilitation. Compartmentalization appears to be a promising strategy for infection control in spinal stabilization.

ID: AGS26/2921
P0630: Neurologic deficits in infectious spondylodiscitis: medium-term treatment results

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Introduction: Infectious spondylodiscitis in adults can have significant negative consequences, particularly when neurological deficits are present. This sometimes makes surgery essential, or even the only option for preserving the patient's function and quality of life. The aim of our study is to report on our experience in the medical and surgical management of infectious spondylodiscitis with deficits, with medium- and long-term results. **Material and Methods:** This was a retrospective, single-center, descriptive study covering a 22-year period from January 2010 to December 2022, collecting data on patients who underwent surgery for infectious spondylodiscitis with neurological deficits. For each patient, we extracted epidemiological data, clinical, radiological, and biological characteristics, and details of their medical and surgical management. **Results:** We identified 35 patients who underwent surgery for infectious spondylodiscitis with a mean age of 63 years and tuberculosis as the cause in 52% of cases. Motor disorders were present in 74% of cases and bladder-sphincter disorders in 15% of patients. Spinal release-synthesis was used in 70% of patients, with complete neurological recovery in 67% of cases and neurological deterioration in 12%. Complications included three cases of pressure sores and two cases of sepsis on osteosynthesis material. **Conclusion:** This work highlights the importance of well-coordinated therapeutic strategies to optimize the management of this complex pathology and improve long-term outcomes for patients with infectious spondylodiscitis, whose therapeutic success depends not only on the type of surgery performed, but also on early assessment and adequate management of risk factors, including the type and location of the infection, the appropriate use of medical treatment, and the speed of intervention.

ID: AGS26/2926
P0631: Persistent oropharyngeal-cervical fistula following multimodal treatment of clival chordoma: a rare and challenging late complication in the upper cervical spine

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Introduction: Chordomas are rare malignant tumors originating from notochordal remnants, most frequently involving the skull base and sacrococcygeal spine. Despite advances in surgical techniques and adjuvant radiotherapy, local recurrence and late radiation-related complications remain significant challenges. We present a rare case of a persistent oropharyngeal-cervical fistula with direct communication between the oropharyngeal cavity and the upper cervical spine following multimodal treatment for clival chordoma. **Material - Methods:** A 40-year-old woman with no significant

comorbidities was initially diagnosed with clival chordoma in 2008 and underwent subtotal tumor resection followed by adjuvant proton beam radiotherapy. In 2015, a local recurrence involving the C1-C2 vertebrae was treated with repeat subtotal resection and CyberKnife radiotherapy. In December 2021, the patient presented with a pharyngo-cervical infection after needle aspiration of the upper oropharynx, which was complicated by a pathological fracture of the anterior arch of C1. Cross-sectional imaging revealed a fistulous tract between the oropharyngeal cavity and the lateral mass of C1-C2, most likely due to radiation-induced osteoradionecrosis combined with secondary infection. **Results:** Initial management included targeted antibiotic therapy and the PENTOCLO protocol (pentoxifylline, tocopherol, clodronate) to address osteoradionecrosis. In April 2022, occipitocervical fusion was performed to stabilize the pathological fracture and prevent further deformity or neurological compromise. Despite these interventions, the fistula persisted. The most recent follow-up in September 2025 showed that the patient remains neurologically intact and fully functional, participating in daily and even strenuous activities. The most recent CT scan demonstrated a large communication between the oropharyngeal cavity and the pre- and paraspinal spaces on the left side, with a cavity showing a wide opening into the oropharynx and extending laterally beyond the midline at the level of C2. Compared with a CT scan performed two years earlier, the cavity demonstrated progressive expansion and a significantly wider communication channel. A multidisciplinary team proposed surgical closure of the defect using a free flap in collaboration between plastic and neurosurgical teams. However, the patient declined surgical intervention due to concerns about potential complications and continues to be monitored closely with regular clinical and laboratory follow-up. PET-CT revealed no evidence of tumor recurrence. **Conclusion:** This case illustrates an exceptionally rare and complex late complication after multimodal management of chordoma involving the upper cervical spine. Radiation-induced osteoradionecrosis, pathological fracture, and subsequent fistula formation represent significant therapeutic challenges due to compromised tissue vascularity, chronic contamination from the oropharyngeal flora, and proximity to vital neurovascular structures. Optimal management requires a multidisciplinary approach, combining spinal stabilization, meticulous infection control, and individualized reconstructive strategies to prevent catastrophic outcomes and preserve neurological function.

ID: AGS26/2927
P0632: Spinal tuberculosis at different anatomical levels: surgical outcomes of five patients

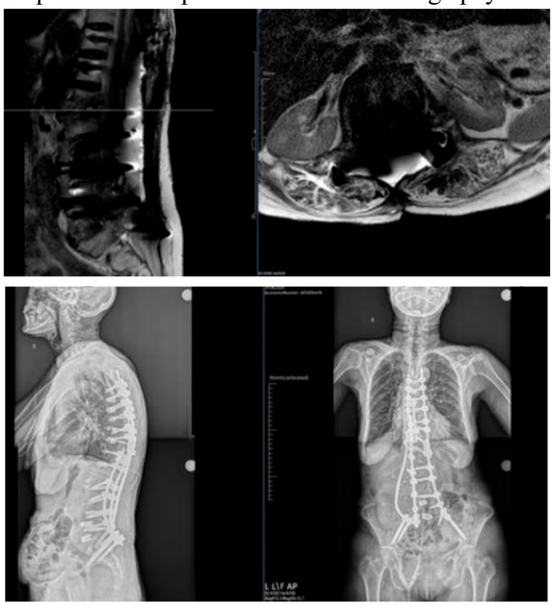
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Introduction: Spinal tuberculosis (TB) remains a significant clinical problem in both developing and developed countries, with an increasing incidence in recent years. The disease can affect any level of the spine, leading to neurological deficits, spinal deformities, and abscess formation. The purpose of this case series is to present the surgical and medical outcomes of spinal TB cases with different localizations, ranging from the craniovertebral junction to the lumbar region. Preoperative MRI: contrast-enhanced T1-weighted sagittal, T1-weighted, and contrast-enhanced T1-weighted axial sequences.



Materials and Methods: Between 2023 and 2024, five patients diagnosed with spinal TB and treated surgically at Ankara Etlik City Hospital were retrospectively evaluated. Demographic characteristics, levels of involvement, surgical approaches, pathological findings, and postoperative clinical courses were analyzed. All patients received postoperative antituberculous pharmacotherapy in accordance with standard treatment protocols. Postoperative MRI: T1-weighted sagittal, T1-weighted axial sequences. Postoperative lateral and AP graphy.



Results: The series included five patients aged 22-60 years, consisting of four females and one male. The distribution of spinal involvement was as follows: craniovertebral (n = 1), lower cervical (n = 1), thoracic (n = 1), and lumbar (n = 2).

• The craniovertebral case underwent posterior stabilization due to tetraparesis.

• In the lower cervical case, instability following tracheostomy was surgically corrected.

• The thoracic case presented with a Pott's abscess at T12, treated with multilevel stabilization and corpectomy.
• Two lumbar cases (L3-iliac and L4-5 levels) underwent abscess drainage and stabilization.
• Histopathological analysis revealed necrotizing granulomatous inflammation, and cultures confirmed *Mycobacterium tuberculosis*. All patients demonstrated postoperative neurological improvement, with no major surgical complications observed. **Conclusion:** Spinal TB can present with heterogeneous clinical manifestations depending on the level of involvement. Surgical stabilization and abscess drainage, when indicated, play a crucial role in improving neurological outcomes and preventing deformity. Early surgical intervention not only facilitates histopathological confirmation but also enhances the effectiveness of subsequent antituberculous therapy. Our series highlights the importance of timely combined surgical and medical management in achieving favorable outcomes for patients with spinal TB.

ID: AGS26/3008
P0632.1: Effectiveness of the therapy strategy in patients with negative cultures in a tertiary reference center

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Introduction: Over the past two decades, a significant increase in the incidence of spondylodiscitis has been documented in Europe, attributable to the aging population, a higher prevalence of chronic diseases, and immunodeficiency states. Native pyogenic spondylodiscitis is a serious spinal infection, capable of causing disabling pain, neurological deficits, vertebral deformities, and systemic complications. Identifying the causative agent is essential for instituting targeted antibiotic therapy; however, between 37% and 50% of patients remain culture-negative despite available diagnostic methods. Establishing optimal antimicrobial management, its duration, and the criteria for selecting patients for conservative or surgical management are currently challenging. In this context, evaluating the effectiveness of different therapeutic strategies in patients with culture-negative native pyogenic spondylodiscitis is a priority. **Objective:** To evaluate the effectiveness of the therapeutic strategy implemented in patients with culture-negative native pyogenic spondylodiscitis at our tertiary care center in terms of clinical outcomes and complication reduction. **Materials and Methods:** An observational, longitudinal, and retrospective study was conducted. It included 108 patients diagnosed with culture-negative native pyogenic spondylodiscitis. **Results:** A total of 108 patients diagnosed with native pyogenic spondylodiscitis and negative cultures were analyzed. All received an initial regimen of intravenous third-generation cephalosporin and vancomycin for two weeks, followed by oral treatment with either a fluoroquinolone or linezolid for an additional four weeks. The overall therapeutic success rate, defined as absence of recurrence or persistence of infection at the end of follow-up, was 87% (n = 94; 95% CI: 80.1-92.4). Furthermore, 60% (n = 65; 95% CI: 50.2-69.1) of patients presented some degree of neurological deficit at the time of diagnosis. None of these patients were treated with surgery; all received conservative management, with significant clinical improvement documented during follow-up ($p < 0.05$). Subgroup analysis showed no statistically significant differences in success rates between patients treated with fluoroquinolone versus linezolid in the oral phase ($p = 0.41$). Furthermore, no association was identified between the initial presence of neurological deficit and infection recurrence ($p = 0.27$). These findings suggest that the antibiotic regimen used offers high clinical effectiveness in patients with negative cultures, and that conservative management may be a safe alternative in the presence of neurological deficit, avoiding the need for surgery in most cases. **Conclusion:** Culture-negative native pyogenic spondylodiscitis continues to represent a diagnostic and therapeutic challenge. Our results show that a structured empirical antibiotic regimen achieved 87% clinical success, even in the absence of microbiological identification. Furthermore, conservative management in patients with neurological deficits was safe and effective, avoiding surgery in most cases. These findings support the need for prospective studies that define standardized therapeutic regimens and criteria.

ID: AGS26/3201
P0633: Is back pain a red-flag sign in hemodialysis patients?

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Introduction: Infections are frequent complications in patients undergoing hemodialysis (HD). Patients with a catheter face a 2-3-fold higher risk of hospitalization due to infection and mortality compared to an arteriovenous fistula or graft. The primary causative pathogens are gram-positive bacteria, with Staph. Aureus and coagulase-negative staphylococci.[1] Recognized issues associated with catheters include bacteremia, infections at the exit site or tunnel, and frequent clotting episodes that necessitate intervention. Effectively managing infected HD catheters is a complex task, with limited evidence-based guidelines available. Nevertheless, persistent bacteremia and the occurrence of metastatic complications,

	Cases		
Characteristic	#1	#2	#3
Age/Gender	78/F	64/F	70/F
Catheter Site	Subclavian	Subclavian	Femoral
Symptom	Upper back pain for 6 months and weakness in legs for 15 days	Weakness in her legs for 50 days and upper back pain for 3 months	Lower back pain for 3 months, unable to walk without assistance
Neurological Examination	Paraplegic. Hypoesthesia below T5, anesthesia below T10	Complete motor and sensory loss below the T9 level	Paraparesis. Motor strength of 2/5 in her knees and ankles. 4/5 strength in her hips.
ASIA Score	ASIA-A	ASIA-A	ASIA-C
Dialysis Period	2 Years	4 years	5 years
Co-Morbidities	Alzheimer's Disease, Bipolar Disorder, Diabetes Mellitus, Hypertension, Coronary Artery Disease	Congestive Heart Failure, Septic Arthritis (knee, 5 times), C6-7 discitis (chronic, stable)	Gut + asthma + HT + DM + hypothyroidism + cirrhosis + T9-10 discitis (chronic, stable) + Septic Arthritis (knee)
CRP (mg/L)	18.74	16.08	14.94
Treatment	Teicoplanin, Ciprofloxacin	Teicoplanin	Teicoplanin
Diagnosis	T4-5 spondylodiscitis + epidural abscess	T9-10 spondylodiscitis + kyphosis	L2-3 spondylodiscitis
Surgery	T4-5 posterior decompression T4 partial corpectomy, T2-3 and T6-7 posterior pedicle screw fixation	T6-L2 posterior pedicle screw fixation. T9 total, T10 partial corpectomy and expandable cage. Extensive posterior osteotomy. Correction of kyphosis and fixation	Patient refused surgery due to Child-Pugh Class C
Outcome	No neurological improvement, continues to receive physical therapy	No neurological improvement, died two months later due to myocardial infarction	She died 5 months after diagnosis due to massive GIS hemorrhage.
Bacterial Culture (Tissue)	None	None	N/A
Blood Culture	Negative	Negative	Methicillin-resistant Staphylococcus aureus (MRSA)

such as epidural abscess, osteomyelitis, discitis, and endocarditis, continue to pose significant challenges for these patients.[2] Spinal infections are infrequent but severe consequences of catheter infections, necessitating surgical intervention and frequently resulting in paralysis or death. Such complications arise from a bacteremic episode during a prolonged period to salvage the infected catheter. The duration between the diagnosis of bacteremia and the onset of spinal infection remains unclear. In this study we present our experience with 3 chronic HD patients who presented with spondylodiscitis. **Material and Methods:** All patients were receiving hemodialysis 3 times a week through a tunneled catheter. (Table 1)

Results: HD patients are at a risk factor for vertebral infections through antegrade bacteremia. Repeated vascular puncturing, long-term catheter or the contamination of dialysis system are known risk factors. Spondylodiscitis in HD patients have a poorer prognosis with a longer hospital stay, higher 1-year mortality and 2.2 fold increase in in-hospital mortality.[3] HD patients tend to have additional co-morbidities further complicating the surgery and post-operative rehabilitation. Thus it is important to quickly recognize, diagnose and treat spinal infections in HD patients. Fever may not always be a presenting symptom in spinal infections of HD patients.[3] However, as is the case in our three patients, back pain and elevated CRP levels are almost always present. 2 cases that were operated on had negative bacterial cultures and this may be due to prolonged antibiotic use before recognizing the spinal infection. Cases that are overseen may present with neurological findings. These may also go unrecognized as HD patients are more prone to have little or no activity. Pain is also a frequent complaint of HD patients thus back pain may also be overseen as a non-specific finding. Previous studies have reported a diagnosis period of 3 to 6 months from the onset of back pain.[4] Our patients had a similar delayed diagnosis period even after the neurological deficits had developed. Although surgical treatment in these patients increase the neurological recovery only slightly, it allows for the stabilization of the spine and decreases pain thus granting the patient to sit upright. Presence of neurological deficit and identification of MRSA are causes of increased mortality whereas surgical treatment has an OR of 0.37 suggesting a role in reducing

mortality rates.[4] **Conclusion:** Hemodialysis patients are prone to a variety of infections including various forms of spinal infections. This risk increases with the use of catheters. Pain is common amongst HD patients and new pain complaints such as back pain can be seen as a non-specific symptom. This prolonged period of diagnosis may lead to irreversible neurological deficits. Thus the primary aim of the surgery becomes to reduce pain, prevent instability, limit the spread of the infection and obtain tissue culture. These three cases have shown us that back pain in HD patients may be a red-flag sign that warrants further evaluation and investigation. In particular, patients with elevated CRP levels along with back pain, it is of vital importance to screen for any spinal pathologies.

References

1. Miller LM, Clark E, Dipchand C, Hiremath S, Kappel J, Kiaii M, Lok C, Luscombe R, Moist L, Oliver M, MacRae J; Canadian Society of Nephrology Vascular Access Work Group. Hemodialysis Tunneled Catheter-Related Infections. Can J Kidney Health Dis. 2016 Sep 27;3:2054358116669129. doi: 10.1177/2054358116669129.

2. Philipneri M, Al-Aly Z, Amin K, Gellens ME, Bastani B. Routine replacement of tunneled, cuffed, hemodialysis catheters eliminates paraspinal/vertebral infections in patients with catheter-associated bacteremia. Am J Nephrol. 2003 Jul-Aug;23(4):202-7. doi: 10.1159/000071479.

3. Kuo G, Sun WC, Lu YA, Chen CY, Kao HK, Lin Y Jr, Chen YC, Hung CC, Tian YC, Hsu HH. Chronic dialysis patients with infectious spondylodiscitis have poorer outcomes than non-dialysis populations. Ther Clin Risk Manag. 2018 Feb 13; 14:257-263. doi: 10.2147/TCRM.S153546.

4. Madhavan K, Chieng LO, Armstrong VL, Wang MY. Spondylodiscitis in end-stage renal disease: a systematic review. J Neurosurg Spine. 2019 Feb 15:1-9. doi: 10.3171/2018.9.SPINE18824.

ID: AGS26/3209
P0634: Early onset osteoporosis after the COVID-19 pandemic

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Introduction: To explore the potential association between SARS-CoV-2 infection and early-onset osteoporosis, and to assess the role of postpartum physiology in predisposing young women to vertebral fragility fractures. The systemic impact of SARS-CoV-2 has extended beyond respiratory pathology, with recent literature suggesting deleterious effects on bone metabolism. Mechanisms include inflammatory activation (notably NLRP3 inflammasome), hypocalcaemia, vitamin D deficiency, and mechanical unloading. Postpartum osteoporosis, while rare, may be underrecognized during periods of physiological stress such as the COVID-19 pandemic. Increasingly, spine surgeons are encountering vertebral compression fractures in young women without traumatic antecedents. **Material and Methods:** A case series of five postpartum women (ages 27-34) presenting with acute vertebral fractures during the COVID-19 pandemic was evaluated. All patients underwent spinal MRI or CT, bone densitometry (DEXA), and laboratory assessment. Relevant clinical data-including COVID-19 infection history, vitamin D levels, and T-scores-were analyzed. Findings were contextualized with recent literature on pandemic-related bone health changes. **Results:** All patients were actively breastfeeding; four had a confirmed history of COVID-19 infection (ranging from one to three episodes). Vertebral involvement included thoracic, lumbar, and sacral regions. Imaging revealed classic features of fragility fractures, without preceding trauma. DEXA scans demonstrated T-scores between -1.0 and -3.8. Three patients were vitamin D deficient (< 20 ng/mL). Conservative management, including cessation of nursing, cholecalciferol supplementation, and in some cases bisphosphonates, led to symptom resolution. These observations align with emerging data on decreased bone mineral density in young adults during the pandemic. **Conclusion:** These findings underscore the need for heightened clinical awareness among neurosurgeons and spine specialists when evaluating postpartum women with atraumatic back pain. Early identification and multidisciplinary management can prevent misdiagnosis and avert unnecessary surgical intervention.

ID: AGS26/3210
P0635: Haematogenous spondylodiscitis in patients with liver cirrhosis: case series of 36 patients

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Introduction: The incidence of haematogenous spondylodiscitis is increasing. This may due to a combined effect between an increase in susceptible populations and an improved accuracy in diagnosis. Patients with liver cirrhosis are well known to be prone to infections. Susceptibility to infection in cirrhosis is related to impaired defense mechanisms due to impaired reticuloendothelial system. These are a source of considerable morbidity and often mortality, and hence need prompt and aggressive treatment. Treatment of SI in those patients remains a challenge. **Material and Methods:** Retrospective analysis of database (2005-2015). In the series of

600 patients, 36 patients (6%) had liver cirrhosis; of them 14 patients had decompensated liver cell failure (26 males and 10 females; mean age of 60.67 ± 10.119 years). According to Child-Pugh score; six patients were class A, 9 were B and 21 were C. We have collected the demographic, clinical, radiological and laboratory data as well as the outcomes of management with mean follow up of 25.4 months. **Results:** 29 patients (81%) had ASA- Score class IV and 7 had Class III. The most common comorbidities were cardiac in 17 patients, diabetes in 19, renal insufficiency in 16, other sites of infection in 9 and peripheral vascular insufficiency in 11 cases. The presurgical interval varied around 33.5 ± 25.1 days (5-150), neurological deficit impaired 24 patients (67%), fever in 15 (an organism could be isolated from blood culture in 10 of them). Nine patients presented with septic manifestations. The lumbar spine was the most common region affecting 25 patients (69%). Non-contiguous infection was found in 9 patients (25%), epidural abscess in 24 and psoas abscess in 12 individuals. The preop. CRP and ESR were elevated in all cases (ø 106 ± 83.22 & 94.9 ± 38.69 respectively) and WBC was pathological in 13 individuals (36%). The commonest isolated organisms were Staph. aureus in 17 patients (MRSA in 4 of them). Ventrodorsal approach was necessary in 28 patients, 30 had minimal invasive surgery and biopsy only was done for microbiological examination in 2 cases. Two patients were reoperated due to recurrent infection (5%). Two patients died with septic shock, 2 with liver cell failure and one with cardiac infarction (in-hospital mortality of 14%). The neurological improvement rate by at least one ASIA grade was 82%. The preop. mean VAS was 8 ± 0.92 and reduced to 2.7 ± 1.28 postop. The postop. antibiotic therapy had to be taken more than 8 weeks in 22 patients. In 15 patients a combination of antibiotics was necessary. **Conclusion:** Spondylodiscitis in cirrhotic patients is often associated with neurological deficit (67%) as well as high mortality rate especially in patients with decompensated liver cirrhosis. Conservative treatment by antibiotics mostly does not reach the target and external immobilization is often impractical. Because of the poor general status, the indication for surgery should be carefully considered. Surgical intervention for SI in such patients can be performed with acceptable outcomes. Minimal invasive surgeries could be favorable in such cases.

ID: AGS26/3353

P0636: Evaluating the safety of prophylactic antibiotic-loaded calcium sulphate beads versus topical antibiotic powder in adolescent idiopathic scoliosis posterior correction surgery

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Introduction: The objectives of adolescent idiopathic scoliosis (AIS) correction surgery are to prevent deformity progression, spine balance, maintain neurological function, preserve spinal motion, and achieve cosmesis. Spine Surgery Infection (SSI) management is important in noninfected and infected patients. The use of antibiotic-loaded calcium sulphate beads was investigated in posterior scoliosis fusion surgery. **Material and Methods:** Retrospective review of all posterior approach surgical patients for scoliosis patients between 2015 and 2023 at St George's University Hospitals NHS Trust, London, United Kingdom. Patient demographics; surgery approach and type; vertebral levels for posterior instrumentation; prophylactic antibiotic regime; washout/debridement surgery; length of postoperative stay; and postoperative infection rate were recorded. **Results:** 171 scoliosis posterior spinal fusion patients (126 Female, 45 Male), with an average age of 15.34 years. Patients that underwent posterior only approach was 157 and combined approach was 14. The average number of levels for posterior instrumentation was 12.22 (lowest:2, highest:22). 162 of the surgeries were primary and 9 revisions. There were 10 unintended return to theatres due to complications. 3 postoperative infections occurred that required debridement surgeries, of which all had received topical antibiotics intraoperatively. There were no postoperative surgical site infections in the antibiotic-loaded calcium sulphate beads. **Conclusion:** The use of antibiotic-loaded calcium sulphate beads for scoliosis correction surgery is a safe method of preventing SSI. Beads deliver local, dose-dependent, antibiotic activity even against "resistant" infections. Beads have been shown in other studies to deliver excellent biofilm reduction, slow continuous elution, and dead space reduction making it an excellent option for non-infected or infected posterior spinal surgery cases. It would prove beneficial for delayed SSI as well that intraoperative antibiotics would not provide.

ID: AGS26/3395

P0637: Culture positivity during primary lumbar fusion: risk factors and association with long-term surgical outcomes

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Introduction: Occult bacteria have been implicated in pseudoarthrosis and implant loosening, yet their prevalence and clinical significance in primary spine surgery remain

incompletely understood. This prospective cohort study assessed the prevalence of intraoperative culture positivity during primary lumbar fusion, identified associated risk factors, and evaluated its relationship with long-term surgical outcomes. **Material and Methods:** Fifty-four consecutive patients undergoing primary posterior lumbar fusion with pedicle screw instrumentation were prospectively enrolled. Inclusion criteria were age 18-80 years with no prior lumbar hardware, trauma, tumor, or infection. All patients received prophylactic antibiotics and antiseptic skin preparation. Intraoperative cultures were obtained from the superficial skin, dermal wound edge, hypodermis, and vertebral pedicle prior to instrumentation. Control swabs from the scalpel, suction, and tap were obtained before incision. Cultures were incubated for 14 days under aerobic and anaerobic conditions. Patients were followed a minimum of four years postoperatively to assess secondary surgical interventions. **Results:** Out of the 54 patients, 18 (33.3%) had at least one positive culture, averaging 3.1 positive samples per case. Rates of positivity were 13.0% at the superficial skin, 16.7% at the dermis, 13.0% at the hypodermis, and 19.0% at the vertebral pedicle. No correlation was found between vertebral body positivity and skin positivity. No control swabs (suction and scalpel) were positive. *Cutibacterium acnes* was the most common isolate, present in 83.3% of positive cases. Male sex ($p = 0.007$) and the use of povidone-iodine preparation ($p = 0.017$) were significantly associated with positive cultures. At four years, reoperation was required in 27.8% of culture-positive patients compared with 13.9% of culture-negative patients. **Conclusion:** Occult bacterial colonization was identified in one third of patients undergoing primary lumbar fusion, most frequently at the vertebral pedicle. Culture positivity was associated with sex, type of skin preparation, and higher rates of reoperation by four years. While causality cannot be established in this cohort, these findings suggest that deep-seated bacterial colonization may represent an underrecognized factor influencing long-term outcomes after spine surgery. Larger studies are warranted to clarify the clinical significance and to inform potential strategies for risk mitigation.

Medical economics

ID: AGS26/97
P0638: Evaluating patient readiness for spine surgery: a cross-sectional study

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Introduction: Spine conditions affect millions, and spine surgery is increasing. Surgical innovation and recovery modernization have improved surgical outcomes, but the preoperative phase remains comparatively underdeveloped. A standardized protocol to prepare patients mentally and physiologically does not exist. The result may be a lack of surgery readiness, which can affect patient outcomes, experiences, and satisfaction. This study aimed to evaluate patient readiness for spine surgery by assessing satisfaction with surgery preparation. **Material and Methods:** This is a prospective observational cross-sectional study. Participants were drawn from a random sample of adult spine surgery patients, completed an anonymous survey, and were grouped as satisfied or unsatisfied with preparation. Additional variables included demographics, surgical details, satisfaction with surgery, and preparation details. Statistical analyses evaluated group differences, problem prevalence, and associations. **Results:** Of 300 participants, the median age was 66 years, 63% females, 67% lumbar surgery, and 52% had at least one prior spine surgery. Most cases were inpatient (86%) and elective (87%). There was no significant difference ($p = 0.305$) in the prevalence of those satisfied (43%) or unsatisfied (49%) with their preparation. The difference between those satisfied (42%) and unsatisfied (53%) with their spine surgery trended towards being significant ($p = 0.05$). Surgery satisfaction was strongly associated with preparation satisfaction, with participants being 28.5 times more likely to report preparation satisfaction when surgical satisfaction was present ($p < 0.001$). Surgical education, elective surgeries, understanding pain management, and surgery satisfaction were strong predictors of preparation satisfaction. Having a greater number of items (6-11 vs. 0-5) included in the preparation process was associated with preparation satisfaction ($p < 0.001$). **Conclusion:** This study detected vulnerability in the spine surgery preparation process. There was no significant difference between those satisfied and unsatisfied with their preparation, leaving room for improvement. A strong association between satisfaction with surgery and with preparation was detected. These results support a public health initiative to develop a standardized readiness guide. An evidence-based standardization of the preparation process has the potential to improve both surgical outcomes and patient satisfaction.

ID: AGS26/539
P0639: Demographic trends among residents applying for orthopedic spine surgery fellowships

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Introduction: Spine surgery remains one of the least diverse subspecialties within orthopedic surgery in terms of gender, race, and ethnicity. This study aimed to identify demographic trends and evaluate factors influencing match outcomes in spine surgery fellowships between 2022 and 2024. **Material and Methods:** Data on applicants to spine surgery fellowships from

2022-2024 were extracted from the San Francisco (SF) Match database. Sociodemographic variables such as gender, race, and ethnicity were recorded. Low sample size groups (< 5 applicants over 3 years) were either excluded as predictors-specifically Native American/Alaskan and Native Hawaiian applicants-or combined with similar groups, such as Black Non-Hispanic and Black Hispanic applicants. Univariate logistic regression was used to assess relationships, variance inflation factor (VIF) scores were calculated to check for multicollinearity, and a multivariate logistic regression model was developed to compare applicants who matched with those who did not. **Results:** Of the 593 applicants, 536 were male (90.39%), 51 were female (8.60%), and 6 did not disclose (1.01%). From 2022-2024, the percentage of female applicants increased from 7.07% to 10.29% and male applicants decreased from 92.93% to 87.75%. The percentage of applicants who chose not to disclose also rose from 0% to 1.96%. The largest ethnic growth was seen in Multi-Racial Non-Hispanics (1.09% to 5.88%) and Multi-Racial Hispanics (0.54% to 2.45%). The percentage of US Allopathic applicants slightly declined from 62.50% to 57.35%, while US Osteopathic and foreign medical graduate (FMG) applicants saw modest increases. Univariate analysis revealed significant correlations between match outcomes and gender, race/ethnicity, and medical school type ($p < 0.05$). The number of years since graduation and the number of applications to non-spine fellowships showed a negative predictive correlation ($p < 0.001$). After removing multicollinear features, multivariate logistic regression identified gender, White/Caucasian status, FMG status, total applications, and applications to AAHKS and pediatric fellowships as significant predictors of spine fellowship acceptance. Females were more likely to match (OR = 3.17, $p = 0.0036$), being White increased the odds (OR = 2.08, $p = 0.0376$), and FMGs had a lower chance of matching (OR = 0.02, $p < 0.0001$). Applying to more AAHKS (OR = 0.92, $p = 0.00003$) or pediatric (OR = 0.88, $p = 0.0067$) fellowships decreased the odds of matching, with minimal effect from other fellowship types. **Conclusion:** This study identified several factors that correlate with spine surgery fellowship match outcomes, including gender, race/ethnicity, FMG status, and the number of applications to other fellowships. While there has been some progress, with increased female and multi-racial applicants, structural barriers may still remain. Strategies for recruiting the best talent in the spine surgery fellowship match process, including mentorship programs and targeted outreach, are crucial for achieving greater representation. Finally, applicants should be mindful of the competitive nature of the match, particularly the role that trying to be competitive across multiple fellowship types can play in their success.

ID: AGS26/612

P0640: Utility of routine pathological examination of disc specimens after lumbar spine surgery: a retrospective chart review

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Introduction: Routine histopathological examination of disc specimens after lumbar spine surgery remains common but controversial. Although it may detect unexpected diagnoses, studies suggest limited clinical benefit and questionable cost-effectiveness. U.S. guidelines do not mandate routine pathology in discectomy cases, and institutional practices vary.The objective of this study is to evaluate the clinical utility and economic impact of routine pathological analysis of disc specimens in lumbar spine surgery. **Material and Methods:** We conducted a retrospective review of adult patients who underwent lumbar discectomy, microdiscectomy, or interbody fusion between January 1, 2020, and May 21, 2024, at a high-volume academic center. Inclusion required intraoperative disc specimen collection; patients with prior malignancy, surgical site infection, thoracic disc herniation, or facet cyst were excluded. CPT codes (e.g., 63030, 22630) were used for case identification. Data included demographics, pathology results, clinical-pathological concordance, treatment changes, and procedure-level cost averages from fiscal year 2023/2024. **Results:** A total of 192 patients were included (median age 49.0; 43.2% female; 79.2% White). Most (97.4%) underwent lumbar laminotomy for lumbar spondylosis (98.4%). All pathology reports confirmed herniated disc tissue; no unexpected diagnoses or treatment changes were noted. Routine histology cost approximately $18.67 per case. While per-patient costs were low, the cumulative financial impact could be significant in high-volume centers. Specialized pathology (e.g., immunohistochemistry) was rarely performed. **Conclusion:** Routine histopathological analysis of disc specimens in lumbar spine surgery did not yield diagnostic or therapeutic benefit in this cohort. Given its limited value and accumulating cost, a selective approach - reserving pathology for atypical or suspicious cases - may be more appropriate.

ID: AGS26/791
P0641: Decreasing medicare payments for anterior cervical discectomy and fusion from 2013 to 2023: an analysis of over 10,000 spine surgeons

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Introduction: Despite its clinical utility and consistent procedural volume, Medicare reimbursement for anterior cervical discectomy and fusion (ACDF) has undergone policy-driven changes over the past decade. This study investigated longitudinal Medicare reimbursement trends for ACDF among orthopaedic and neurological spine surgeons from 2013 to 2023. **Materials and Methods:** A retrospective analysis was performed using publicly available Centers for Medicare and Medicaid Services (CMS) databases. Surgeons who billed ≥ 10 ACDF procedures (CPT 22551) per year were included. Provider demographics, procedural volumes, average Medicare standardized amount (AMSA), inflation-adjusted AMSA, and average annual procedural income (API) were analyzed. Comparisons were made by surgical subspecialty by year. **Results:** A total of 10,311 spine surgeons performed 187,062 ACDF procedures between 2013 and 2023. Neurosurgeons comprised 65% of providers and procedures, while orthopaedic surgeons comprised 35%. Average annual case volumes were similar across specialties. Between 2013 and 2023, inflation-adjusted AMSA declined 23% and API declined 27%, despite stable procedural volumes. These declines were consistent across neurosurgeons (-23% AMSA, -27% API) and orthopaedic surgeons (-22% AMSA, -27% API). The number of neurosurgeons performing ACDF decreased over the study period (17% decrease), while the number of orthopaedic surgeons increased (31% increase). Both specialties saw a reduction in average procedures per provider. **Conclusion:** Medicare reimbursement for ACDF declined significantly over the past decade across both orthopaedic and neurosurgical specialties. These findings raise concerns about the financial sustainability of providing ACDF services in the Medicare population and underscore the need for policy strategies that protect access to surgical care for an aging population.

ID: AGS26/843
P0642: 1-2 level lumbar decompression surgery is highly cost effective at 1- and 2-year follow-up

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Introduction: 1-2 Level lumbar decompression is widely performed to relieve symptoms of spinal stenosis or disc herniation. With healthcare expenditures rising due to aging populations, technological advancements and growing demands, cost-effectiveness evaluations are essential for optimizing resource allocation and ensuring healthcare sustainability. This study assesses the cost-effectiveness of 1-2 level lumbar decompression in the Australian healthcare system. **Material and Methods:** A prospective adult registry cohort study was queried for patients undergoing 1-2 level decompression surgery by a single surgeon. Costs analyzed included hospital fees, medical professional fees (NoGAP) disposables, inpatient rehabilitation and revision surgeries. Patient outcomes, assessed using the Oswestry Disability Index (ODI) and EQ5D-3L, enabled cost per QALY calculation with discounting adjusted for health decline and annual inflation at 3%. Cost-effectiveness was determined using the World Health Organization threshold of Cost/QALY below 1×GDP per capita. **Results:** A total of 167 patients were included with 1-year and 89 patients with 2-year follow-up (mean age 59 yrs, 35% female). On average 1.2 levels were decompressed, the length of stay was 1.2 days, and 2% were discharged to rehabilitation. Revision surgery was required in 6.6% of patients by 2-years, including same-level decompression (2.4%), same-level fusion (2.4%), and adjacent-level surgery (1.8%). The mean total cost was $12,685.66 per patient, driven mainly by hospital costs ($6,844; 53%), followed by Medical Professional Fees ($3,530; 27%), Revision Surgery ($1,737; 13%), disposables ($674; 5%), and inpatient Rehabilitation ($163; 1%). ODI improved from Baseline 41.5, to 15.2 at 1-year and15.5 at 2-years. EQ5D Index increased from Baseline 0.585, to 0.821 at 1-year and 0.804 at 2-years. Cost/QALY was $47,113.61 at 1-year, and $22,167.90 at 2-years, well below the highly cost-effective threshold of $97,131.34. **Conclusions:** One and 2-level lumbar decompression surgery demonstrates significant improvement in patient reported outcomes at high cost-effectiveness at 1- and 2-year follow-up.

ID: AGS26/850

P0643: Single position circumferential fusion demonstrates clinical efficacy and high-cost effectiveness at 2 year follow-up

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Introduction: Single-position lumbar fusion surgery (SPS), performed prone or lateral decubitus, aims to streamline workflows, minimize complications, and maintain high fusion rate and alignment restoration. With rising healthcare costs due to aging populations and technological advancements, evaluating cost-effectiveness is essential. This study evaluates the economic and clinical outcomes of SPS, focusing on direct costs, patient-reported outcomes, and Cost/QALY analysis. **Material and Methods:** A prospective, consecutive registry cohort of patients undergoing 1-2 level SPS for degenerative conditions using anterior lumbar interbody fusion (ALIF) and/or lateral lumbar interbody fusion (LLIF) with posterior instrumentation and minimum 1-year follow-up. Perioperative metrics and complications were recorded, including reoperations. Patient reported outcomes included ODI and EQ5D-3L, facilitating QALY calculations. Costs included hospital costs, consumables, implants/biologics, rehabilitation, professional fees and revision surgery costs using 'no-gap' insurance schedules. Cost/QALY was calculated, with discounting (3%p. a) accounting for ageing and inflation. High cost-effectiveness defined by the WHO guidelines as Cost/QALY < 1xGDP per capita. **Results:** 83 patients (mean age 65 years; 63% female) were included. Mean 1.3 levels fused, LOS 2.29 days and rehab disposition 3.4%. Baseline ODI 39, improved to 17 at 1-year and 15 at 2-years. EQ5D index improved from baseline 0.559 to 0.775 at 1-year, and 0.760 at 2-years with revision fusion in 1.2% (adjacent segment disease), and 3.6% requiring further decompression. Average cost for 1-2 level SPS was $39,599AUD. Cost/QALY with discounting at 1-year was $182,608, and at 2-years was 72,269. By 2-years, SPS had crossed below the highly cost-effective threshold of $97,131AUD. The cost drivers per patient were implants and biologics (17,094; 47%), Inpatient Hospital costs ($12,228; 30%), Professional Fees ($7,633; 19%), Revision Surgery ($1,113; 3%) and Rehab ($493; 1%). **Conclusion:** SPS demonstrates substantial QoL improvements and high cost-effectiveness by 2-year postoperatively. Costs were driven predominantly by implant and biologics.

ID: AGS26/1115

P0644: Cost-effectiveness of epidural platelet-rich plasma (PRP) injection versus open lumbar discectomy in two tertiary care centers of Bangladesh

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Introduction: Disc herniation is a leading cause of disability and economic loss worldwide. Surgery is effective but expensive; whereas epidural platelet-rich plasma (PRP) injection has shown potential as a minimally invasive, cost-saving alternative. This study aims to compare the cost-effectiveness of epidural PRP injection with open lumbar discectomy in patients with lumbar intervertebral disc herniation. **Materials and Methods:** A retrospective study was conducted at two tertiary hospitals. Patients undergoing either epidural PRP injection or open lumbar discectomy were included. Direct costs (procedure, hospital stay, medications), indirect costs (workday loss), and clinical outcomes such as Visual Analog Scale (VAS) were analyzed. Incremental cost-effectiveness ratio (ICER) was calculated. **Results:** 100 patients were evaluated (PRP: n = 50, Surgery: n = 50). The mean treatment cost was significantly lower in the PRP group (USD 120) compared with the Surgery group (USD 635). Average workday loss were 3 days for PRP and 30 days for open surgery. At 12-month follow-up, VAS reduction was measured (PRP 80% vs. surgery 95%). PRP demonstrated a favorable ICER, indicating cost savings without significantly affecting outcomes. **Conclusion:** Epidural PRP injection provides near similar clinical improvement with much less cost and hospital stay (OPD based), quicker return to work compared to open lumbar discectomy. PRP offers a cost-effective alternative that may reduce the economic burden of intervertebral disc prolapse.

ID: AGS26/1241
P0645: Causes of cancellation in elective spinal surgery: frequency analysis and associated predictors

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Introduction: Spinal surgery represents one of the surgical specialties with the greatest organizational complexity and demand for technical and human resources. The cancellation of elective procedures constitutes an adverse event that compromises institutional efficiency and the patient's experience. **Materials and Methods:** We conducted a retrospective observational study based on an institutional database that included 421 patients with a medical indication for spinal surgery who ultimately did not undergo the procedure. Each patient was asked why the surgery was not performed. Organizational and demographic variables were analyzed. Multinomial logistic regression was used to determine predictive variables. The level of statistical significance was set at $p < 0.05$. **Results:** The three most frequent reasons for cancellation were: "Cause not reported," "Personal reasons," and "Economic reasons." Independent predictive factors were hospital center ($p = 0.0006$), the physician who indicated the surgery ($p = 0.000$), use of supplies ($p = 0.0094$), and operating room hours ($p = 0.0148$). In the multivariate analysis, the variables with the greatest predictive weight for cancellation were: treating physician (relative importance = 0.47; $p < 0.01$), hospital center (0.06; $p = 0.03$), type of surgery (0.02; $p = 0.08$), and diagnosis (0.00; $p = 0.56$). The overall accuracy of the model was 45.4%. **Conclusion:** The causes of cancellation in elective spinal surgery show significant association with institutional factors. Identifying these patterns allows the development of targeted strategies to reduce preventable causes and optimize the efficiency of the surgical system.

ID: AGS26/1393
P0647: Quality-adjusted life years in spine surgery

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Introduction: Spinal disorders such as degenerative disc disease, spinal stenosis, and disc herniation are major causes of chronic pain and disability worldwide. Surgical intervention often improves quality-adjusted life years (QALY) compared to conservative care, a key measure in cost-utility analysis. With rising spine surgery rates in the aging U.S. population, evaluating safety, economic value, and patient-reported outcomes is essential. While prior studies examined single levels, regions, or pathologies, variability in QALY across procedures and levels remains unclear. This study analyzed 1-year improvements in QALYs generated compared to baseline after single and multi-level cervical and lumbar fusions and decompressions. **Material and Methods:** Patients who underwent single- or multi-level cervical or lumbar decompression or fusion surgeries, with completed preoperative and one-year follow-up PROMIS-GH questionnaires at a single academic center were included. Patients with prior spine surgery, additional surgeries within one year or surgical indications for malignancy, trauma, and infection were excluded. QALYs were calculated by mapping PROMIS-GH to EQ-5D-3L values and using a validated formula to determine the net gain in health-related quality of life after 1 year postoperative. Baseline was defined as QALYs generated in the preoperative health-state over 1 year. One-sided paired t-tests assessed the significance of improvements in QALYs generated. One-way ANOVA and post hoc Tukey's tests assessed differences between surgical groups. Linear regression was used to evaluate associations between baseline health states and postoperative improvements. **Results:** 218 subjects were included in the final analysis, with cervical decompressions ($n = 4$) excluded due to insufficient sample size. All surgical groups demonstrated significant 1-year improvements in QALYs generated. ANOVA revealed significant overall differences in improvement depending on type of surgery ($p = 0.035$). The largest gains were seen in 1-level lumbar fusion (QALY: 0.05 ± 0.04) and 1-level lumbar decompression (QALY: 0.05 ± 0.06), while the smallest were in multi-level cervical fusion (QALY: 0.02 ± 0.04) and multi-level lumbar decompression (QALY: 0.02 ± 0.05) (all $p < 0.05$). 1-level cervical fusion (QALY: 0.03 ± 0.05, $p = 0.016$) and multi-level lumbar fusion (QALY: 0.04 ± 0.05, $p < 0.001$) also generated more QALYs compared to non-operative management. Regression analysis demonstrated a significant negative association between baseline health status and postoperative improvements ($R = -0.338$, $p < 0.001$). **Conclusion:** QALYs generated were significant across all spine surgeries, with the greatest gains in 1-level lumbar fusion and decompression. Multi-level procedures showed smaller gains and higher negative outcomes compared to single-level counterparts. Lower baseline health states were associated with greater improvements, underscoring the influence of preoperative condition. Economically, if the 0.05 QALYs gained in single-level lumbar

decompression were sustained for 5 years (0.25 QALYs total), cost per QALY = $88,708, referencing the Spine Patient Outcomes Research Trial's costs. This is well within commonly cited U.S. willingness-to-pay ranges ($50,000-$150,000/QALY) despite not accounting for further improvements in health state beyond 1 year. These findings inform evidence-based clinical decision-making and provide valuable insights into the comparative effectiveness of spine surgeries in cost-utility analyses.

ID: AGS26/1403
P0647.1: Portal Message Utilization in Orthopedic Spine Surgery: Patterns, Predictors, and Financial Implications

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Introduction: Electronic patient portals (EPPs) aim to enhance engagement and access to healthcare by facilitating communication between patients and providers. While extensively studied in primary care, their role in orthopedic spine surgery remains underexplored. This study aimed to quantify portal message volume, identify demographic predictors of high utilization, and estimate the potential financial and administrative burden portal messaging may impose on orthopedic spine practices. **Material and Methods:** In this retrospective review of patient portal messaging data from a single-center orthopedic spine department, we analyzed portal messages sent via Epic MyChart by 833 new patients seen between April 2, 2024 and October 31, 2024. Messages were categorized by timeframe and encounter type. Patients were stratified into low- (Group 1) and high-utilizers (Group 2), with high utilization defined as ≥2 standard deviations above the mean number of portal messages. Independent t-test and chi-squared analyses demographic differences between groups; including age, sex, race, marital status, provider, and insurance payor. Billable encounters were identified per Centers for Medicare and Medicaid Services (CMS) guidelines and assigned costs by Evaluation and Management (E/M) service level. A Monte Carlo Simulation was used to estimate lost revenue from unbilled patient-physician interactions (100,000 iterations, R Studio v4.3.3). **Results:** A total of 548 messages were sent (mean 0.658 per patient; SD 1.66; range 0-18). The most frequent encounter types included appointment scheduling (97) and imaging related concerns (94), followed by other post-operative concerns (79), pain management (70), and paperwork or other third party (59). High utilization (≥4 messages, Group 2) was observed in 43/833 patients (5.2%), with a mean of 5.19 messages per patient (range 3-18). Patient age at initial encounter was not a significant predictor of portal message use ($p = 0.276$). Race was the only significant predictor of high portal utilization ($\chi^2 = 6.172$, $p = 0.046$), with White/Caucasian patients overrepresented in Group 2 (86.0% vs 70.3%), while Black/African American patients were underrepresented (7.0% vs 23.0%). Only 25/548 messages sent (4.6%) met CMS criteria for billable services. Messages distribution by E/M service levels was: Level II = 8%, Level III = 72%, Level IV = 20%. The simulation estimated a 95% confidence interval for total unbilled charges between $4,677 and $10,548. **Conclusion:** Portal message utilization among patients within the orthopedic spine department significantly varied by race, suggesting potential disparities in access or engagement. Although only a small proportion of encounters qualified as billable, this study highlights potential gaps in patient-physician communication and the growing administrative burden of post-encounter portal messaging. Further investigation is needed to elucidate breakdowns in communication, optimize portal use, and ensure equitable access to digital orthopedic care.

ID: AGS26/1730
P0648: The influence of marketing mix factors on the interest in undergoing surgery for patients with back pain

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Introduction: As a hospital specializing in spine treatment, our institution requires information to increase public interest in undergoing spinal surgery among patients with back pain and to develop effective and efficient marketing strategies that will enhance program growth and competitiveness compared to other hospitals. **Material and Methods:** This study employed a quantitative approach with a cross-sectional design. Study population consisted of 112 patients, and the sampling technique used was purposive sampling. Data were collected using a structured questionnaire consisting of closed-ended questions with predefined response scales. Data analysis was carried out using univariate, bivariate, and multivariate statistical methods. **Results:** The results showed a significant relationship between patient interest in undergoing surgery and the marketing mix elements of product ($p = 0.036$), price ($p = 0.000$), promotion ($p = 0.005$), people ($p = 0.000$), and process ($p = 0.034$). Multivariate analysis indicated that the most dominant factors were the marketing mix elements of people ($p = 0.043$) and price ($p = 0.018$). **Conclusion:** The marketing mix elements of product, price, promotion, people, and process significantly influence the interest of patients with back pain in undergoing surgery at our hospital. Among these, people and price are the most dominant factors.

ID: AGS26/1767
P0649: The Spinal Invasiveness Score (SIS) as a tool to improve surgical waitlist management

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Introduction: Spine care delivery worldwide faces significant challenges due to prolonged patient wait times. Conventional waitlist management methods that rely solely on patient count fail to capture case complexity, often leading to inequities-patients requiring complex procedures such as scoliosis correction typically wait longer than those scheduled for less invasive operations like discectomies. However, the Spinal Invasiveness Score (SIS) offers an alternative framework for waitlist organization that has the potential to address these shortcomings. SIS is a validated system that assigns points based on six procedural parameters: anterior decompression, anterior fusion, anterior instrumentation, posterior decompression, posterior fusion, and posterior instrumentation. By quantifying surgical complexity, SIS-based waitlists allow stratification by procedure category and enable more accurate comparisons of surgical demand and resource needs. This study explores the perceptions of spine surgeons and healthcare administrators on the benefits, limitations, and potential barriers to SIS adoption in routine clinical practice. **Material and Methods:** A qualitative descriptive study was conducted surveying spine surgeons and hospital administrators across Canada. Participants reviewed a case study comparing the current waitlist model with the SIS-based approach and were surveyed on their preferred method for wait time calculation and asked for insights on the potential advantages and barriers of adopting SIS. Responses were analyzed using thematic analysis to identify recurring themes around SIS's perceived benefits, limitations, and barriers to adoption. **Results:** Among 21 respondents, 17 (81%) favored the SIS approach over the current system. This group included 9 of 11 surgeons and 8 of 10 administrators, showing robust support across disciplines. Respondents identified several benefits of the SIS approach:

• **Enhanced Prioritization**: The SIS model's ability to quantify procedural complexity allows for the subcategorization of waitlists (e.g., multi-level vs. single-level surgeries), facilitating more precise case prioritization.
• **Improved Case Triaging**: The SIS system enables more efficient triaging of surgeries based on their complexity, allowing healthcare providers to allocate resources more effectively.
• **Better Waitlist Management**: By distinguishing between different types of procedures (e.g., instrumented vs. non-instrumented), the SIS approach supports optimal scheduling and resource distribution. However, barriers identified included difficulty for the health system to capture SIS score for each surgery, cost of implementation and SIS not capturing full complexity of cases such as elevated BMI or revision status. **Conclusion:** The Spinal Invasiveness Score demonstrates strong potential as an equitable, standardized tool for surgical waitlist management that can be adapted to diverse global healthcare systems. By quantifying invasiveness, SIS provides a more accurate reflection of surgical demand than simple patient counts, supporting better prioritization and resource utilization. Although challenges remain regarding data integration and capturing case complexity beyond invasiveness, early experiences suggest that SIS facilitates tailored scheduling solutions, such as allocating longer operating sessions for complex cases. With thoughtful implementation, SIS could play an important role in addressing global challenges of surgical access and efficiency.

ID: AGS26/2379
P0650: Uninformed compliance or informed consent: what patients think about animal-based products in spinal surgery

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Introduction: Animal-based products (ABP) are routinely utilized in standard spinal procedures. Patients ordinarly are uninformed of ABP used in their treatment, whilst most surgeons lack adequate knowledge to deliver comprehensive ABP information. Montgomery principles state that patients must receive sufficient information regarding their treatment, including material origins and ethical considerations. Increasingly in a multicultural society, a cohort of patients will necessitate an enhanced understanding of ABP used in their treatment, prior to providing informed consent. This study assesses patient understanding of ABP used in spinal surgery. **Method:** We conducted a prospective survey of 68 patients attending a spinal elective outpatient clinic. Median age 61 yrs (27-91years) of whom 17 patients were women, formed the cohort. A standardised questionnaire was distributed to assess patient awareness, acceptance, and preferences regarding ABP. The responses were documented and analysed. **Results:**

82% of patients were unaware of ABP utilisation in spinal surgery. 75% considered that all patients should be informed about ABP utilisation and receive reasonable background information prior to providing their informed consent. 26% reported a preference to be informed of ABP utilisation for an emergency spinal operation. 5% reported that they would not give consent for ABP utilisation for an emergency spinal operation. The most frequently cited reason influencing patients' decisions regarding animal-based products is ethical concerns. Horse-based ABP were deemed least favourable ABP. **Conclusion:** This study identified that most patients are uninformed of ABP routinely used in their spinal surgery. Despite varied responses to ethical, culture, religious and dietery considerations, most patients would accept the use of ABP necessarily involved in either an elective or emergency spinal operation. A strong preference for full disclosure regarding ABP utilisation confirms the requirement for its inclusion as part of fully informed consent.

ID: AGS26/2447
P0651: Robot-assisted anterior lumbar interbody fusion does not increase costs compared to computer-navigated procedures: a single-institution study

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Introduction: Robotic systems have been increasingly adopted in spine surgery to improve surgical precision and outcomes. Prior reports suggest that robotics reduce radiation exposure, lower surgical complications, and improve pedicle screw placement accuracy. While these studies suggest clinical benefits, the financial implications remain unclear, particularly in anterior lumbar interbody fusion (ALIF) with posterior spinal fusion (PSF). Current health policies prioritize high-quality care at low cost. With the growing adoption of robotic techniques, hospitals must evaluate the economic difference between robotic and computer-navigated ALIF. While some studies indicate that robotic systems can be cost-effective, others suggest that robot-assisted spine surgeries have a higher intraoperative cost. This study examines the cost-effectiveness of robotic-assisted versus computer-navigated ALIF with PSF. **Material and Methods:** A retrospective review was conducted on patients who underwent single-level L5-S1 ALIF with same-day PSF at a single academic institution from March 2018 to May 2025. Exclusion criteria included staged procedure, deformity surgery, multi-level fusion, and other interbody techniques. Patients were stratified by technique of pedicle screw placement into one of two groups: computer-navigated ALIF and robot-assisted (RA) ALIF. All RA-ALIFs were performed using the Mazor Robotic guidance system. Cost data pertaining to the procedure, including total cost, operating room (OR) cost, and other costs, were obtained from financial services. The medical record was reviewed for demographic data and clinical variables, including estimated blood loss (EBL), length of stay (LOS), and operative time. Descriptive statistics included Wilcoxon rank-sum test for continuous variables and chi-squared test for categorical variables. Multivariable logistic regression was used to evaluate cost across treatment groups. **Results:** A total of 75 patients met inclusion criteria, including 23 (30.7%) computer-navigated ALIFs and 52 (69.3%) RA-ALIFs. The mean age of the patient population was 61.0 ± 13.4 years and 54.5 ± 13.6 years for the computer-navigated and RA-ALIF cohorts, respectively. Thirty-seven (49.3%) of the patients were male, and 38 (50.7%) were female. Mean total costs were \$44,525 ± 19,245 for computer-navigated and \$42,994 ± 11,700 for RA-ALIF (all $p > 0.05$). Operative costs were \$16,958 ± 14,775 and \$17,977 ± 11,938, respectively, while other costs were \$27,567 ± 16,900 and \$25,017 ± 11,215 (all $p > 0.05$). EBL (126.59 vs 120.77 mL) and operative time (5.10 vs 5.28 hours) were similar across groups ($p > 0.05$). LOS was significantly shorter following RA-ALIF (4.30 vs 3.17 days, $p = 0.01$). Multivariable regression adjusting for age, BMI, sex, diabetes, and hypertension revealed no statistically significant difference in total cost, operative cost, or other costs between robot-assisted and computer-navigated ALIF (all $p > 0.05$). **Conclusion:** Robot-assisted ALIFs were not associated with higher total cost, OR cost, or other costs. These findings offer valuable insight into the economic viability of RA ALIF, emphasizing its cost-effectiveness. By clarifying the financial impact, this study can inform clinical practice and hospital policy, supporting the adoption of robotic techniques.

ID: AGS26/2521
P0652: Measuring value in surgery: a systematic review of economic indices across specialties

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Introduction: Rising healthcare costs and increasing procedural complexity have accelerated the shift toward value-based care in surgery. Central to this shift is the ability to measure the relative value of interventions, balancing patient outcomes with economic impact. While numerous indices and models have been proposed to evaluate surgical value, there is little consensus on which measures are most appropriate, and variability across studies limits cross-disciplinary comparisons. To date, no systematic review has comprehensively assessed how value indices are being applied across surgical specialties. The purpose of this study is to identify economic value indices, characterize their components, and evaluate their application. **Materials and Methods:** This systematic review was conducted in accordance with PRISMA guidelines. PubMed, Embase, and Google Scholar were searched in July 2025 for studies published between 2015-2025 using combinations of "surgery," "value-based care," "cost-effectiveness," and "value index." Eligible studies were peer-reviewed, English-language primary research applying a quantitative value index, model, or formula to evaluate surgical care across any subspecialty. Exclusions included case reports, reviews, pharmacologic, or nonoperative interventions. Two reviewers independently screened studies, with arbitration by a third. Extracted data included surgical specialty, type of index, components measured (e.g., costs, QALYs, complications), study design, and key findings. **Results:** A total of 342 articles published between 2015 and 2025 met the inclusion criteria. Our systematic review identified 11 different indices used to measure economic value in surgery across various specialties. Frequently applied indices included the Incremental Cost Effectiveness Ratio (ICER), used in 189 studies (55.3%), and the Time-Driven Activity-Based Costing (TDABC) in 93 studies (27.2%). Other commonly used indices were the Cost-Specific Metrics (such as cost per length of stay or reoperation), applied in 92 studies (26.9%), the Return on Investment (ROI) in 23 studies (6.7%), and the Net Monetary Benefit (NMB) in 27 studies (7.9%). Additional indices included the Activity-Based Costing (17 studies, 5.0%), the Incremental Cost Utility Ratio (ICUR) in 8 studies (2.3%), as well as the Operative Value Index (OVI) in 6 studies (1.8%). Least commonly observed indices were the Net Health Benefit (NHB) and Net Present Value, each in 3 studies (0.9%), the Average Cost-Effectiveness Ratio (ACER) in 3 studies (0.9%), and the Procedure Value Index (PVI) in 3 studies (0.9%). Highly represented surgical specialties include general, orthopedic, neurosurgery, cardiothoracic, and vascular surgery. **Conclusion:** To our knowledge, this is the first systematic review to evaluate the indices and tools used to measure surgical value across specialties. We found that patient-level cost-effectiveness metrics, most notably ICER, remain the dominant approach. However, a growing number of studies employ broader economic and operational frameworks such as NMB, ROI, and TDABC, reflecting increased recognition of financial efficiency and resource utilization as critical components of value. This heterogeneity highlights the need for a more standardized framework to guide how surgical value is assessed across specialties.

ID: AGS26/2536
P0653: "The value proposition:" what do healthcare stakeholders actually value when it comes to enabling technology and innovation?

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Introduction: Advancements in spine technology are essential for improving patient outcomes, but conflict often arises due to differing priorities held by stakeholders. There is a gap in understanding how diverse value priorities influence technology adoption and how to measure value in this field. This study aims to develop a stakeholder-specific value index to better assess spine technologies, guide informed decision-making and optimize resources. **Materials and Methods:** A modified Delphi study was conducted to identify key evaluation factors for adopting spine technologies, involving adults with 3+ years' experience across spine surgery, hospital administration, medical technology, and insurance. Participants were recruited via purposive and snowball sampling, aiming for at least 50 diverse participants. The study included a survey with initial open-ended responses, followed by Likert-scale ratings to reach consensus ($\geq$ 50% agreement) across value metrics like operational costs, patient satisfaction, and technological advancement. Data was collected through REDCap, analyzed thematically and statistically, resulting in stakeholder-specific lists of the top 10 evaluation factors and insights into technology scores across these criteria. **Results:** Out of 30 invited participants, 24 completed a 145-question survey. Consensus was defined as $\geq$ 50% agreement per question. Overall, the greatest disagreement appeared in Value Ratings & Barriers (36%) and Clinical Impact (44%), with notable gaps around reoperation rates, surgical expectations, and cost-effectiveness. Surgeons and medtech professionals showed the highest levels of non-consensus-up to 45%-particularly in Technology Features, Operational Efficiency, and Value Ratings. In contrast, hospital administrators demonstrated strong alignment across nearly all categories, reaching up to 100% consensus in Financial & Value-Based Metrics and over 90% in Operational Efficiency and Patient Outcomes. These differences highlight varying priorities across stakeholder groups, especially regarding usability, institutional support, and long-term value. Data from insurance/payer representatives was insufficient for analysis due to low participation. **Conclusion:** The impetus for this work was to

identify the priority factors each stakeholder group considers when evaluating and adopting enabling technologies (ET). However, the data revealed that even within individual stakeholder groups, there is limited consensus on key ET-related factors. Results from the study highlighted substantial disparities in stakeholder predilections-particularly around value ratings, clinical impact, and technology features. These findings underscore a broader issue: while major decisions around ET are common in health systems, the early stages of stakeholder engagement are often combative rather than collaborative. This lack of alignment begins to uncover the deeper challenges health systems face when negotiating and implementing new technologies. To address this, the next survey will focus on areas where consensus is lacking, aiming to clarify or reconcile stakeholder value differences. Ultimately, this will support the development of a stakeholder-specific value index for spine technologies-providing a framework for more productive initial discussions and helping align adoption decisions with diverse perspectives to refine resource use.

ID: AGS26/3299
P0655: Why business tools are essential for managing a spine program

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Introduction: Spine care delivery globally, and in particular Canada, is in a state of crisis and clinician advocacy to hospital leadership and government is essential to successfully implement positive change. While clinical research and quality improvement work are both well-established domains familiar to surgeons, business techniques such as granular financial quantification and operational modeling are not commonly used but can play a crucial role in advocacy efforts. This study describes 2 instances that business tools were used from October 2023 to October 2024 to successfully advocate for major progress in increasing the capacity of a provincial spine program. **Material and Methods:** The first example of the use of a business technique was granular financial quantification to compare costs of an existing program to export spine surgeries to the USA against the costs of building capacity within the province instead - via capital investment to expand the spine program within the province. The second use case was quantification of the existing waitlist via an operational model in order to accurately ascertain the exact OR resources required to address a surgical backlog. **Results:** The initiative led to the successful cancellation of surgeries being sent to the United States, yielding net savings of $30 949 per case and $4.1M per annum. The capital procurement for the secondary site expansion ($2.2M) along with an operating budget ($959 000) was approved due to the demonstration of a return on investment (ROI) of 27%. The precise quantification of the waitlist demonstrated a 4.3-year waitlist for spine surgery, on track to reach 5.7 years by 2027. This data provided a strong case for additional OR time, which is being incrementally added, after a fifteen-year status quo. **Conclusion:** Advocacy for additional resources was unsuccessful until the introduction of business tools resulting in accurate quantification (in this case, net profit/ROI values and precise wait times). We hope these techniques become more widely implemented nationally as our experience highlights the potential benefits of strategic data-driven decision-making.

Minimally invasive spine surgery

ID: AGS26/45
P0656: Lateral access minimally invasive spine surgery in adult spinal deformity

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Introduction: Oblique lumbar interbody fusion (OLIF) and percutaneous posterior approach for screw fixation (PPS) are the latest minimally invasive treatments for spinal deformity in adult patients (ASD). Adult spinal deformity is a condition that causes sagittal and coronal imbalance, debilitating pain, neurological impairment, and/or functional loss. The approach to treating and managing ASD needs to concentrate on restoring age-specific harmonious alignment, comorbidities, and risk factors of everyone for the prevention of devastating complications and improvement of quality of life. The core concept of this minimally invasive spinal surgery technique (MISS) is to gain adequate strong fusion via the insertion of a cage. Some of the important points to consider are: 1) the placement of an accurate reference frame is necessary to avoid an otherwise risk of cage or PPS misplacement, 2) the exposure to radiation is significantly decreased for the operating surgeons and their staff, and 3) the navigating O-arm-guided PPS is accurate. The latest novel techniques used for ASD correction include oblique lumbar interbody fusion at the L5-S1 level (OLIF51) to consider success in creating lumbar lordosis and 360° fusion. The application of CT-MRI combined fusion image clarification purposes of lumbosacral vascular anatomy using 3D non-enhanced MRI and CT medical image fusion techniques. The objective of this retrospective study is to discuss key points that will help in the strategic planning of lateral access in ASD surgery. **Material**

and Methods: We retrospectively analyzed 54 patients who had undergone OLIF with PPS for ASD from October 2019 to January 2022 (average 71.5 ± 6.2 years old, 4 males and 50 females) with a mean follow-up period of 29.2 months. Clinical outcomes are expressed by values including the Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS) for back pain. The imagistic assessment was also performed preoperatively and at 12 and 24 months postoperatively. For OLIF51, CT-MRI fusion images were obtained before surgery. **Results:** Postoperative ODI and VAS were 30.5 ± 18.9% and 31.2 ± 6.9 mm, respectively. The average operating time and blood loss during the surgical exposure were 490.9 ± 85.4 min and 1195.2 ± 653.8 ml. Preoperative SVA, PI-LL, and PT were 96.5 ± 55.9 mm, 39.3 ± 22.1°, and 34.5 ± 11.0°, respectively. Postoperatively, SVA and PT became normal (24.1 ± 39.0 mm, 17.1 ± 10.3°) and PI-LL was ideal (2.4 ± 12.6°). Postoperative ODI and VAS were 30.5 ± 18.9% and 31.2 ± 6.9 mm. For OLIF51, the results revealed a gain in L5-S1 lordosis and intervertebral disc height of 9.4° and 4.2 mm, respectively. The complications consisted of PJK in 21 cases (38.9%), rod breakage in 5 cases (9.3%), and deep or superficial wound infection in 2 cases (3.7%). **Conclusion:** Clinical and radiological results of OLIF and PPS for ASD correction were excellent. The radiographic outcomes showed that OLIF51 created good L5-S1 lordosis and L5-S1 disc height. CT-MRI fusion images were useful for evaluating the vascular anatomy of OLIF51. The C-arm-free technique is a safe and effective technique that reduces radiation exposure.

ID: AGS26/102

P0657: Stable low-grade degenerative spondylolisthesis does not adversely affect clinical outcome of full-endoscopic decompression in patients with spinal stenosis

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Introduction: The optimal surgical management of lumbar spinal stenosis (LSS) in the presence of stable low-grade degenerative spondylolisthesis remains a subject of ongoing debate. This study aimed to evaluate the clinical outcomes and radiological stability of full-endoscopic unilateral laminotomy with bilateral decompression (Full-Endoscopic ULBD) in this patient population. Specifically, we sought to determine whether this minimally invasive approach compromises spinal stability or leads to progression of spondylolisthesis over time. **Material and Methods:** A total of 36 patients diagnosed with LSS and grade I degenerative spondylolisthesis who underwent Full-endoscopic ULBD at the Minimally Invasive Spine Center between February 2019 and December 2023 were retrospectively reviewed. All patients completed at least 12 months of follow-up, with a mean final follow-up duration of over 1 year. Clinical outcomes were assessed preoperatively, at 12 months, and at the final follow-up using the visual analog scale for back pain (VAS back), visual analog scale for leg pain (VAS leg), and Oswestry Disability Index (ODI). Radiological evaluations included canal cross-sectional area (CSA), lumbar lordosis (LL), segmental lumbar lordosis (SLL), sagittal vertical axis (SVA), slip percentage (Slip%), pelvic tilt (PT), and other sagittal alignment parameters. At the 12-month follow-up, mean scores were as follows: VAS back, 1.71 ± 2.04; VAS leg, 2.17 ± 2.19; and ODI, 14.82 ± 12.83. At final follow-up, the respective values were: VAS back, 1.92 ± 2.03; VAS leg, 2.26 ± 2.25; and ODI, 14.40 ± 13.35. **Results:** All clinical outcome measures demonstrated statistically significant improvement from baseline at both 12 months and final follow-up ($p < 0.001$ for all comparisons). Pain scores and functional disability were markedly reduced, indicating sustained clinical benefit of the procedure. Notably, the canal cross-sectional area (CSA) significantly increased at final follow-up (from 51.49 ± 28.41 mm^2 preoperatively to 90.30 ± 50.60 mm^2, $p = 0.001$), suggesting effective and lasting neural decompression. While lumbar lordosis and segmental lumbar lordosis angles did not exhibit statistically significant changes ($p > 0.1$), the slip percentage remained stable throughout the postoperative period (preoperative: 12.40 ± 5.34%; final follow-up: 11.99 ± 4.62%, $p = 0.724$), indicating no progression of vertebral slippage. Additionally, pelvic tilt improved significantly at the 12-month mark (from 20.37 ± 7.92° to 12.77 ± 8.47°, $p < 0.001$), although this change was not maintained at the final follow-up. **Conclusion:** Full-endoscopic ULBD is a safe and effective surgical option for patients with lumbar spinal stenosis and stable grade I degenerative spondylolisthesis. The procedure achieves significant and sustained improvements in pain and functional outcomes without inducing spinal instability or progression of spondylolisthesis. Future prospective studies with larger cohorts and extended follow-up are warranted to further substantiate these findings.

Keywords: Lumbar Spinal Stenosis, Degenerative Spondylolisthesis, Endoscopic Spine Surgery, Unilateral Laminotomy

and Bilateral Decompression, Minimally Invasive Surgical Procedures, Clinical Outcomes, Spinal Stability.

ID: AGS26/110
P0658: Hybrid endoscopic thoracic discectomy using robotic arm and navigation for highly migrated calcified disc herniation: case and tech note

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Introduction: We discuss a case of T5/T6 highly migrated calcified disc herniation on the right side that was successfully treated by hybrid endoscopic thoracic discectomy robotic arm and navigation. **Material and Methods:** With the development of techniques, endoscopic spine surgery has emerged as a reliable treatment for thoracic myelopathy. This approach offers high-resolution, off-axis visualization of the surgical field. The field is poised to advance further as endoscopic instruments are refined, becoming less invasive and more precise through the integration of navigation and robot-assisted systems. Here we provide a step-by-step guide for performing the hybrid endoscopic thoracic discectomy using navigation and robotic arm for addressing high migrated calcified disc herniation. **Results:** A 62-year-old woman presented to us with chief complaints of Both legs' weakness. She had difficulty standing and walking after squatting due to weakness in her legs and her ODI score was 66. On examination her both side knee extension and ankle dorsiflexion were grade 4 without dysesthesia. The imaging examination confirmed the diagnosis of thoracic myelopathy caused by a highly migrated calcified disc herniation at T5-6 level. The patient underwent an endoscopic thoracic discectomy using robotic arm and navigation for addressing highly migrated calcified disc herniation, resulting in an excellent outcome. **Conclusion:** The continuous development of navigation and robotic systems in endoscopic thoracic surgery enhanced accuracy in surgical incisions and instrument placement, as well as improved efficiency in locating pathology and achieving precise decompression. Endoscopic thoracic discectomy combines full-endoscopy and UBE techniques to leverage the benefits of both approaches, including the cross-viewing of full-endoscopy cannula and the use of larger Kerrison rongeurs under UBE.

Keywords: endoscopic spine surgery, thoracic disc herniation, migrated calcified disc herniation, navigation, robotic arm assist.

ID: AGS26/178
P0659: Endoscopic resolution of radiculopathy after minimally invasive TLIF: a case report with intraoperative neurophysiological monitoring

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Introduction: Persistent or recurrent radicular pain after instrumented lumbar fusion such as TLIF represents a significant clinical challenge. There is still very little literature available regarding this topic. Causes include epidural fibrosis, osteophyte formation, or foraminal stenosis. Revision with open surgery carries risks of bleeding, infection and neural injury, particularly in patients with postoperative scarring. Endoscopic transforaminal foraminotomy with osteophytectomy, guided by intraoperative neurophysiological monitoring (IOM), may provide an ultra-minimally invasive alternative in selected cases. **Material and Methods:** We report the case of a 44-year-old male patient who presented with progressive lumbar pain with right L5 radiculopathy for 2 years. The pain was moderately severe (VAS 7), requiring daily analgesics and preventing him from performing work activities. The patient has previous history of open L4 laminectomy performed several years ago in another hospital, followed by right-sided minimally invasive L4-L5 TLIF at our institution (October 2021) which initially improved his symptoms. On physical examination there is no neurological impediment. Our patient had scars from previous surgeries along the middle line (from laminectomy) and in both sides (Wiltse approach from TLIF). RMI and a CT showed right L4-L5 foraminal and lateral recess stenosis due to an L5 facet osteophyte and fibrosis. No hardware complications were detected. A uniportal right-sided endoscopic transforaminal approach in L4-L5 under general anesthesia and continuous IOM was performed. Severe foraminal fibrosis was debrided. The compressive osteophyte was removed with foraminotomy and motorized instruments until free mobilization of the L5 root was confirmed ("floating sign"). Isolated neurotonic discharges and decreased MEP amplitudes in the right gastrocnemius were observed initially, but normalized after decompression. Transient MEP changes occurred during cannula placement and resolved after repositioning. Sacral reflex study (H-reflex) showed right absent baseline responses, which recovered and normalized by the end of surgery. Representative intraoperative neurophysiological waveforms and endoscopic images are displayed in the poster figures. **Results:** The patient experienced immediate

postoperative improvement in right leg sensory symptoms and was discharged within less than 24 hours. At follow-up, he reported significant pain relief and progressive return to normal daily activities. Postoperative CT confirmed removal of the osteophyte. No neurological complications were observed. **Conclusion:** Foraminal fibrosis and osteophytes are recognized causes of radiculopathy after TLIF. Endoscopic decompression provides an effective and safe approach in patients with important fibrosis and previous surgeries. This technique minimizes tissue disruption and avoids manipulation of existing hardware. The use of IOM was a key differential feature in this case, ensuring root safety and guiding decompression in real time. Intraoperative changes correlated with clinical outcomes. This case supports endoscopic foraminal decompression as a valuable option in selected postfusion radiculopathy patients, thought further studies are needed to assess long-term effectiveness and reproducibility. Careful patient selection and a thorough understanding of the potential benefits and risks of the procedure are crucial for optimizing outcomes.

ID: AGS26/225
P0660: Indications for lumbar disc herniation surgery in patients without neurological deficits: a critical review of red flags and the role of pulsed radiofrequency combined with physiotherapy

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Introduction: Lumbar disc herniation (LDH) is a common cause of radicular low back pain, with most patients presenting with no motor deficits. Current guidelines recommend initial conservative management, including analgesics, physiotherapy, and patient education for neurologically intact individuals. Surgery is typically reserved for cases with "red flag" signs - cauda equina syndrome or rapidly progressive neurological impairment. The indications for discectomy in patients without deficits remain controversial. This review critically examines the current evidence on operative decision-making in such cases, focusing on the predictive value of red flags and the role of pulsed radiofrequency (PRF) therapy combined with rehabilitation. **Material and Methods:** A literature review was conducted using PubMed, Embase, and Cochrane Library, covering publications from 2000 to 2025. Search terms included "lumbar disc herniation", "surgery indications", "red flags", "pulsed radiofrequency", "physiotherapy" and "conservative management." Eligible studies included adult patients with symptomatic LDH without neurological deficits. Emphasis was placed on comparative studies of surgical versus conservative treatment, interventional procedures such as PRF, and guidelines addressing red-flag frameworks. Additional focus was given to the literature on the influence of socioeconomic factors and intervention timing. **Results:** Urgent surgery is mandatory in patients with neurological deficits. Conservative management remains the first-line treatment for neurologically intact patients, with most patients experiencing symptom resolution within 6-8 weeks. However, delaying surgery in patients with persistent pain beyond this interval can negatively affect socioeconomic outcomes, including prolonged sick leave, reduced work productivity, and academic disruption. Early microdiscectomy offers faster pain relief and quicker return to function, although long-term results often match those of conservative treatment within one year. Evidence suggests that relying solely on red flags to guide surgical timing is inadequate, as it fails to address patient-specific contexts such as significant occupational or educational consequences from delayed recovery. PRF, particularly combined with physiotherapy, has shown promise in reducing radicular pain and in delaying or avoiding surgery. Physiotherapy, including core stabilization, manual therapy, and targeted exercises, remains the cornerstone of the treatment pathway. While PRF may extend remission periods and improve function, its variable efficacy requires careful follow-up. For patients whose symptoms persist despite optimal conservative and minimally invasive measures, early surgical intervention should be considered, even in the absence of neurological deficits. Predictive tools such as the Microdiscectomy for Lumbar Disc Herniation Scoring System may help identify patients most likely to require surgery. Factors, such as prolonged symptom duration, advanced disc degeneration, and nerve root compression, are associated with higher rates of conservative treatment failure. **Conclusion:** Surgical management of LDH in patients without neurological deficits requires an individualized multifactorial approach. Conservative treatment should be the initial strategy; however, exclusive reliance on red flags is insufficient for guiding elective surgery. Early surgery may be justified in cases where conservative care, including PRF and physiotherapy, fails to achieve sustained relief or when socioeconomic factors significantly affect quality of life. Treatment decisions should balance clinical severity, the risk of neurological deterioration, and patient-specific socioeconomic considerations. Future guidelines should incorporate both clinical and socioeconomic predictors to optimize the timing and selection of surgical interventions.

ID: AGS26/226
P0661: Restoring sagittal balance through a biportal endoscopic fusion combined with bilateral osteotomy

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Introduction: Endoscopic fusion is a minimally invasive spine surgery technique accepted as an alternative for the treatment of lumbar spine disorders. Biportal endoscopic decompression can be applied to almost all cases of lumbar stenosis and has become a safe technique for minimally invasive spine surgery. In cases of spinal instability a fusion is needed and also biportal endoscopic is an option. In the past two decades, high-level evidence has shown that sagittal balance correction parameters impact quality of life scales and future revision prognostics**.** The main objective of this study is the description of the biportal endoscopic technique for sagittal balance correction performing a interbody fusion and bilateral osteotomy. **Material and Methods:** With the use of the Unintech Endosurg Standard System and multimodal intraoperative neurophysiological monitoring with electromyography stimulation by the same spine neurosurgeon and neurophysiologist, Preplanning is conducted to select the correct cage size and determine the level of osteotomy. Two skin incisions of approximately 2cm are made, followed by dissection with dilators. The endoscope is introduced, and dissection over the ipsilateral facet joint is performed. We then perform a partial facetectomy of inferior articular process and a total facetectomy of the superior articular process. We locate the inferior lamina and perform over-the-top decompression, as well as a contralateral facetectomy through the same approach. Next, we continue dissection over Kambin's triangle, perform a discectomy and introduce the titanium 3D banana-shaped cage. Finally, percutaneous screws are inserted compressing to help improve lumbar lordosis achieved with the previous osteotomy. Intraoperative X-Ray and 6 weeks and 3 months control to ensure spinal fusion and follow-up for spinal balance correction.The database includes demographic data, hospital length of stay, clinical scales, and functional follow-up (EVA, ODI) of patients treated at a single spine center. **Results:** Three patients underwent surgery for a total of five biportal fusions with osteotomy levels. The average age of the patients was 34 years, with two being female. The average hospital stay was 1.5 days. Before surgery, 100% of the patients used some form of neuromodulator, and only one required it for three weeks after the procedure. Sagittal alignment parameters showed improvements in lumbar lordosis and segmental lordosis. Mismatch and pelvic tilt were within normal values. Fusion outcomes were assessed at six weeks and three months, with CT reaching 200 UH. Clinical scales indicated that VAS pain and functional scores improved. No complications were observed. **Conclusion:** The biportal endoscopic technique is safe for performing interbody fusion and bilateral osteotomy with single-side access. It is a feasible method for correcting sagittal parameters, with a lower rate of complications related to access. Overall, these findings suggest that biportal fusions can be a viable option for patients seeking relief from spinal conditions while minimizing recovery time and medication dependency. Future studies could expand on these results to enhance understanding and optimize patient care in similar cases.

ID: AGS26/234

P0662: Comparative study between open mini-incision TLIF (4.0 cm) vs hybrid endoscopic TLIF; Surgical and early clinical results report

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Introduction: Surgeons choose minimally invasive spine surgery due to its positive outcomes and speedy recovery for patients. Many surgeons from different institutes say uniportal and biportal endoscopic TLIF surgery are equally effective as micro or open surgery. Compared to open TLIF surgery with a 4.0 cm mini-incision, TLIF endoscopic surgery requires sophisticated surgical skills and expensive endoscopic equipment. Which method is best? This study compared the pros and cons of each method. **Material and Methods:** The retrospective analysis comprised 63 patients who had single-level open and hybrid endoscopic TLIF surgery between February 1 and September 30, 2023. Based on surgical approaches, 34 patients were in the open TLIF group and 29 were in the hybrid endoscopic group. The study excluded cancer and infection patients and included symptomatic and unstable lumbar spine spondylolisthesis patients. In addition to gender, age, underlying disease, body mass index (BMI), and smoking status, we will collect data on symptoms before and after surgery, such as leg and back pain, on the first day after surgery, the day of discharge, and 3 months after surgery. Evaluation of patient satisfaction and ODI data before and three months after surgery. Surgery length, blood loss, complications, pain medication, and postoperative hospitalization were recorded. **Results:** A total of 63 patients were enrolled. Mean ages, genders, BMI, intraoperative blood loss, painkiller consumption, and hospital stay were not significantly different across groups ($p > 0.05$). The mean operational time was substantially shorter in the open TLIF group compared to the hybrid endoscopic group ($p < 0.001$). The Visual Analogue Scale (VAS) of leg discomfort did not differ between groups on the first day after surgery, discharge, or 3 months following surgery ($p > 0.05$). On the first day following surgery, the open TLIF group had considerably lower back pain VAS scores compared to the hybrid endoscopic group ($p < 0.05$). However, VAS values for back pain were similar between groups on discharge and 3 months following surgery. ($p > 0.05$). Both groups improved their ODI scores, although there was no significant difference. ($p > 0.05$). Open and hybrid endoscopic TLIF groups reported 91.8% and 87.6% satisfaction rates, respectively. No significant difference existed across groups. ($p > 0.05$). The hybrid endoscopic TLIF group had 3 postoperative neurapraxia instances that cleared within 3 weeks. Additionally, one patient needed pedicular screw revision. The open TLIF group had 4 neurapraxia cases, which recovered within 4 weeks. **Conclusion:** Hybrid endoscopic TLIF surgery

does not outperform open TLIF surgery in reducing leg and back pain on the first day, discharge, and 3 months after surgery, while improving quality of life, blood loss, postoperative hospitalization, and painkiller usage. However, hybrid endoscopic TLIF surgery involves more expensive materials, takes longer, and exposes patients to more fluoroscopic radiation.

ID: AGS26/260
P0663: Return to work after transforaminal endoscopic lumbar surgery in adults: a systematic review and meta-analysis

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Introduction: TELS is a minimally invasive spine surgery technique that has been examined extensively in the literature for a wide variety of outcomes; however, no synthesized study exists on RTW, limiting clarity of the data. The purpose of this study is to examine return to work (RTW) outcomes in adult patients after transforaminal endoscopic lumbar surgery (TELS) to enhance education and manage patient expectations. **Material and Methods:** A pre-registered systematic review and meta-analysis (CRD420251064802) was conducted that searched four databases through June 1st, 2025. Inclusion criteria was articles that examine RTW outcomes in adult patients after TELS. Outcomes include time to RTW and percent RTW. A random effects meta-analysis using mean difference (MD) was also conducted for RTW time for TELS versus open microdiscectomy. **Results:** Seventeen observational articles were included out of 141 articles retrieved. Patients (n = 2,228; 57.3% male) who underwent TELS had a pooled average age of 46.5 (6.7) years with a total complication rate of 11.7% and a reoperation rate of 3.8%. Pooled average time to RTW after TELS was 43.0 (45.5) days (range: 5.6-125.1 days) with 90.3% (range: 75.4-100.0%) of patients experiencing RTW. Adult patients who underwent TELS (n = 381) had a clinically and statistically significant faster RTW as compared to patients who underwent open microdiscectomy (n = 395) via meta-analysis (MD = -30.9 days; $p < 0.001$). **Conclusion:** In the largest study population to date, patients who underwent TELS had favorable RTW outcomes, with a pooled average time to RTW of approximately six weeks with approximately 90% of patients also experiencing RTW. Patients who underwent TELS had a clinically and statistically significant faster time to RTW by approximately four weeks as compared to patients who underwent OMD; however, this outcome should be taken with caution given the small sample size and low data certainty. Future controlled studies continuing to examine TELS in isolation or compared to OMD should include various outcomes related to RTW, such as time to RTW, percent RTW, as well as type of postoperative RTW.

ID: AGS26/279
P0664: Comparative effectiveness of percutaneous discectomy and conservative management in symptomatic disc herniation: a systematic review and meta-analysis

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Introduction: Percutaneous discectomy (PD) is a minimally invasive technique designed to relieve radicular pain while minimizing tissue disruption. Although it has been used in clinical practice for decades, the evidence comparing PD with conservative treatment (CT) in patients with symptomatic lumbar and cervical disc herniation remains limited and heterogeneous. This study aimed to assess the efficacy and safety of PD compared with CT in this patient population. **Material and Methods:** A systematic search of PubMed, Embase, and Cochrane CENTRAL through July 2025 identified randomized controlled trials and observational studies comparing PD with CT in patients without spinal stenosis. Pain outcomes (VAS, NRS) and functional outcomes (ODI) were pooled using random-effects meta-analysis. Sensitivity analyses were conducted to address heterogeneity, including subgroup analyses of RCTs, lumbar-only interventions, and comparisons excluding epidural steroid injections (ESI). Risk of bias was evaluated using ROB 2 and ROBINS-I. **Results:** Nine studies (5 RCTs, 4 observational; 876 patients) were included. PD significantly reduced pain compared with CT (MD -1.64; 95% CI -2.17 to -1.10; $p < 0.001$), with stronger

effects when ESI studies were excluded (MD -1.94; 95% CI -2.85 to -1.60; $p < 0.001$). Functional improvement favored PD but was not statistically significant (MD -3.67; 95% CI -10.40 to 3.06; $p = 0.28$). Subgroup analyses confirmed consistent pain reduction across RCTs and lumbar-only studies. Risk of bias was low to moderate; heterogeneity was largely attributable to study design and comparator variations. **Conclusion:** PD provides superior pain relief compared to conservative management for disc herniation, though functional benefits remain unclear. These findings support PD as a minimally invasive option for selected patients, particularly after failure of conventional therapy or when surgery carries increased risk. Further high-quality RCTs are needed to clarify long-term outcomes and its comparative role against ESI and open discectomy.

ID: AGS26/304
P0665: The efficacy of intraosseous basivertebral nerve ablation: retrospective, single-arm, cohort study

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Introduction: The innervation of vertebral endplates by the basivertebral nerve makes it a prime target for intraosseous basivertebral nerve ablation (BVNA) in treating vertebrogenic low back pain associated with type 1 or type 2 Modic changes. This study represents the clinical outcomes of 103 patients with significant differences between pre-op, 3-month, and 12-month intervals in a community practice setting. BVNA has emerged as a promising minimally invasive option for patients who have not responded to conservative management, including physical therapy, medications, and injections. This study aims to provide real-world evidence supporting its safety and efficacy outside of controlled clinical trials. **Material and Methods:** Intraosseous BVNAs were performed in 103 patients at a single site using the Intracept procedure (Relievant Medsystems, Inc.). A retrospective, open-label, single-arm analysis was conducted on 103 patients who underwent intraosseous BVNA, with clinical assessments including Oswestry Disability Index (ODI), Visual Analog Scale (VAS) scores, and responder rates at baseline, 3 months, and 12 months post-procedure. Patient demographics, comorbidities, and prior interventions were also recorded to characterize the study population and ensure appropriate patient selection. **Results:** Patients demonstrated statistically significant reduction of VAS and ODI scores at 3 months and 12 months postoperatively compared to baseline. VAS scores decreased by 3.6875 (95% CI: [2.4028, 4.9722]) at 3 months and 3.0120 (95% CI: [1.6360, 4.3640]) at 12 months from baseline. Similarly, ODI scores declined by 17.84 (95% CI: [8.4214, 27.2586]) at 3 months, with sustained improvement of 12.76 (95% CI: [0.6624, 24.8576]) at 12 months. Observations showed no significant difference between 3 and 12 months ($p = 0.330$ for VAS, $p = 0.424$ for ODI), suggesting durable clinical benefit. Subgroup analyses indicate consistent benefits across different age groups and baseline disability levels. **Conclusion:** Intraosseous BVNA demonstrates clinically significant improvements in chronic low back pain with durable benefits up to 12 months post-procedure. BVNA appears to be a minimally invasive treatment with positive outcomes in real-world practice, offering a potential option for patients who have not responded to conservative therapies. Further prospective studies with longer follow-up are warranted to confirm the long-term efficacy and safety of BVNA across diverse patient populations.

ID: AGS26/315
P0666: Comparison of open, tubular, and bi-portal endoscopic decompression for lumbar spine degenerative disease – A 2-year follow-up study

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Introduction: In recent times, minimally invasive spine surgery (MISS) has rapidly expanded to include tubular and endoscopic techniques designed to preserve paraspinal muscle integrity, minimize soft tissue damage and blood loss, and enhance postoperative recovery in patients undergoing surgery for lumbar spine degenerative disease. However, the optimal surgical treatment for lumbar degenerative disease remains controversial. We aim to review the clinical and patient-reported outcomes of lumbar spine surgeries across open discectomy/decompression (OD), tubular microdiscectomy/decompression (TM), and biportal endoscopic discectomy/decompression (BE) over a 2-year follow-up period. **Material and Methods:** A retrospective analysis was performed for 129 patients who had undergone decompression surgeries for lumbar spine degenerative disease at a tertiary institution from January 2021 to February 2023, with 2-year follow-up. We evaluated demographics and perioperative factors including surgical duration, postoperative length of stay, incidence of complications including dural tears, wound complications, recurrence of symptoms and VAS leg and back pain scores at intervals of 6 weeks, 3 months, 6 months, 1 year and 2 years postoperatively. **Results:** 129 patients were included, with a mean age of 54.3, 52.9, and 52.9 years in those who underwent OD ($n = 28$), TM ($n = 38$) and BE ($n = 63$) respectively. Half of the OD surgeries (50%) were performed for single-level decompression, while 44.7%

of TM and 39.7% of BE were performed for discectomies. The BE group had significantly shorter postoperative length of stay compared to the TM and OD groups (3.0 vs 4.2 vs 5.8 respectively, p = 0.003). There were no significant differences between the groups for other perioperative factors including surgical time, incidence of dural tears or surgical complications. In terms of patient-reported VAS leg and back pain scores, all 3 groups showed an improvement in outcomes from preoperative to immediate postoperative assessment. However, there were no significant differences in VAS back or leg pain scores between the groups at 6 weeks, 3 months, 6 months, 1 year or 2 years postoperatively. **Conclusion:** There was no significant difference in clinical outcomes, including pain control and complication rates, between the 3 different surgical techniques used to address lumbar degenerative disease. BE spine surgery had the shortest postoperative length of stay, potentially due to faster recovery as a result of less soft tissue and muscle trauma. Overall, compared to other procedures, BE is a safe, effective, and viable surgical procedure for treating lumbar spinal degenerative disease, and may offer potential advantages compared to currently established surgical techniques, as familiarity with the technique increases.

ID: AGS26/388
P0667: Midline-sparing separation surgery for spinal metastases: a comparative study against the conventional open approach

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Introduction: In patients with disseminated cancer, the vertebral column is the predominant site of bony metastasis. Separation surgery is a well-established technique in which the surgeon creates a several-millimeter gap between the tumor and spinal cord, providing sufficient space for subsequent spinal stereotactic radiosurgery. Conventionally, separation surgery has been performed through a bilateral open approach with or without fusion. While effective, disrupting the midline structures can lengthen post-operative recovery and increase the likelihood of hardware failure due to alteration of spinal biomechanics. We present a novel midline-sparing technique utilizing a paramedian approach that spares midline bony structures, contralateral paraspinal muscles, and facet joints to preserve spinal stability and report comparison with the standard approach. **Materials and Methods:** We conducted a retrospective cohort review of patients who underwent separation surgery for thoracolumbar spinal metastases at a single institution by a single surgeon from 2022-2025. Patients with confirmed metastatic disease with epidural involvement were included and stratified into standard (bilateral open approach with or without fusion) and midline-sparing (MSp) groups based on surgical approach. Continuous variables were compared using the Mann-Whitney U test. Significance was defined as a $p < 0.05$. **Results:** In total, 38 patients were included: 7 underwent separation surgery via MSp and 31 via standard approach. Median age, BMI, and ASA scores were not different between groups (all $p > 0.05$). Median operative time did not differ between MSp (228min [IQR 95]) and standard approaches (238min [IQR 98]; p=0.81). Median intraoperative blood loss was lower in MSp cases, but this difference was not statistically significant (100mL [IQR 250] for MSp vs 250mL [IQR 225] for standard; p = 0.13). Length of stay did not differ between approaches (median 6 days [IQR 7] after MSp vs 7.5 days [IQR 10] after standard; p = 0.58), nor did visual-analog pain scores at discharge (median 1 [IQR 3] after MSp vs 3 [IQR 7] after standard; p = 0.39). **Conclusion:** This study showed that operative characteristics including blood loss and length of surgery did not significantly differ between MSp and standard approaches. Further studies with long term follow-up are needed to evaluate patient reported outcomes and differences in hardware failure.

ID: AGS26/434
P0668: Endoscopic - Assisted Sacroiliac Joint Fusion

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Introduction: Chronic sacroiliac joint pain is a debilitating condition with limited effective treatment options. This paper reports a 40-year-old female patient suffering from 16-year refractory sacroiliac pain, unresponsive to conventional therapies including physiotherapy, pharmacotherapy, and acupuncture-moxibustion. The case highlights the clinical challenge of persistent pain and the need for innovative surgical solutions. **Material and Methods: Preoperative Evaluation:** Comprehensive diagnostic workup: MRI and CT scans,Diagnostic intervention: Sacroiliac joint block (partial pain relief). **Surgical Procedure:** Technique: Endoscopic-assisted right sacroiliac joint arthrodesis with screw fixation,Equipment: Standard lumbar endoscopic fusion tools,Key advantages: Magnified visualization, precise hemostasis, minimally invasive approach. **Postoperative Protocol:** Pain assessment: Visual Analogue Scale (VAS),Imaging follow-up: X-ray and CT at 2 weeks post-op,Monitoring: Vital signs and laboratory parameters.

Results:
1. Pain Relief: VAS score reduction: 8 (pre-op) → 3 (2 weeks post-op).
2. Imaging Outcomes: Confirmed proper position of fusion devices, Successful joint arthrodesis.
3. Surgical Benefits: Minimal invasiveness, Reduced intraoperative bleeding, Rapid postoperative recovery.
Conclusion: endoscopic - assisted sacroiliac joint arthrodesis provides an effective minimally - invasive treatment option for patients with sacroiliac joint pain and offers another perspective and method for sacroiliac joint arthrodesis. However, further accumulation of cases and long - term follow - up studies are still required to evaluate its long - term efficacy and safety.

ID: AGS26/468
P0669: Thoracoscopic technology in treating giant thoracic disc herniation: a retrospective study based on 280 patients

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Introduction: Thoracic disc herniation (TDH) is a rare but complex condition to treat. Its pathological features and surgical challenges make traditional treatment methods highly invasive. In contrast, thoracoscopic technology, with its minimally invasive and precise nature, has emerged as an ideal choice. **Material and Methods:** This study retrospectively analyzed 280 cases of giant thoracic disc herniation (GTHD) treated with thoracoscopic surgery from 2003 to 2023. The study focused on the outcomes in patients with calcified lesions and assessed long-term efficacy using follow-up data, including neurological improvement, pain relief, and recurrence rates. **Results:** The study showed significant neurological improvement based on Frankel grading, with most patients improving by at least one level postoperatively, and some achieving complete recovery. The mean mJOA score increased by over 2.5 points. The average hospital stay was 5.5 days, and long-term efficacy remained stable with a low recurrence rate. **Conclusion:** Thoracoscopic technology has significant advantages in treating giant thoracic disc herniation, including precise lesion removal, minimal trauma, rapid recovery, and stable long-term efficacy. Its effectiveness is particularly pronounced in calcified lesions, providing a reliable foundation for clinical practice.

ID: AGS26/476
P0670: Optimizing epidural pressure in endoscopic spine surgery

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Introduction: High epidural pressure during the endoscopic spinal procedure can lead to disastrous consequences for the patient, particularly in cases of dural injury. In order to avoid these complications, an efficient outflow system was created to maintain the work area pressure at acceptable levels without compromising the quality of the image obtained by the endoscope and enabling an effective surgery. **Methods:** The two types of cannulas available on the market were compared, the conventional and the oval with the optimized ouflow evaluated by the COMSOL Multiphysics software, used in simulating real-world physics for creating an anatomically accurate model of the human spine. **Results:** the oval cannula was more efficient in keeping the pressure low regardless the amount of flow of saline solution infused into the work area. **Conclusion:** The oval optics system is an efficient and simple alternative to prevent a high pressure inside the work area.
Keywords: spine surgery, spine endoscopic surgery, lumbar spine, epidural pressure.

ID: AGS26/479
P0671: Morphometric analysis of the lumbar interlaminar window and its surgical implications

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Full-endoscopic lumbar spine surgery has gained popularity due to advantages over open surgery, including reduced tissue trauma, less postoperative pain, faster rehabilitation, and lower complication rates. The transforaminal endoscopic discectomy was the first-generation technique, but it encounters challenges at certain levels (e.g. L5-S1) and in migrated disc herniations due to anatomical constraints such as high iliac crest or narrow foramen. The interlaminar endoscopic approach, first described by Ruetten *et al.* (2007), expanded the reach of endoscopy to these problematic cases by accessing the disc through the interlaminar space. This interlaminar approach enabled effective endoscopic discectomy at L5-S1 and later was applied to higher lumbar levels and even spinal canal stenosis. However, to accommodate the endoscope at upper levels (L3-L4, L4-L5), a smaller bony window often necessitates partial laminotomy or drilling of the inner facet to create a sufficient working channel. In practice, the feasibility and ease of an interlaminar approach depend on the size of the interlaminar "window" (the bony space between adjacent

laminae) available on preoperative imaging. Despite its surgical importance, the normal dimensions of the lumbar interlaminar window have not been well characterized in the literature. Prior morphometric studies of the lumbar spine have focused on canal diameters and interpedicular distances rather than the interlaminar space. A recent study by Sakçı *et al.* (2018) specifically examined the radiologic anatomy of the lumbar interlaminar window and highlighted considerations for endoscopic and microscopic disc surgery, underscoring the relevance of this anatomical parameter to surgical planning. In order to build on this knowledge, we performed a morphometric analysis of the lumbar interlaminar window in a large patient cohort. In this study, we measured both the vertical and horizontal dimensions of the interlaminar window at levels L3-L4, L4-L5, and L5-S1 on anteroposterior (AP) radiographs. Our objectives were to define normative ranges of interlaminar window size, to assess how these dimensions vary with spinal level, sex, and age, and to correlate them with implications for interlaminar endoscopic lumbar procedures. We hypothesized that lower lumbar levels (especially L5-S1) would have larger interlaminar windows than upper levels, and that smaller window size (e.g. at L3-L4 or in certain patient subsets) would correlate with the need for more extensive bony work during endoscopic access. By quantifying these anatomical patterns, we aim to improve preoperative planning for interlaminar endoscopic discectomy and decompression.

ID: AGS26/530
P0672: Radiological parameters after LLIF for adjacent-level disease treatment

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Introduction: Posterior spinal arthrodesis is a standard surgical treatment for degenerative lumbar diseases, but it can lead to Adjacent-level disease (ASD)-a symptomatic condition caused by biomechanical overload on spinal segments neighboring the fusion. Traditionally, treating ASD required extending the original fusion, a revision surgery associated with high morbidity, increased blood loss, and prolonged hospital stays. As an alternative, minimally invasive techniques like lateral lumbar interbody fusion (LLIF) have emerged. LLIF offers a less traumatic approach that achieves high fusion rates, restores sagittal parameters through indirect decompression, and enhances stability, making it a viable option for both the treatment and prevention of ASD. **Objective:** To analyze the radiological outcomes of using the LLIF technique to treat adjacent-level disease. **Material and Methods:** Patients undergoing LLIF surgery for treatment of adjacent level disease, with preoperative radiography and postoperative radiography at 3 months to 1-year of follow-up, who had completed the informed consent form were included. Patients whose radiographs did not allow the measurements proposed in the study to be performed were excluded. The following outcomes were analyzed: pelvic incidence, pelvic version, sacral tilt, lumbar lordosis, and adjacent-level segmental lordosis on preoperative and postoperative radiographs. **Results:** 37 patients were included in the study (16 women and 21 men) were included in this study. The most frequently addressed levels were L3L4 (20) and L2L3 (14). Patients had an average of 4.9° (±4.2°) segmental lordosis gain at the addressed level, whereas they had an average of 6.7° (±7.3°) lumbar lordosis correction ($p < 0.05$). **Conclusion:** The use of the LLIF technique for the treatment of adjacent-level disease can significantly improve several spinopelvic parameters and segmental lordosis.

ID: AGS26/555
P0673: Minimally invasive oblique lateral approach for lumbar corpectomy

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Introduction: The oblique lateral approach, also known as the pre-psoas approach, using minimally invasive techniques, is employed in degenerative disc disease as an alternative to lateral (LLIF) or posterior approaches. However, there is limited evidence regarding the applicability of this approach for performing lumbar corpectomies of various etiologies. **Material and Methods:** Patients who underwent lumbar corpectomy via an minimally invasive anterior-to-psoas approach in pour institution were selected. Data were collected regarding the type of pathology, perioperative complications, and whether posterior fixation was used for supplementation. **Results:** Between 2018 and 2025, 14 patients underwent lumbar corpectomy using an oblique lateral approach. The etiology was traumatic in 6 patients, metastatic in 5, and infectious (spondylodiscitis) in the remaining 3 patients. In the latter group, corpectomies were performed at two vertebral levels (L1-L2, L2-L3, and L3-L4), while in cases of fractures and metastases, a single-level corpectomy was performed (5 patients at L3, 4 patients at L2, and 2 patients at L4). In all cases, the vertebral body was replaced with an expandable cage, and posterior fixation was added percutaneously in 12 patients and via an open approach in 2 patients. One patient with pulmonary carcinoma metastasis died postoperatively due to complications from the primary disease. Four patients experienced complications in the immediate postoperative period, and two required reoperation (one for screw

malposition and another for deep infection in a patient with prior spondylodiscitis). **Conclusion:** The oblique lateral approach enables lumbar corpectomy using a minimally invasive technique and provides better access to the spinal canal compared to traditional lateral approaches, while minimizing psoas muscle retraction and reducing the risk of injury to the lumbar plexus.

ID: AGS26/639
P0674: Has thoracoscopic spine surgery been replaced a comparative study with transforaminal endoscopic discectomy

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Introduction: To compare the clinical efficacy of thoracoscopic discectomy and transforaminal endoscopic spine surgery (TFES) in the treatment of giant thoracic disc herniation (GTHD) with ventral spinal cord compression, and to clarify the application scope and clinical positioning of the two surgical methods. **Material and Methods:** A total of 86 patients with GTHD were retrospectively enrolled and divided into two groups according to the surgical method, with 43 cases in each group: one group underwent thoracoscopic decompression, and the other group received TFES via intercostal-foraminal access. The therapeutic effects of the two surgical methods were systematically compared by evaluating neurological function improvement (using Frankel classification and mJOA score), Visual Analogue Scale (VAS) score, surgical access success rate, and recurrence rate at 2-year postoperative follow-up. Meanwhile, perioperative indicators such as intraoperative blood loss, postoperative hospital stay, and complication rate were recorded in both groups. **Results:** In the treatment of central calcified lesions, thoracoscopic surgery achieved significantly better decompression effect, with a lesion removal rate of 94%, which was significantly higher than 62% in the TFES group ($\chi^2 = 12.87$, $p < 0.001$). Although the TFES group had a shorter average operation time [(85.2 ± 16.3) min vs. (112.5 ± 21.7) min in the thoracoscopic group, $t = 6.73$, $p < 0.001$], the incidence of postoperative residual compression was higher (27.9% vs. 4.7% in the thoracoscopic group, $p < 0.01$). The 2-year postoperative follow-up results showed that the long-term recurrence rate in the TFES group was 11.6% (5/43), which was significantly higher than 2.3% (1/43) in the thoracoscopic group ($p < 0.05$). In addition, there were no significant differences in intraoperative blood loss, postoperative hospital stay, and complication rate between the two groups ($p > 0.05$). **Conclusion:** Although transforaminal endoscopic spine surgery (TFES) has the advantage of minimal invasiveness, thoracoscopic surgery remains irreplaceable for central or calcified giant thoracic disc herniation with ventral spinal cord compression-it performs better in terms of thoroughness of lesion resection and reducing the risk of long-term recurrence. Therefore, with the continuous development of minimally invasive spinal surgery techniques, thoracoscopic spine surgery still has important clinical value in patients with specific indications and has not been completely replaced by transforaminal endoscopic surgery.

ID: AGS26/640
P0675: Short-term outcomes of percutaneous anterior thoracoscopic surgery for thoracic disc herniation

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Introduction: Thoracic disc herniation is characterized by complex anatomical structures within the thoracic cavity, making traditional open surgery associated with large trauma and slow postoperative recovery. As a new minimally invasive technique, percutaneous anterior thoracoscopic surgery can achieve precise anterior decompression through small incisions. However, systematic data on its short-term efficacy and safety remain limited, requiring further verification of its clinical application value. **Methods:** Patients with thoracic disc herniation who underwent percutaneous anterior thoracoscopic surgery at our hospital from January 2021 to December 2022 were retrospectively enrolled. Baseline data (age, gender, lesion segment, herniation type) of patients were collected. The Visual Analog Scale (VAS) was used to assess the improvement of thoracolumbar pain before surgery and at 1 week, 3 months, 6 months, and 12 months after surgery; the Oswestry Disability Index (ODI) was applied to evaluate the recovery of patients' daily activity ability after surgery. Preoperative and postoperative thoracic MRI/CT imaging examinations at the last follow-up were used to assess the thoroughness of disc decompression (herniated material resection rate). Meanwhile, operation time, intraoperative blood loss, postoperative hospital stay, and the occurrence of complications (infection, nerve injury, pleural effusion, etc.) were recorded. Paired t-tests were used to compare the differences in VAS and ODI scores between preoperative and postoperative time points. **Results:** A total of 30 patients were included, including 18 males and 12 females, aged 35-65 years with an average of (48.6 ± 8.3) years. Lesion segments were distributed at T6-T12, including 17 cases of central herniation, 13 cases of paracentral herniation, and 9 cases of calcified herniation. All patients successfully completed the surgery without conversion to open surgery. The average operation

time was (95.2 ± 15.7) minutes, the average intraoperative blood loss was (42.5 ± 13.6) mL, and the average postoperative hospital stay was (4.8 ± 1.2) days. During the 12-month postoperative follow-up, the VAS score of patients decreased continuously from the preoperative average of (8.2 ± 1.1) points to (2.3 ± 0.9) points at 12 months after surgery, with statistically significant differences between each time point and preoperative values (all $p < 0.01$). The ODI index improved from the preoperative average of (60.4 ± 12.3)% to (20.5 ± 7.8)% at 12 months after surgery, with an improvement rate of 66.1%, and the difference was statistically significant ($p < 0.01$). Imaging evaluation showed that the resection rate of herniated disc tissue was over 90% in all patients, and the ventral spinal cord compression was completely relieved. No serious complications such as incisional infection or permanent neurological deficit occurred after surgery; only 2 patients developed a small amount of pleural effusion, which was cured by conservative treatment. **Conclusion:** Percutaneous anterior thoracoscopic surgery is a minimally invasive, safe, and effective approach for the treatment of thoracic disc herniation. It can significantly relieve thoracolumbar pain and improve daily activity function in the short term with a low complication rate, and its short-term efficacy and safety are worthy of recognition.

ID: AGS26/664
P0676: Endoscopic spine surgery in lumber spinal canal stenosis: bridging the gap with modern world of spinal surgery

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Introduction: Lumbar spinal canal stenosis (LSCS) is a leading cause of pain and disability in the aging population. Conventional open decompression, though effective, is associated with extensive tissue disruption, blood loss, prolonged hospital stay, and delayed rehabilitation. With advances in optics, instrumentation, and surgical techniques, endoscopic spine surgery has emerged as a minimally invasive alternative, aiming to reduce morbidity while ensuring adequate decompression. **Material and Methods:** A narrative review of recent literature and clinical outcomes was conducted focusing on endoscopic decompression techniques for central and lateral recess stenosis. Parameters analyzed included operative time, blood loss, hospital stay, complication rates, and functional outcomes such as Visual Analog Scale (VAS) for pain and Oswestry Disability Index (ODI). **Results:** Endoscopic spine surgery demonstrates significant advantages over conventional approaches, including reduced soft tissue trauma, minimal blood loss, shorter hospitalization, and faster postoperative recovery. Functional outcomes measured by VAS and ODI show superior improvements to open techniques, with a lower incidence of perioperative complications. Furthermore, technological advances have expanded indications, enabling safe and effective treatment of complex stenotic pathologies. **Conclusion:** Endoscopic spine surgery represents a paradigm shift in the treatment of LSCS, combining efficacy of decompression with the benefits of minimally invasive surgery. By aligning surgical practice with the global movement toward patient-centered, less invasive care, it effectively bridges the gap between traditional spine surgery and the modern world of spinal innovation.

ID: AGS26/729
P0677: Long-term radiological results of anterior cervical foraminotomy and their clinical correlation

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Introduction: Anterior cervical foraminotomy (ACF) was introduced by Hae-Dong Jho in 1996 as an alternative to ACDF in order to preserve the intervertebral disc (IVD) and mobility of the operated segment. The purpose of our work is to measure the IVD height and mobility of the operated segment in patients with cervical degenerative compressive monoradiculopathy after ACF in the long-term postoperative period. **Material and Methods:** The study comprises 50 patients (44±9 years, 28-72 years) after ACF with a long-term postoperative period (3 months-6 years, average period 22 months). The height of the operated and adjacent IVD was measured by the interbody distance and by Farfan method on CT before and after surgery. The mobility of the operated and adjacent segments was measured by the interspinous distance on functional radiographs. **Results:** The height (interbody distance according to CT) of the adjacent above, operated and adjacent below IVD was 4.6 ± 0.9 mm, 4.6 ± 0.9 mm and 5.1 ± 0.9 mm before surgery and 4.4 ± 0.9 mm, 2.8 ± 1.0 mm and 4.8 ± 0.9 mm after surgery, respectively. The mobility of the operated segment after ACF was 3.7 ± 2.4 mm (according to the interspinous distance on functional radiographs). The mobility of the adjacent above and adjacent below segments was 7.1 ± 3.8 mm and 6.8 ± 2.4 mm, respectively. Mobility of the operated segment ≥ 3 mm was detected in 38 (76%) patients (convincing mobility), less than 3 mm was determined in 12 (24%) patients (questionable mobility). Preserved disc (IVD height according to the Farfan method > 0) and convincing mobility (≥ 3 mm) altogether were detected in 25 (50%) patients. In 4 (8%) patients, the disc was preserved, but the segmental mobility was questionable. Disc collapse (IVD

height according to the Farfan method=0) with questionable mobility of the operated segment was detected in 8 (16%) patients. In the remaining 13 (26%) cases disc collapse was accompanied by convincing mobility of the operated segment. According to the Odom scale, excellent results were obtained in 36 patients (72.5%), **good - in 9 (17.5%),** poor - in 5 (10%). Moderate and significant neck pain after ACF were noted in 22% and 10% of patients, respectively. A significant decrease in the IVD height of the operated segment correlates with the appearance or increase of neck pain after ACF. No correlation was found between changes in the height of the IVD and the mobility of the operated segment with clinical results according to Odom. **Conclusion:** In 84% of cases after ACF the IVD and/or mobility of the operated segment were preserved. A significant decrease in the IVD height of the operated segment correlates with the appearance or increase of neck pain after ACF.

ID: AGS26/759
P0678: Efficacy of low-dose Escherichia coli-derived recombinant human bone morphogenetic protein-2 in minimally invasive transforaminal lumbar interbody fusion

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (misTLIF) offers advantages over open procedures, including reduced tissue disruption and faster recovery. However, the limited availability of autologous bone grafts remains a major drawback. Recombinant human bone morphogenetic protein-2 derived from Escherichia coli (E.BMP-2) has emerged as a scalable osteoinductive substitute. Although widely studied in open fusion techniques, its efficacy and safety in the context of misTLIF have not yet been investigated. The purpose of this study was to evaluate the efficacy and safety of low-dose E.BMP-2 with hydroxyapatite (HA) carriers in the context of misTLIF. **Material and Methods:** This retrospective case-control study included 70 patients (85 fusion levels) who underwent one- or two-level misTLIF for degenerative lumbar conditions between 2016 and 2024, with a minimum follow-up of one year. Patients were divided into two groups: the E.BMP-2 group (34 patients, 39 levels), who received standard bone grafts supplemented with 1 mg of E.BMP-2 on hydroxyapatite (HA) carriers, and the control group (36 patients, 46 levels), who received standard bone grafts only. Fusion status was evaluated using dynamic radiographs and CT scans. Solid fusion on radiographs was defined as segmental motion of less than 3°, and on CT as continuous trabecular bridging across the intervertebral space. Clinical outcomes were assessed with the visual analog scale (VAS) for back and leg pain, the Oswestry Disability Index (ODI), and the physical and mental component summaries of the Short Form-36 (SF-36). Perioperative and delayed complications, including fever, elevated inflammatory markers, seroma, heterotopic ossification, and cage subsidence, were reviewed using imaging studies and medical records. **Results:** The E.BMP-2 group showed significantly higher fusion rates (89.7% vs. 63%, $p = 0.005$) without increased complications. Clinical improvements were similar between groups. No cases of seroma, heterotopic ossification, or reoperation were observed in the E.BMP-2 group. The cage subsidence rate was significantly lower in the E.BMP-2 group at 6 and 12 months. A standardized application protocol using 1 mg of E.BMP-2 per patient, along with a containment technique, likely contributed to these favorable outcomes. **Conclusion:** Low-dose E.BMP-2 appears to be a safe and effective osteoinductive option for misTLIF, particularly where autologous bone is limited. Proper carrier selection, dosing, and technique are key to optimizing outcomes.

ID: AGS26/761
P0679: Learning curve for full-endoscopic transforaminal lumbar interbody fusion in experienced uniportal endoscopic surgeon

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Introduction: Adoption of Full-endoscopic uniportal transforaminal lumbar interbody fusion (FE-TLIF) is challenged by a steep learning curve. This study aimed to evaluate the learning curve, perioperative outcomes, and complications of conventional FE-TLIF performed under fluoroscopic guidance with a non-expandable cage by an experienced uniportal endoscopic surgeon. **Material and Methods:** An ambidirectional cohort study was conducted on 29 consecutive patients who underwent FE-TLIF at a single center between January 2023 and February 2025. Operative time was used as the primary metric for learning curve analysis, assessed using the cumulative sum (CUSUM) method and polynomial regression. Perioperative outcomes and complications were compared between the early and late phases, defined by the learning point derived from the CUSUM analysis. **Results:** The learning curve stabilized at approximately 12 cases, as identified by the peak of the fitted polynomial regression curve. The model showed a coefficient of determination (R^2) of 0.52, indicating moderate explanatory power. Operative time showed a non-significant reduction between the early (237.5 ± 33.9 min) and late phases (216.1 ± 28.4 min; $p = 0.0885$). Postoperative pain on day 2 was significantly lower

in the late phase (1.88 ± 1.80) than in the early phase (3.67 ± 2.02; p = 0.0225). Complications were more frequent in the early phase but not significant (p = 0.3970). **Conclusion:** Proficiency in conventional FE-TLIF using fluoroscopic guidance and a non-expandable cage can be achieved after approximately 12 cases in an experienced expert in uniportal endoscopic surgery. Although the regression model demonstrated moderate fit ($R^2 = 0.52$), the findings provide practical insights for surgeons adopting this technique, emphasizing the importance of procedural familiarization to reduce complications and improve outcomes.

ID: AGS26/806
P0680: Risk factors for intraoperative bone cement leakage in percutaneous kyphoplasty: a prospective dual-center non-randomized study

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Introduction: Bone cement leakage is a common and potentially serious complication of percutaneous kyphoplasty (PKP). While previous studies have identified several risk factors, evidence remains limited regarding their consistent impact across different hospital settings, especially in county-level versus urban centers. This study aims to prospectively identify significant risk factors for cement leakage during PKP in patients with osteoporotic vertebral compression fractures (OVCF). **Material and Methods:** A non-randomized prospective cohort study was conducted across two centers: one county-level hospital and one municipal hospital in Chongqing, China. A total of 200 patients (100 per center) undergoing PKP for OVCF were enrolled. Preoperative parameters included bone mineral density (T-score ≤ -2.5) and degree of vertebral collapse (Genant grade ≥ II). Intraoperative data encompassed cement volume, injection time, and needle approach. Cement leakage was evaluated within 24 hours postoperatively using CT and classified according to Zou et al. (2021). Multivariate logistic regression was performed using R software (Bibliometrix package) to identify independent risk factors, including age >70 years, posterior wall breach, cement volume > 5 mL, and operative level. **Results:** Cement leakage occurred in 33 patients (16.5%), with distribution across leakage types as follows: paravertebral (8.0%), intravenous (4.5%), intradiscal (3.0%), and spinal canal (1.0%). Regression analysis identified three independent risk factors: posterior wall breach (adjusted OR = 4.21, 95% CI: 2.05-8.63, p < 0.001), cement volume > 5 mL (aOR = 3.24, 95% CI: 1.52-6.89, p = 0.002), and age >70 years (aOR = 2.15, 95% CI: 1.08-4.30, p = 0.029). No significant difference in leakage rates was observed between the two centers (p = 0.442). **Conclusion:** Posterior wall breach, cement volume >5 mL, and advanced age are significant predictors of cement leakage during PKP. These findings support preoperative risk stratification and tailored surgical planning to mitigate leakage complications. The consistency of risk factors across hospital levels underscores their broad clinical relevance.

Keywords: Percutaneous kyphoplasty, bone cement leakage, risk factors, osteoporotic vertebral compression fracture, dual-center study, posterior wall breach

ID: AGS26/823
P0681: Endoscopic spine surgery: navigating the neural architecture

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Introduction: Endoscopic spine surgery (ESS) represents a paradigm shift in the management of spinal pathologies, transitioning from traditional open exposures to ultra-minimally invasive, targeted interventions. This review explores the core principles and advanced techniques of ESS, emphasizing the criticality of navigating the intricate neural architecture of the spine-including the spinal cord, nerve roots, and thecal sac-with unparalleled precision. By utilizing specialized optics and instruments through small-diameter portals. Promising outcomes such as reduced tissue trauma decreased blood loss, shorter hospital stay & faster recovery have been driven its adoption. **Material and Methods:** This prospective observational study was carried out at the Department of Orthopedic & Spine Surgery at Bangladesh Spine & Orthopedic Hospital, Dhaka, Bangladesh, between May 2025 to August 20205. A total of 30 patients who underwent full endoscopic spine surgery for various degenerative lumbar pathologies were included. **Inclusion Criteria:**

- Age between 20 and 70 years.
- Patients with single or multiple level lumbar disc herniation, spinal stenosis, foraminal stenosis, or recurrent disc herniation confirmed by MRI/CT.
- Persistent radicular pain, back pain, or neurogenic claudication not relieved by ≥6 weeks of conservative management.
- Fit for surgery under general anesthesia.
- Surgery was done by posterior Stenoscopic Lumbar Decompression (PSLD) & UBE.
- Clinical outcomes was assessed by VAS, ODI, MacNab criteria.

Results: ESS demonstrates high success rates (>85-90%) for contained and non-migrated lumbar disc herniations, with

excellent relief of radicular pain. The complications were observed as dural tear, nerve root irritation, heamatoma & discitis, but the percentage of complications was very minimum (less than 2%). Clinical outcome was assessed by ODI (62.3 to 18.5) & VAS (7.4 to 1.9). The patient satisfaction was assessed by Macnab criteria (excellent 56.5% & good 32.4%). **Conclusion:** ESS embodies a sophisticated, patient-centric approach that prioritizes the integrity of the neural architecture, resulting in reduced blood loss, diminished postoperative pain, and accelerated recovery. As technology and techniques continue to evolve, ESS is poised to expand its role in restoring spinal health with maximal safety and efficacy.

ID: AGS26/829
P0682: Opioid use following sacroiliac joint fusion in opioid-naïve patients

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Introduction: Sacroiliac joint (SIJ) pain is a common cause of chronic lower back pain, affecting a significant portion of the population and contributing to disability. In opioid-naïve patients, the appropriate quantity and duration of opioids are critical to balancing effective pain relief with minimizing risks. However, research on opioid prescribing practices following SIJ fusion, particularly in opioid-naïve patients, remains limited. This study aims to evaluate narcotic prescription practices post-discharge in SIJ fusion patients. **Methods:** This retrospective chart review examined opioid-naïve SIJ fusion patients seen between 2018 and 2023. Eligible patients were adults who underwent MIS SIJ fusion and were prescribed opioids at post-op. Exclusions included those with sporadic or chronic opioid use, or cases involving revision surgeries, fractures, tumors, infections, or trauma. Demographic data (age, sex, BMI), opioid type, dosage, and morphine milligram equivalent (MME) were collected. Patients were grouped based on the procedure (SIJ fusion only vs. SIJ fusion with concomitant lumbar fusion). All common opioid formulations were included. **Results:** A total of 116 patients were included in this study. Thirty-eight patients (32.8%) were male, 78 were female (67.2%). The overall mean number of oxycodone 5mg tablets prescribed at post-op was 30.0 (±13.2) and associated overall mean MME at post-op was 233.9 (±109.9). There was no difference between number of oxycodone 5mg tablets ($p = 0.95$) and associated MME ($p = 0.40$) in patients with concomitant lumbar fusion and those without. **Conclusions:** This study describes the general trends in opioid prescribing after minimally invasive SIJ fusion. Prescribing patterns in opioid naïve patients did not find a greater number of oxycodone 5mg tablets or associated MMEs between patients with concomitant lumbar fusion and those without.

ID: AGS26/833
P0683: Two-year outcomes after SI joint fusion using porous threaded implants at a tertiary referral center

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Purpose: The sacroiliac joint (SIJ) contributes to 15% to 30% of all chronic low back pain (LBP) with an even higher contribution (35-43%) after lumbar fusion. Surgical fusion of the SIJ has emerged as the intervention of choice to eliminate the motion thought to cause inflammation and SI joint pain. Herein, we report outcomes from primary SIJ fusions using a porous threaded 3D-printed implant (PTI, iFuse TORQ) with 2 year outcomes in a subset of this cohort. **Patients and Methods:** A retrospective chart review at 1 academic medical institution was performed. Medical records of patients ≥ 18 years old who underwent primary SIJ fusion with PTI were reviewed. Data collection included patient demographics, mechanical failures, and postoperative outcomes. **Results:** 64 patients (mean age 54, 72% women) underwent SI joint fusion, with 7 undergoing simultaneous bilateral treatment. Surgical time averaged 42 minutes for unilateral cases and 88 minutes for bilateral cases. There were no perioperative adverse events, no PTI malpositions or breakages. 23 patients had 24-month outcomes. At 24 months, pain improvement averaged 1.6 points ($p = .0021$) and ODI improved 11.6 points ($p = .0082$). Revision surgery occurred in 7 cases (symptomatic screw lucency, $n = 6$ and clinical deterioration without lucency, $n = 1$). **Conclusion:** In our real world evidence case series, patients undergoing primary SIJ fusion with PTI demonstrated clinically reasonable improvement in pain and disability due to pain. The rate of surgical revisions was low.

ID: AGS26/839
P0684: When approach matters: tubular but not endoscopic complications prolong hospitalization

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Introduction: Minimally invasive spine surgery (MISS) has shortened hospital stays compared to open decompression for

lumbar spinal stenosis (LSS), reflecting quicker recovery and reduced costs. Yet within MISS, the two leading approaches, tubular microscopy and full endoscopy, remain under debate when it comes to how they influence hospitalization. Length of stay (LOS) is not only a marker of surgical efficiency but also a practical indicator of patient recovery. This study evaluated whether LOS differs between tubular and endoscopic decompression and explored perioperative factors that might prolong hospitalization. **Material and Methods:** We retrospectively reviewed 180 patients treated for LSS with minimally invasive decompression between June 2021 and April 2024 (tubular: n = 101; endoscopic: n = 79). Admission-to-discharge and surgery-to-discharge times were recorded, along with demographic findings, perioperative complications, and smoking status. LOS between the groups were compared using two-sample t-tests. Within-group analyses of LOS and modifiers were conducted using Pearson correlations. Statistical significance was set at $p < 0.05$. **Results:** Mean LOS was not significantly different between groups for either admission-to-discharge ($t = -1.489$, $p = 0.138$) or surgery-to-discharge intervals ($t = -1.404$, $p = 0.163$). However, complication status strongly influenced outcomes in the tubular group: intraoperative complications ($\rho = 0.352$, $p < 0.001$) and postoperative complications ($\rho = 0.245$, $p = 0.013$) correlated with longer stays, particularly durotomy ($\rho = 0.352$, $p < 0.001$) and infection ($\rho = 0.212$, $p = 0.033$). In contrast, LOS after endoscopic decompression was not significantly affected by complication status. Smoking status showed no impact on LOS in either cohort. **Conclusion:** While overall hospital stays were similar between endoscopic and tubular decompressions, recovery after tubular surgery was more vulnerable to setbacks from complications. Endoscopic LOS appeared stable regardless of complication status, suggesting a more predictable hospitalization course. These findings highlight the importance of approach selection not only for surgical outcomes but also for recovery reliability and resource utilization.

ID: AGS26/899
P0685: Evaluation of the feasibility of 2-level lumbar canal decompression using unilateral biportal endoscopy

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Introduction: Multi-level surgery for lumbar stenosis is common and generally treated by open laminectomy. The endoscopic technique, increasingly used in spine surgery, is indicated for single-level surgeries, but because of the longer operative time, rarely for 2 and almost never for more than 2 levels. However, the advantages of endoscopy make this tedious procedure legitimate. Unilateral biportal endoscopy (UBE), which appears to allow rapid 1-level decompression, allows for consideration on 2 levels. This study aims to assess the feasibility of this procedure. **Material and Methods:** This is a retrospective observational single-center study. We included all patients who underwent double-level UBE decompression between April 2022 (start date of the UBE technique by the center's surgeons) and December 2024. Demographic, operative and clinical data (ODI, lumbar and radicular pain: L-VAS and R-VAS) were collected. **Results:** 20 women and 15 men, mean age 67, underwent double-level lumbar decompression surgery since March 2023. 17 patients were operated on levels L3L5, 10 on levels L4S1, 7 on levels L2L4, and 1 patient was operated on levels L2L3 and L4L5. The average operative time was 109 min for the entire procedure, and the average length of hospital stay was 1.7 days; all patients were mobilized on the first postoperative day. The following complications were observed: 5 dural tears (14.3%, ie 7.1% of operated levels), 2 hematomas (5.7% of patients) including 1 requiring revision surgery, and 1 patient experienced postoperative visual impairment, which resolved within 3 months. Mean preoperative data were: ODI 43.3, L-VAS 6.8 and R-VAS 6.9/10. At 3-months postoperative, they were improved respectively by 15.2, 2.3 and 2.7 points; 87.5% of patients were satisfied or very satisfied. At 1-year, ODI improved by 28.8 points, L-VAS by 2.2 and R-VAS by 1.5. **Conclusion:** This monocentric case-series demonstrates the feasibility of 2-level UBE decompression with good clinical results. These results need to be confirmed by larger-scale studies.

ID: AGS26/919
P0686: Clinical & radiological outcome of minimally invasive decompression and interbody fusion in dorsalspondylodiscitis - 2 years follow up

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Introduction: Open Spinal fusions and decompression are a common treatment for dorsal spondylodiscitis with / without end plate defects and / or neurodeficit and back pain caused by pyogenic, tubercular and parasitic aetiology. Majority of this

subset of patients are elderly and have many associated comorbidities (DM, CKD, immunocompromised, myeloma, lymphoma etc). We introduce a novel MIS technique that allow thorough disc debridement and places an interbody graft or a cage similar to the MIS procedure as done in lumbar spine through a lumbar analogue Kambin's triangle in dorsal spine and allow decompression through a tubular retractor system (Medtronic METRx II system). **Material and Methods:** This is a prospective observational study of 25 patients who had undergone this procedure. All the patients were assessed clinically &radiologically. Assessment of all patients were done using VAS score, ODI score, ASIA score and Radiological assessment was done using BRIDWELL score. **Results:** 25 patients underwent MIS interbody fusion and decompression for spondylodiscitis in dorsal spine with various associated medical comorbidities. There were significant improvement ($p < 0.05$) in ODI and VAS (Back) scores in the post operative periods. In addition there was significant improvements in ASIA scores of the patients who had neurodeficits. The Bridwell grading for spinal fusion shows grade 4 fusion in all the cases at the end of two years follow up. **Conclusion:** MIS decompression and interbody fusion in dorsal spine is a novel and new technique with a very effective clinical and radiological outcome in this this subsets of patients.

ID: AGS26/927

P0687: Comprehensive analysis of the relationship between preoperative morphological and radiological characteristics of lumbar segments and long-term clinical outcomes of lumbar total arthroplasty and transforaminal interbody fusion in railway workers

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Introduction: In-depth study of degeneration processes at the level of microstructural changes in the supporting elements of the spine is necessary for an objective assessment of the severity of the degree of degeneration and the choice of the volume of surgical intervention to optimize long-term clinical outcomes in railway workers. The aim of the study was to evaluate the relationship between preoperative morphological and radiological characteristics of lumbar segments and remote clinical outcomes of surgical treatment of railway workers with degenerative diseases of the spine using lumbar total disk replacement (TDR) and transforaminal lumbar interbody fusion (TLIF) to objectify the indications for their use. **Material and Methods:** The results of surgical interventions of 223 railway workers were retrospectively analyzed. In the period 2015-2018, TDR (n = 64) and TLIF (n = 159) were performed for single-segment degenerative disease at the lumbar level. Univariate logistic regression analysis was used to identify and assess the influence of various risk factors on the development of unsatisfactory clinical outcomes of each surgical intervention. **Results:** It has been established that the influence on the formation of a unsatisfactory long-term outcome of lumbar TDR are: age > 40 years, BMI > 28 kg/m^2, smoking, posterior osteophytes, dynamic sagittal angle over 10^0, a decrease in the height of the interbody space > ½ of the overlying one, IVD degeneration according to Pfirrmann C. > III, FJ degeneration according to Fujiwara A. > II, ADC < 1200 mm^2/sec, facet angle > 60^0, tropism of the FJ, the cell density of the nucleus pulposus < 1500 cells/mm^3, the presence of collagen types X and XI. For TLIF - BMI > 28 kg/m^2, smoking, work category by the level of energy consumption III, dynamic linear translation < 4 mm, facet angle < 60^0. **Conclusion:** The obtained results contribute to the systematization of patients taking into account the severity of preoperative degenerative changes in the lumbar segments and provide an optimal choice of surgical strategy taking into account the prediction of the follow-up postoperative result. Evaluation of the prognostic value of microstructural degenerative transformations in the tissues of the spinal cord has the potential for the development of unified surgical approaches aimed at selecting a surgical technology taking into account grouped morphological and radiological signs. A unified choice of surgical technology based on grouping patients taking into account a comprehensive analysis of preoperative morphological and radiological signs is aimed at effectively eliminating existing clinical symptoms in the long-term postoperative period in railway workers with single-level lumbar degenerative disease.

ID: AGS26/943
P0688: Open versus minimally invasive TLIF for L5-S1 isthmic spondylolisthesis: a retrospective single-center study

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Introduction: Currently, interbody fusion is the primary method for achieving arthrodesis across the isthmic spondylolisthesis L5. The results of treating such patients using minimally invasive technologies remain insufficiently reported. The objectives of this study was to conduct a comparative analysis of the postoperative results of patients with isthmic spondylolisthesis L5 by using minimally invasive and open posterior reconstruction with two-level transforaminal lumbar interbody fusion. **Material and Methods:** The retrospective study included 77 patients with isthmic spondylolisthesis L5 operated on from January 2015 to December 2020. Two groups of patients were identified: in the first (Open group, n = 39), a phased two-level open rigid stabilization performed from the midline approach was performed; in the second (MIS group, n = 38), transcutaneous transpedicular fixation was performed, then laminectomy and two-level transforaminal lumbar interbody fusion were performed through a central mini-approach. Perioperative parameters and clinical data, including the level of pain syndrome by VAS and functional status by ODI, were assessed before surgery, at discharge, 12, 24 months and last follow-up after surgery. According to the MRI performed before the operation and in the long-term postoperative period, the area of the multifidus muscle was calculated. The minimum follow-up period was 24 months, the maximum was 85 months, and the median was 42 months for patients in both groups. **Results:** Comparison of the results in the MIS group revealed significantly better indicators of the duration of the intervention ($p = 0.003$), blood loss ($p < 0.01$), mobilization time ($p = 0.02$), long term clinical parameters of severity of pain in the lumbar spine ($p < 0.001$) and functional status in ODI ($p < 0.001$). The duration of X-ray exposure was comparable in both groups ($p = 0.06$). The number of perioperative complications in the Open group was 25%, in the MIS group - 7% ($p = 0.02$). An estimate of the area of the multifidus muscle on MRI of the lumbar spine before surgery and on average after 30 months established muscle atrophy of more than 50% in the Open group and no more than 20% in the MIS group ($p < 0.01$). **Conclusion:** Minimally invasive posterior reconstruction with two-level transforaminal lumbar interbody fusion in patients with isthmic spondylolisthesis L5 can significantly reduce damage to the multifidus muscle and the risks of adverse perioperative effects, as well as significantly improve the long-term clinical results of patients compared to the two-level open rigid stabilization performed from the midline approach.

ID: AGS26/983
P0689: Ten-step technique for navigated tubular transforaminal and extraforaminal lumbar interbody fusion

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (mTLIF) is an effective option for degenerative lumbar disease refractory to nonoperative care that requires fusion with or without decompression. We present a ten-step, fully 3D-navigated tubular workflow for mTLIF and its extraforaminal variant - minimally invasive extraforaminal lumbar interbody fusion (mELIF) - integrating expandable interbody cages and single-step navigated pedicle screws to enhance safety, efficiency, and reproducibility. **Material and Methods:** We retrospectively reviewed our experience with mTLIF and mELIF procedures, based on a total of 350 cases, to develop step-by-step surgical techniques and workflows. These techniques were supplemented by illustrations and operative videos demonstrating the key steps. **Results:** Our overview documents the key technical details for the reliable and reproducible performance of mTLIF and mELIF. Across 350 patients, complications occurred exclusively in the mTLIF cohort (2.1%), including CSF leak, wound infection, and hardware complications, with no neurological complications reported. Median hospital stay was shorter for mELIF

(24 hours) compared to mTLIF (48 hours). Median follow-up time was 2.0 years. **Conclusion:** We present a comprehensive ten-step workflow for navigated mTLIF and mELIF. This workflow integrates three key features: (1) total 3D navigation, eliminating radiation exposure for the surgical team while minimizing radiation to the patient, (2) the use of expandable cages to enhance segmental lordosis; and (3) single-step navigated pedicle screws designed to streamline the surgical workflow. By providing clear and standardized workflows, we aim to support the education and training of surgeons, enabling consistent and safe outcomes.

ID: AGS26/988
P0690: Impact of diabetes mellitus on minimally invasive spine surgery outcome: a systematic review

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Introduction: Diabetes mellitus (DM) is a common comorbidity known to increase the risk of complications after spinal surgery. Minimally invasive spine surgery (MIS) has been shown to reduce tissue trauma and perioperative morbidity; however, its safety and effectiveness in diabetic patients remain uncertain. In this study we evaluated the impact of diabetes mellitus on postoperative complications and outcomes following minimally invasive lumbar spine procedures. **Material and Methods:** This systematic review was conducted in accordance with PRISMA guidelines and registered in PROSPERO. A comprehensive literature search was performed across PubMed, Scopus, Embase, and Web of Science through December 2024. Studies included if they evaluated adult diabetic patients undergoing MIS lumbar discectomy, interbody fusion, or decompression. Methodological quality was assessed using the Newcastle-Ottawa Scale. **Results:** Sixteen studies were included: eleven focused on interbody fusion or discectomy (n = 2,041), and five on decompression-only procedures (n = 1,256). The majority of studies reported similar rates of surgical complications between diabetic and non-diabetic patients, though some identified increased risks for medical complications, prolonged hospitalization, or pseudarthrosis in diabetics. Functional outcomes, including pain scores and disability indices, were generally comparable across groups in long-term follow-up. However, diabetic patients occasionally reported lower postoperative quality of life scores. Due to heterogeneity in study design and reporting, a meta-analysis was not performed. **Conclusion:** Despite some variability in perioperative risks, MIS appears to offer safe and effective outcomes for diabetic patients. The long-term benefits are largely similar to those observed in non-diabetic populations. Further research comparing MIS and open surgery in diabetics is warranted to guide surgical decision-making.

ID: AGS26/1002
P0692: Simulation training in spinal endoscopic surgery: a systematic review of current status and future directions

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Introduction: This systematic review aims to comprehensively evaluate the existing literature on endoscopic spine surgery (ESS) simulation. By assessing current designs, validation processes, and educational impacts in training of ESS simulators, our study aims to identifies strengths and limitations, highlights critical gaps, and proposes approaches to enhance simulator effectiveness. **Material and Methods:** A systematic search identified 2,130 studies, with 10 meeting the inclusion criteria. The included studies comprised descriptive studies, randomized controlled trials, cohort studies, and a cross-sectional study. Data were extracted on simulator models, validation approaches, training strategies, and educational outcomes. **Results:** Eleven simulator models were evaluated: animal (18%), mixed reality (9%), self-made (55%), synthetic (9%), and cadaveric (9%). Only six studies validated their simulators, revealing variable face, content, and construct validity. Notably, the mixed reality simulator showed the most promising outcomes. Multimodal teaching strategies combining didactic instruction and hands-on practice led to improvements in learner satisfaction, confidence, and technical performance. However, studies exhibited moderate to high risk of bias, with an average MERSQI score of 9.8/18. **Conclusion:** Diverse ESS simulation models demonstrate potential to enhance surgical training. This review identified moderate methodological quality and variability in study design, sampling, and validity across existing programs. Nevertheless, consistent improvements in technical performance and learner satisfaction were observed with multimodal training approaches. Standardized, validated simulators and structured curricula are essential to improve surgical proficiency, optimize educational outcomes, and reduce variability in practice.

ID: AGS26/1022
P0693: Percutaneous spine stabilization: benefits and limitations

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Introduction: Percutaneous spine stabilization has become increasingly used in recent years for both traumatic and degenerative disorders. Its main advantages include reduced invasiveness, less surgical trauma, and faster recovery compared with open techniques. However, certain limitations and potential pitfalls remain less frequently discussed. This study aimed to evaluate our own patient cohort treated with this technique, focusing on short-term outcomes and perioperative complications. **Material and Methods:** We retrospectively analyzed 47 patients who underwent percutaneous spine stabilization at our institution between 2020 and 2024: 39 for traumatic injury, 4 for tumors, and 3 for spondylodiscitis. Outcomes assessed included operative time, postoperative pain (VAS), perioperative blood changes, clinical status, radiological findings (X-ray and/or CT), and complications. Minimum follow-up was 6 months. **Results:** Analysis revealed considerable variability in operative parameters and clinical results depending on diagnosis and surgical extent. Expected benefits-particularly reduced blood loss and faster recovery-were observed, but several less frequently addressed drawbacks of the percutaneous approach also emerged. **Conclusion:** Percutaneous spine stabilization is an effective and minimally invasive technique in appropriately selected cases. Its application requires careful risk assessment and sufficient surgical experience across both traumatic and non-traumatic conditions.

ID: AGS26/1048
P0694: Precision without navigation: C-arm guided MISS for thoracolumbar fractures-redefining recovery and compliance

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Introduction: Minimally Invasive Spine Surgery (MISS) has revolutionized the management of thoracolumbar fractures by reducing surgical trauma and enhancing recovery. While advanced navigation systems like O-arm and robotic guidance offer precision, their cost and accessibility remain barriers in many clinical settings. This study evaluates the efficacy of C-arm fluoroscopy-guided MISS in thoracolumbar fractures, focusing on recovery metrics, hospital stay, intraoperative blood loss, and patient compliance. **Material and Methods:** A retrospective analysis was conducted on patients undergoing percutaneous pedicle screw fixation for thoracolumbar fractures using only C-arm fluoroscopy. No intraoperative navigation or robotic assistance was employed. Clinical parameters including operative time, estimated blood loss, hospital stay duration, Visual Analogue Scale (VAS) scores, and postoperative compliance were recorded. Screw placement accuracy was assessed via postoperative CT imaging. **Results:** C-arm guided MISS demonstrated:

- **Reduced blood loss** (mean: 50 mL) compared to traditional open techniques.
- **Shorter hospital stay** (average: 2 days), facilitating early mobilization.
- **High patient compliance**, attributed to minimal postoperative pain and smaller incisions.
- **Acceptable screw placement accuracy** (Grade A+B: 90.4%) without navigation support.
- **No significant perioperative complications** were observed.

Conclusion: MISS using only C-arm fluoroscopy offers a viable, cost-effective alternative to navigation-assisted techniques in thoracolumbar fracture management. It ensures favorable outcomes in terms of recovery, safety, and patient satisfaction, especially in resource-constrained environments. This approach empowers spine surgeons to deliver high-quality care without reliance on expensive technology, making it globally scalable.

ID: AGS26/1105
P0695: Assessment of blood loss during kyphoplasty for neoplastic vertebral fractures: impact of PET/CT-defined lesion activity in multiple myeloma

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Introduction: PBK is a widely used intervention in the management of painful vertebral compression fractures (VCFs) in MM. While PET/CT imaging plays a central role in disease monitoring, its potential to predict intraoperative complications such as bleeding has not been established. We aim to investigate whether 18F-FDG PET/CT-defined lesion activity predicts intraoperative bleeding risk during percutaneous balloon kyphoplasty (PBK) in patients with multiple myeloma (MM), and to explore the correlation between radiological restoration and clinical outcomes. **Material and Methods:** This study evaluated

26 patients with neoplasia (35 vertebral levels) treated with PBK between June 2021 and January 2024. Data included demographics, radiological parameters (anterior and mid-vertebral height, local kyphotic angle), functional outcomes (VAS, ODI), and intraoperative bleeding volumes. PET/CT was used to determine lesion activity in MM patients. Logistic regression analysis (Firth's method) was used to assess predictors of high bleeding (> 100 mL). Statistical comparisons were made based on fracture etiology, spinal level, and age group. **Results:** Among 20 MM patients, five had PET/CT-active lesions; four of these experienced bleeding ≥ 100 mL. 6 patients had other neoplasia. Mean bleeding was 100 mL in MM and 13 mL in non-MM cases. Firth's logistic regression analysis identified PET/CT-defined lesion activity as a significant predictor of high bleeding risk (OR: 4.81; 95% CI: 1.14-26.2; $p < 0.05$). Radiological restoration (AVHR, MVHR, LKA) showed no correlation with clinical improvement (VAS/ODI). Cement leakage occurred in 5 cases, with no neurological complications. **Conclusion:** Metabolic activity on PET/CT is a strong and independent predictor of increased intraoperative bleeding risk in MM patients undergoing PBK. While PBK offers effective radiological correction, clinical outcomes are not directly associated with anatomical restoration. Preoperative PET/CT may aid in risk stratification and surgical planning for this patient group.

ID: AGS26/1128
P0696: A modified technique of minimally invasive cortical bone trajectory screws with U-rod for treatment of spondylolysis

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Introduction: Spondylolysis is a common cause of low back pain especially in young athletic population. It involves a defect, either unilateral or bilateral, of the pars interarticularis. Numerous techniques have been developed for the surgical treatment of spondylolysis, each with its own strengths and weaknesses. This article aims to describe a minimal invasive novel technique using cortical bone trajectory screws with a U-rod to stabilize the spondylolysis. **Material and Methods:** Adult patients who presented between July 2020 and August 2024 with low back pain due to spondylolysis was included in this study. Imaging studies of the lumbar spine was performed to confirm the spondylolysis. All patients were confirmed to be treated conservatively for at least twelve months prior to surgical intervention. A 2.5 cm midline incision was made over the level of the spondylolysis. Under fluoroscopic guidance, two screws were inserted into the level of the spondylolysis in the cortical bone trajectory and the screws were connected with a U-shaped bent rod. **Results:** Four adult patients (1 male, 3 females) were included. The mean age was 38.5 ± 16.1 years. Average intraoperative blood loss was 6 ± 3 ml. Mean postoperative hospital stay was 3 ± 0.5 days. Both postoperative Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) scores showed significant improvement. Lumbar spine CT scans performed one year post-operation confirmed fusion of the pars defect in 7 of the 8 defects. **Conclusion:** We described a modified novel, minimally invasive technique for the treatment of spondylolysis. This approach offers the advantage of being minimally invasive, leading to less blood loss, short hospital stays, and fast recovery. It also requires less technical expertise than traditional pars screw placement and utilizes readily available instrumentations. Patients reported improved pain scores and imaging confirmed successful fusion of the pars defect.

ID: AGS26/1133
P0697: Minimally invasive treatment of lumbar degenerative spondylolisthesis using a minimally invasive approach with iCT and surgical navigation

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Background: Most surgeons adhere to the "gold" standard in the treatment of spondylolisthesis - a traditional median approach with wide laminectomy and fusion of the segment, which is accompanied by profound blood loss, soft tissue and muscles injury and persistent postoperative pain. Given the fact that most patients with spondylolisthesis have severe concomitant pathology due to age, the issue of minimizing risk of surgical treatment in this category of patients is quite acute. **Methods:** 224 patients (74 men and 150 women) were included in the study with 2 groups - patients who underwent surgical treatment using a traditional method (104 patients) and patients treated with a minimally invasive paravertebral approach (120 patients). In both groups, the level of intervention was determined using intraoperative CT (Siemens Somatom Definition Edge) and surgery was performed under navigation guidance (StealthStation S8). Both groups were, analyzed for blood loss, pain length of stay, surgical time and other parameters. **Results:** After thorough analysis of both groups, patients treated with a minimally invasive approach reported better outcomes for blood loss, postoperative pain, length of stay, surgical time and other

parameters. Use of preoperative planning, intraoperative CT and navigation increased safety and ensured precise planning of surgical approach, estimation of performed decompression with high accuracy of screw and interbody implant placement. **Conclusions:** Minimally invasive spondylolisthesis surgery can reduce pain in the area of surgical intervention; reduce the time of surgery, the amount of blood loss and the time of hospitalization. The use of iCT and surgical navigation allows screws to be inserted into the vertebral bodies under stronger convergence, and this in turn eliminates the risk of fusion system failure.

ID: AGS26/1135
P0698: Current concepts of treatment of spinal cord vascular pathology: surgical, radiosurgical and endovascular. Experience of Burdenko centre of neurosurgery

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Objectives: Describe the current concepts and our clinical experience of surgical treatment of various vascular pathology of the spinal cord. **Background:** Vascular pathology of the spinal cord are a relatively rare and overlooked group of lesions that can cause substantial neurologic morbidity. It comprises various pathologies, including dural arteriovenous fistulae, arteriovenous malformation (AVM), cavernous malformation (CM), hemangioblastomas, infarction and genetic abnormalities. Clinical presentation of vascular pathologies is variable, as the localization within the spinal cord correlate with different symptoms and requires prompt recognition and treatment. Treatment may involve surgery, endovascular embolization, radiation therapy or combination treatments. **Methods:** Authors report the current treatment options and their clinical experience on surgical**,** radiosurgical and endovascular treatment of various spinal cord vascular pathology. **Results:** Presentation contains our data on surgical**,** radiosurgical and endovascular treatment of various spinal cord vascular pathology, our tips and tricks for treating patients and an analysis of our patients series. **Conclusions:** Diagnosis and treatment of vascular pathologies of the spinal cord remains a difficult task even for the modern neurosurgeon. Surgery continues to be the mainstay treatment method, although radiosurgical and endovascular treatment methods show more and more promising results. Our analysis of current available literature and our vast experience help delineate clinical hallmarks necessary for successful treatment. It is worth noting, that most treatment strategies are reliant on a multidisciplinary approach.

ID: AGS26/1158
P0699: Modified hybrid MISS TLIF: what we do?

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Introduction: MIS-TLIF is a common surgical procedure to treat lumbar spondylolisthesis. However, we introduced and practice our own method of doing the surgery. We have invented our own Modified Hybrid MIS-TLIF and documented the long-term results of Our own surgical strategy. **Material and Methods:** Eighty-four patients who had undergone instrumented Modified Hybrid MIS-TLIF between July 2021 and June 2025 were retrospectively reviewed. Here we used MIS Screw system with a midline mini open Incision to put the cage for fusion. The visual analog scale, Oswestry Disability Index, patient satisfaction rate, and the patient's return-to-work status, effect on back muscle were used to assess clinical and functional outcomes. Radiologic follow-up were carried out in patients to check for adjacent segmental degeneration (ASD). The plain radiographs, computed tomography were used in all patients in last follow-up period. **Results:** The mean visual analog scale scores for back and leg pain decreased from 5.9 and 7.1 to 3.5 and 3.7, respectively, in the DS group ($n = 49$) and from 6.7 and 6.8 to 1.8 and 2.0, respectively, in the IS group ($n = 35$) ($p < 0.001$). The mean Oswestry Disability Index scores improved from 60.7% to 23.5% in the DS group and from 63.9% to 19% in the IS group ($p < 0.001$). Patient satisfaction rate was 80% and 81% in the DS and IS groups, respectively. Paraspinal Muscle Cross sectional area increased by 6.7% postoperatively. Evidence of fusion was observed radiologically in 47 (96%) and 35 (100%) of the patients in the IS and the DS group, respectively, giving an overall fusion rate of 97.7% (82 out of 84). The final ASD rate, observed using radiography, was 68.4% (33 out of 49) in the DS and 40% (14 out of 35) in the IS group. However, 15.8% (7 out of 49) in the DS and 3% (1 in 35) in the IS group had symptoms associated with ASD. **Conclusion:** The long-term clinical and radiologic outcomes after instrumented Modified Hybrid MIS-TLIF in patients with unstable single-level spine are favorable.

ID: AGS26/1188
P0700: Less pain, faster recovery: endoscopic surgery for lumbar spinal stenosis

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Introduction: Lumbar spinal stenosis (LSS) is a prevalent condition, particularly in older adults, causing pain, mobility

impairment, and significant societal and healthcare burdens. Advances in surgical techniques have shifted from open approaches to minimally invasive methods, including tubular and endoscopic techniques. This study compares the outcomes of tubular and endoscopic approaches to LSS to determine the potential superiority of one technique. **Material and Methods:** A single-center, retrospective study analyzed 181 patients undergoing tubular or endoscopic LSS surgery. In-hospital and outpatient data were collected on different demographic and outcome parameters, including complication rates, recurrence, and pain intensity measured using the visual analogue scale (VAS). Statistical analysis was performed using multivariate analyses and parametric and non-parametric mean comparisons. **Results:** No significant differences in demographics were observed. Most outcomes, including average postoperative pain, complication rates, and recurrence, were comparable between groups. Analysis showed postoperative maximum pain to be significantly lower in the endoscopic group (4.3 ± 3.6) compared to the tubular group (7.1 ± 3.3, $p < 0.001$*). This difference was most pronounced in single-level procedures (tubular: 8.0 vs. endoscopic: 3.5, $W = 686$, $p = 0.0004$). The reduction in maximum pain compared to preoperative levels was also significantly greater in the endoscopic group (-3.8 vs. -0.9, $p = 0.02$*). Regression analyses further supported these findings. In univariate analysis, endoscopic surgery was significantly associated with lower postoperative maximum pain ($\beta = -2.95$, $p < 0.001$) and greater pain reduction ($\beta = -2.85$, $p = 0.021$). After adjustment for potential confounders such as complications, preoperative pain, and demographics, the multivariate model revealed an even stronger independent effect of endoscopic surgery on reducing postoperative maximum pain ($\beta = -4.05$, $p = 0.012$, 95% CI: -7.15 to -0.95) and on change in maximum pain ($\beta = -4.05$, $p = 0.012$, 95% CI: -7.15 to -0.95). Other factors, including intraoperative complications, BMI, inpatient treatment, and smoking status, did not significantly affect postoperative pain outcomes. **Conclusion:** In the evolving landscape of spinal surgery, our study reveals that while tubular and endoscopic techniques offer comparable outcomes for lumbar spinal stenosis, the endoscopic approach stands out by significantly reducing postoperative maximum pain.

ID: AGS26/1198
P0701: Infection-free spine surgery: endoscopic advantage over tubular decompression

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Introduction: Minimally invasive spine surgery has reshaped lumbar decompression, replacing large exposures with tubular and endoscopic techniques. Both aim to minimize muscle trauma, speed recovery, and reduce complications. Yet whether one approach offers a distinctly advantageous safety profile remains debated. Our study directly compared complication rates of tubular and endoscopic decompression for lumbar spinal stenosis. **Material and Methods:** We reviewed 180 consecutive patients treated between 2021 and 2024 (endoscopic: n = 79; tubular: n = 101) in our tertiary care center. Patients' charts were analyzed for intra- and postoperative complications: incidental durotomy, infection, surgical site hematoma, new-onset dysesthesia, recurrence of stenosis, and reoperation rate. Group comparisons were performed using Chi-square and Fisher's exact tests. **Results:** There were no differences in mean age (49.6 vs. 52.6 years, $p = 0.233$), gender distribution (54 [53.5%] vs. 42 [53.2%] male, $p = 0.968$), body mass index (29.6 vs. 31.2, $p = 0.101$), and Charlson Comorbidity Index (2 vs. 2, $p = 0.207$) between the tubular and endoscopic groups. No infections occurred in the endoscopic group, compared to 5% in the tubular group ($p < 0.05$). Comparing other complications between the groups, no significant associations were found: durotomy (7.7% vs. 9.9%, $p = 0.36$), hematoma (1.0% vs. 2.0%, $p = 0.37$), dysesthesia (2.0% vs. 3.0%, $p = 0.59$), recurrence (15.0% vs. 11.9%, $p = 0.51$), and reoperation (5.0% vs. 5.9%, $p = 0.80$). **Conclusion:** Overall, both tubular and endoscopic decompression proved to be safe, with low complication rates and favorable risk profiles. The absence of infections in the endoscopic cohort was noteworthy and may point toward a relative advantage in reducing infectious morbidity. Other complications, however, were comparable between the groups. Taken together, these findings suggest that the endoscopic approach might offer added value in specific domains of perioperative safety. Larger multicenter studies are needed to validate these trends and refine patient selection.

ID: AGS26/1201
P0702: Adjacent disc vacuum phenomenon as a risk factor for adjacent vertebral fracture after balloon kyphoplasty

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Introduction: Balloon kyphoplasty (BKP) is widely performed for osteoporotic vertebral fractures (OVF) to achieve pain relief and restoration of vertebral height. However, subsequent adjacent vertebral fracture (AVF) remains a major clinical concern after BKP. While several predictors for AVF

have been reported, the potential impact of vacuum phenomenon (VP) in the adjacent intervertebral disc has not been clarified. This study aimed to investigate whether the presence of adjacent disc VP increases the risk of AVF after BKP. **Material and Methods:** We retrospectively reviewed consecutive patients who underwent BKP for OVF between April 2019 and September 2024. Inclusion criteria were single-level OVF between T11 and L2 and a minimum follow-up of three months with radiographic evaluation. Patients with a history of prior spinal surgery, multiple-level BKP, or concomitant decompression/fixation were excluded. VP was assessed on preoperative sagittal computed tomography (CT) scans and classified into VP-positive (VP+) and VP-negative (VP-) groups. Clinical and radiological parameters including age, sex, time from injury to surgery, bone mineral density (lumbar spine and femoral neck T-scores), magnetic resonance imaging (MRI) risk patterns (confined high-intensity signal and diffuse low-intensity signal), intravertebral cleft, endplate or posterior wall injury, and presence of pre-existing vertebral fractures were collected. The primary outcome was the occurrence of AVF at final follow-up, diagnosed by plain radiographs. Group comparisons were performed using chi-square or Fisher's exact test for categorical variables and t-test or Mann-Whitney U test for continuous variables. Logistic regression analysis was used to identify independent risk factors for AVF. **Results:** A total of 124 patients were included (mean age, 76.2 ± 8.1 years; 54 males, 70 females). VP was observed in 48 patients (38.7%), with cranial in 19, caudal in 14, and both in 15. Patients in the VP+ group also had a longer injury-to-surgery interval [32.5 days (range, 5-300) vs 17.0 days (2-120), p = 0.004], a higher prevalence of endplate injury (47.9% vs 28.9%, p = 0.037), and a greater frequency of intravertebral cleft (75.0% vs 40.8%, p = 0.001). During follow-up, AVF occurred in 21 patients (16.9%). When AVF(+) and AVF(-) groups were compared, patients in the AVF(+) group were more likely to have VP (71.4% vs 32.0%, p = 0.001) and had a longer injury-to-surgery interval [40.0 days (range, 6-150) vs 17.0 days (2-300), p = 0.002]. Multivariable logistic regression analysis was performed with VP and injury-to-surgery interval as independent variables. In this model, the presence of VP remained independently associated with AVF (odds ratio, 4.97; 95% confidence interval, 1.71-14.5; p = 0.02), whereas injury-to-surgery interval was not (p = 0.63). **Conclusion:** The presence of VP in the adjacent intervertebral disc was identified as an independent risk factor for adjacent vertebral fracture following BKP. These findings highlight the importance of preoperative CT assessment of disc VP in risk stratification for patients undergoing BKP. Surgeons should be aware that patients with adjacent disc VP may require closer follow-up or preventive strategies to mitigate the risk of AVF.

ID: AGS26/1224
P0703: Comparative analysis of MIS-TLIF and lumbar decompression outcomes for LDH with and without degenerative spondylolisthesis: a cohort study with minimum 12-month follow-up

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Introduction: Lumbar disc herniation is a common cause of radiculopathy and functional impairment, with surgical options including decompression alone or decompression combined with fusion. Minimally invasive fusion techniques, such as Transforaminal Lumbar Interbody Fusion (MIS-TLIF), have been developed to provide biomechanical stability while reducing muscle dissection, blood loss, and postoperative pain compared with traditional open fusion. Although decompression alone is effective for isolated disc herniations, its role in the management of degenerative spondylolisthesis (DS) and disc herniations remains controversial due to concerns regarding segmental instability and higher reoperation risk. There is currently a paucity of literature investigating decompression versus minimally invasive fusion techniques regarding pain relief and long-term functional outcomes. The present study aims to compare patient-reported outcomes between MIS-TLIF and decompression in patients with lumbar disc herniations with and without DS. **Methods:** This study was a retrospective cohort analysis of a prospectively collected database of adult patients with lumbar disc herniations, with or without degenerative spondylolisthesis greater than grade 1 confirmed on radiography. Patients underwent 1-4 level surgery with either MIS-TLIF or decompression between 2020 and 2024. Clinical outcomes were

assessed using the visual analogue scale (VAS) for back pain and leg pain, and the Oswestry Disability Index (ODI), recorded preoperatively and at 3, 6, and 12 months post-operatively. **Results:** A total of 212 patients (51% male) were included, and the mean age was 61 ± 15 years. Half of the cohort (50%) were diagnosed with degenerative spondylolisthesis (DS), 42% underwent MIS-TLIF, 58% underwent decompression, and 75% were primary surgeries. Females had a significantly higher rate of DS compared to males ($\chi^2 = 12.8$, $p < 0.001$), and patients with DS were older than those without DS (64 ± 14 vs 57 ± 16 years, $p < 0.001$). Treatment strategy varied by diagnosis: patients with lumbar disc herniation without DS were twice as likely to undergo decompression, whereas those with DS were twice as likely to undergo MIS-TLIF ($\chi^2 = 6.4$, $p = 0.011$). Pairwise comparisons of estimated marginal means, adjusted for baseline levels, were performed for back pain VAS, leg pain VAS, and ODI. Among patients without DS, TLIF was associated with significantly higher back pain scores compared to decompression at 12 months (mean difference 1.65, $p = 0.007$). In contrast, among patients with DS, decompression was associated with higher back pain scores as compared to TLIF at 12 months (mean difference 1.50, $p = 0.005$). For leg pain, DS patients treated with decompression demonstrated worsening scores between 3 and 12 months (mean difference 1.03, $p = 0.018$). Regarding disability, decompression in patients with DS had significantly worse ODI scores at 12 months compared to non-DS patients (mean difference 6.19, $p = 0.047$). In patients without DS, TLIF was associated with increased disability scores at 3 months (mean difference 9.8, $p = 0.008$), 6 months (mean difference 7.4, $p = 0.041$), and 12 months (mean difference 12.1, $p = 0.002$). **Conclusion:** In patients without DS, decompression provided superior outcomes, with lower back pain and disability scores compared with TLIF. In contrast, in patients with DS, TLIF resulted in improved back pain at 12 months and stable leg pain, whereas decompression was associated with progressive worsening of pain and disability despite similar short-term results. These findings suggest that decompression is the preferred surgical approach for patients with lumbar disc herniations only, while MIS-TLIF may be considered the treatment of choice in cases of lumbar disc herniations with DS.

ID: AGS26/1275
P0704: Prediction of new vertebral compression fractures after vertebroplasty based on radiomorphometric parameters

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Introduction: New vertebral compression fractures (NVCF) following percutaneous vertebroplasty (PVP) remain a clinical challenge. This study aimed to identify radiographic morphometric parameters associated with NVCF risk in a Ukrainian cohort and develop a simple predictive model for clinical application. **Material and Methods:** A retrospective cohort study (2023-2025) was conducted at the Institute of Spine and Joint Pathology, Ukraine, involving 27 patients (24 females, 3 males; mean age 71.1 ± 1.3 years) with osteoporotic vertebral compression fractures treated with PVP. Morphometric parameters of 109 vertebrae were assessed on digital radiographs (frontal/sagittal, RadiAnt DICOM Viewer, precision 0.1 mm/0.1°): anterior (Ha), middle (Hm), posterior (Hp) heights, relative compression (%), wedge index, local kyphotic angle, thoracic kyphosis, lumbar lordosis, and scoliosis (Cobb angles). Statistical analysis (Statistica 13) included Shapiro-Wilk normality tests, Mann-Whitney comparisons ($p < 0.05$), and multivariate discriminant analysis (backward stepwise). **Results:** NVCF occurred in 40.7% of cases (45 fractures in 11 patients). Significant differences between NVCF and non-NVCF groups were observed for Ha compression (20.69 ± 1.16 mm vs. 23.89 ± 0.78 mm, $p = 0.0338$), Hm (17.84 ± 1 mm vs. 21.31 ± 0.61 mm, $p = 0.0021$), Hp (26.97 ± 0.81 mm vs. 29.61 ± 0.51 mm, $p = 0.0073$), lumbar lordosis (18.00 ± 1.74° vs. 38.28 ± 1.46°, $p = 0.01$), and scoliosis (7.53 ± 0.56° vs. 5.90 ± 0.48°, $p = 0.022$). The discriminant model, based on Hm (canonical correlation -0.863) and relative Ha compression (0.139), achieved Wilks' $\Lambda = 0.8$ ($\chi^2 = 15.77$, $p = 0.000376$), classification accuracy of 76.3% (sensitivity 75.9%, specificity 76.9%), and AUC=0.763. Simplified function: $F = 6.17 - 0.28 \times Hm - 0.035 \times Ha$ (%); $F > 0$ indicates NVCF risk. Other parameters were excluded due to low discriminatory power or collinearity. **Conclusion:** This two-parameter model, using Hm and relative Ha compression, offers moderate predictive accuracy for NVCF post-PVP. Its simplicity suits resource-limited Ukrainian clinics. External validation and inclusion of confounders (e.g., BMD, therapy) are required for broader adoption.

Keywords: Percutaneous vertebroplasty, new vertebral compression fractures, radiographic morphometry, discriminant analysis, osteoporosis.

ID: AGS26/1420
P0705: Bertolotti syndrome, tubular resection of megapophysis in a young patient - Case report

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Introduction: Bertolotti's syndrome, first described in 1917, is characterized by a lumbosacral transitional vertebra with pseudoarticulation between the transverse process of L5 and

the sacrum or iliac crest. It remains an underdiagnosed cause of chronic low back pain in young adults. Surgical management is considered when conservative treatment fails. **Case presentation:** 23-year-old female with a 5-year history of chronic low back pain radiating to the right lower limb, refractory to conservative management including radiofrequency denervation. Imaging confirmed a right L5 mega-transverse process with pseudoarticulation to the sacrum. After multidisciplinary evaluation, the patient underwent a minimally invasive resection of the transverse process, performed through a 3.5 cm paramedian incision using a tubular retractor under fluoroscopic guidance. The pseudoarticulation was resected with high-speed burr and Kerrison clamp under fluoroscopic vision and intraoperative CT, followed by hemostasis and layered closure. **Results:** The procedure was uneventful, with an estimated blood loss of 300 cc. Postoperative pain was controlled with multimodal analgesia. At follow-up visits (1, 3, and 6 months), the patient reported significant improvement in radicular pain and functional capacity, with only mild localized discomfort at the surgical site. Radiographic controls demonstrated expected postoperative changes without complications. **Conclusion:** Bertolotti's syndrome should be considered in young patients with chronic refractory low back pain. Surgical resection of the transverse process though a minimally invasive approach is a safe and effective therapeutic option to resect the pseudoarticulation, achieving meaningful pain relief and functional improvement in selected cases mainly in young patients.

ID: AGS26/1421
P0706: Lateral surgery for thoracic disc herniation

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Introduction: Thoracic disc herniations are among the most complex degenerative pathologies of the spine, due to the difficulty of access to the region, the presence of several important structures in the adjacencies of the access routes, and due to the potential complications that can occur during the surgical treatment. Thus the aim of this study was to analyze the clinical outcomes of using the minimally invasive technique by a lateral approach for the treatment of herniated discs of the thoracic spine. **Material and Methods:** The study included patients undergoing surgical treatment of thoracic disc herniation using a minimally invasive technique, who had completed the ICF. Patients who did not have complete data about the surgery and patients who had not undergone surgery for thoracic herniation treatment through a minimally invasive lateral approach were excluded from the study. The following parameters were analyzed: demographic data, surgical data, and clinical outcomes. **Results:** 13 patients were included in the study, 6 women and 7 men. The most approached levels were T11-T12, with an average of 358 minutes of blood loss and 175 minutes of surgery. **Conclusion:** The use of the minimally invasive technique by lateral approach for the management of thoracic disc herniation showed good postoperative evolution and low complication rate.

ID: AGS26/1471
P0707: Full-endoscopic management of bone graft migration following lumbar interbody fusion presenting with foraminal stenosis in a multi-morbid patient

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Introduction: Transforaminal endoscopic spine surgery is a minimally invasive technique that accesses the spinal foramen to decompress the spinal nerve roots. Unlike conventional posterior-based surgery, it offers several advantages, including reduced muscle and soft tissue disruption, feasibility under local anesthesia, and faster postoperative recovery.1,2 Revision surgery, however, remains challenging due to altered anatomy and scar tissue formation. Despite these difficulties, endoscopic decompression has been associated with a low incidence of complications, even in elderly patients with complex degenerative disease, adjacent segment pathology, or failed back surgery syndrome. In such scenarios, it is frequently regarded as a "rescue" procedure. This report describes a rare case of postoperative bone graft migration following biportal endoscopic transforaminal lumbar interbody fusion (UBE-TLIF), managed successfully with full-endoscopic revision surgery in a high-risk patient. **Material and Methods:** A 56-year-old woman of Thai nationality who has systemic lupus erythematosus (SLE), hypertension, and polyarthritis was admitted with a two-month history of severe back pain accompanied by right-sided sciatica. Her visual analog scale (VAS) pain score was 8/10. Neurological examination revealed sensory deficits in the right L4-L5 dermatomes, with preserved motor function. An MRI demonstrated significant central canal stenosis at L3-L5, recess stenosis on both sides, and grade 1 spondylolisthesis at

L4-L5. She underwent UBE-TLIF from L3-L5, using local bone graft alone at L3-4 and local bone graft with a PEEK cage at L4-5. Postoperatively, her pain and neurological symptoms improved significantly. On postoperative day 2, however, she developed acute dyspnea and hypoxemia. Pulmonary embolism secondary to inferior vena cava thrombosis was confirmed, and anticoagulation with enoxaparin was initiated along, followed by prophylactic vena cava filter placement. The next day, she developed worsening right leg pain, numbness, and progressive weakness. An examination revealed right quadriceps strength of grade I and tibialis anterior strength of grade III. **Results:** The procedure was completed uneventfully with complete removal of the displaced bone fragments. Postoperative imaging confirmed full decompression. The patient's visual analog scale score improved from 8 to 2, and quadriceps strength improved from grade I to IV. She was ambulatory with assistance by day 3 and regained independent walking at 6 months, with only mild residual numbness. No recurrent neurological or systemic complications were observed. **Conclusion:** Bone graft migration after endoscopic lumbar fusion, though rare, may cause severe neurological compromise. Full-endoscopic transforaminal decompression under local anesthesia offers a reliable and beneficial revision strategy in high-risk patients. Early recognition and timely intervention are crucial for optimizing outcomes and minimizing systemic complications.

ID: AGS26/1486
P0708: Endoscopic spine surgery: constraints and success in the management of lumbar spine pathology

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Introduction: Endoscopic spine surgery (ESS) has emerged as a transformative, minimally invasive surgical (MIS) technique for treating lumbar spine pathologies, including disc herniations, spinal stenosis, and spondylodiscitis. Promising outcomes such as reduced tissue trauma, decreased blood loss, shorter hospital stays, and faster recovery have driven its adoption. However, its technical execution presents unique constraints that can impact surgical success. This objective of the study is to evaluate the clinical success rates and patient outcomes of fully endoscopic techniques for lumbar pathology and to delineate the significant learning curve, technical constraints, and patient selection criteria that are critical for achieving optimal results. **Material and Methods:** This prospective observational study was carried out at the Department of Orthopedic & Spine Surgery at Bangladesh Spine & Orthopedic Hospital, Dhaka, Bangladesh, between May 2025 to August 20205. A total of 30 patients who underwent full endoscopic spine surgery for various degenerative lumbar pathologies were included. **Inclusion Criteria:**

- Age between 20 and 70 years.
- Patients with single or multiple level lumbar disc herniation, spinal stenosis, foraminal stenosis, or recurrent disc herniation confirmed by MRI/CT.
- Persistent radicular pain, back pain, or neurogenic claudication not relieved by ≥6 weeks of conservative management.
- Fit for surgery under general anesthesia.
- Surgery was done by posterior Stenoscopic Lumbar Decompression (PSLD) & UBE.
- Clinical outcomes was assessed by VAS, ODI, MacNab criteria.

Results: ESS demonstrates high success rates (> 85-90%) for contained and non-migrated lumbar disc herniations, with excellent relief of radicular pain. The complications were observed as dural tear, nerve root irritation, heamatoma & discitis, but the percentage of complications was very minimum (less than 2%). Clinical outcome was assessed by ODI (62.3 to 18.5) & VAS (7.4 to 1.9). The patient satisfaction was assessed by Macnab criteria (excellent 56.5% & good 32.4%). **Conclusion:** Endoscopic spine surgery is a highly successful and patient-centric option for a defined subset of lumbar spine disorders. While it offers substantial advantages over traditional open and other MIS techniques, its efficacy is constrained by a demanding technical learning process and specific anatomical challenges. Future success in expanding its indications hinges on continued technological innovation, structured surgical training, and the development of standardized protocols to overcome its current limitations.

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P0709: Early clinical outcomes of percutaneous stenoscopic lumbar decompression: a retrospective analysis of the first 8 cases

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Introduction: Endoscopic spine surgery has become a minimally invasive alternative to open procedures, aiming to reduce pain, disability, and recovery time. Evidence from peripheral centers, however, remains limited. Objective: To evaluate clinical outcomes of percutaneous stenoscopic lumbar decompression (PSLD) in patients with lumbar degenerative pathology, with emphasis on pain and functional improvement. **Material and Methods:** A retrospective observational study was conducted on 8 patients who underwent PSLD. Pain was assessed using the Visual Analogue Scale (VAS), and functional

disability using the Oswestry Disability Index (ODI), both preoperatively and at follow-up. Statistical analysis was performed using paired t-tests. **Results:** The mean preoperative VAS score was 7.75 ± 1.44, which significantly decreased to 2.12 ± 1.73 postoperatively ($t = 8.44$, $p < 0.001$), representing a 72.6% reduction in pain. The mean ODI score improved from 57.75 ± 4.23 to 7.12 ± 2.95 ($t = 24.46$, $p < 0.001$), corresponding to an 87.7% functional improvement. The mean follow-up duration was approximately 4-6 months (range 99-172 days). No major perioperative complications were observed, and all patients achieved early mobilization. **Conclusion:** PSLD is a safe and effective minimally invasive technique for lumbar degenerative conditions, providing significant pain relief and functional recovery, even during the initial learning curve. Larger prospective studies with longer follow-up are warranted to validate these promising results.

ID: AGS26/1589
P0710: Multi-level posterior endoscopic cervical decompression for cervical radiculopathy: case series

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Introduction: Cervical radiculopathy remains a debilitating condition caused by compression or irritation of cervical nerve roots, leading to pain, functional impairment and reduced quality of life. While most patients respond to conservative management, surgical intervention is indicated for persistent or severe symptoms. Traditional open or microscopic cervical discectomy and foraminotomy achieves effective decompression but is associated with soft tissue disruption, prolonged recovery, and increased post-operative pain. Endoscopic cervical decompression has therefore emerged as a collection of novel surgical techniques aiming to address the limitations associated with open or microscopic surgeries. Despite growing interest, evidence on the outcomes and complications of endoscopic techniques remains limited, particularly for multi-level cervical decompression. Multi-level endoscopic decompression allows for an ultra-minimally invasive alternative for multiple segment pathology. Hence, this case series reports the clinical outcomes and complications associated with multi-level posterior endoscopic cervical decompression for cervical radiculopathy. Through addressing a critical gap in the literature, this study aims to inform surgical decision-making in the management of cervical radiculopathy. **Material and Methods:** This retrospective single-centre case series included 12 patients undergoing multi-level posterior endoscopic cervical discectomy and foraminotomy for cervical radiculopathy between 2023 and 2025. Inclusion criteria included adult patients with symptomatic cervical radiculopathy refractory to conservative management who underwent multi-level posterior endoscopic cervical decompression. Exclusion criteria included prior cervical surgery, myeloradiculopathy and radiculopathy caused by other pathologies including tumour, infection and trauma. Pre-operative and post-operative patient-reported outcome measures (PROMs) were assessed using validated questionnaires, including Visual Analogue Scale (VAS) for arm, neck and back pain, the Neck Disability Index (NDI), and EQ-5D-5L for quality of life. Incidence of complications was also recorded. Outcomes were measured at routine post-operative follow up appointments and paired t-test were utilised to evaluate changes in scores and the efficacy of the intervention. **Results:** The case series included 12 patients (7 males, 5 females; mean age 55.8 ± 11.9) and found an improvement in all validated questionnaires post-operatively compared to pre-operatively. There was statistically significant outcomes in pain, functional capacity and quality of life in the following PROMs: VAS neck (Δmean = -3, $p < 0.003$), VAS back (Δmean = -3.083, $p < 0.009$), NDI (Δmean = -10.5, $p < 0.0005$) and the EQ-5D-5L subcategories 'Activities' (Δmean = -1.083, $p < 0.003$), 'Pain' (Δmean = -1.25, $p < 0.0009$) and 'Quality of Life' (Δmean = 22, $p < 0.001$). However, improvements in VAS arm (Δmean = -1.67, $p < 0.24$) and EQ-5D-5L subcategories 'Mobility' (Δmean = -0.083, $p < 0.75$), 'Self-care' (Δmean = -0.25, $p < 0.27$) and 'Anxiety' (Δmean = -0.083, $p < 0.75$) were not statistically significant. **Conclusion:** Evidence on multi-level posterior endoscopic cervical decompression remains limited, as only a small proportion of patients require multi-level surgery. In this series, several validated outcome measures showed statistically significant improvements, suggesting promising results of this surgical intervention for patients with cervical radiculopathy. However, more robust, multi-centre studies with larger patient cohorts are required to better define safety and efficacy of multi-level posterior endoscopic decompression.

ID: AGS26/1606
P0711: Minimally-invasive reconstructive spinal surgery for infectious spondylitis: 3 years follow-up analysis

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Introduction: The choice of treatment strategy for infectious spondylitis remains debatable. Currently, up to 50-65% of patients receive conservative treatment. The role and place of minimally invasive surgical technologies in patients with

infectious spondylitis is defined mainly in the context of debridement procedures; however, the potential for performing minimally invasive spinal reconstructions has not been fully explored. **Material and Methods:** The cohort study 81 patients, aged from 24 to 79 years (M = 51.2 ± 6.4 years), who underwent MIS spinal reconstructions of lumbar and lumbo-sacral spine due to spondylitis. All cases operated by three column reconstructions with anterior column fusion by tubular (n = 62) or video-assisted (n = 19) techniques followed by transcutaneous screw fixation. Follow-up period was evaluated at list 12 months. Analyzed parameters included: ASIA, VAS, ODI, Charlson Comorbidity Index, ASA, SF-36. Risk of complications was assessed using the SITE score (Pluemer J., 2021). Intraoperative blood loss (ml) and operation time (min) was recorded. Orthopedic and infectious complications were evaluated according to the Clavien-Dindo classification (2004). Hospitalization duration (days) was also taken into account. **Results:** Neurological improvement was observed postoperatively in all groups. In group I, blood loss amounted to 150 ± 19 ml, whereas in group II 200 ± 56 ml. The severity of postoperative pain was 4.95 ± 0.56 and 2.8 ± 0.7 in the groups. Length of hospital stay was 9.1 ± 1.4 days in group I and 11.4 ± 3.9 in group II. No infectious complications were detected in group I; group II had 10 (13.3%) IIIB complications according Clavien-Dindo. Postoperative quality of life assessed 1 month after surgery using the SF-36 questionnaire was 88.5 ± 3.61 in group I and 72.86 ± 3.47 in group II. The ODI index at 1 year postoperatively was 25.48% ± 12.92, 31.41% ± 10.91 in group II respectively. **Conclusion:** The use of minimally invasive technologies for the treatment of infectious spondylitis of the lumbar spine reduced complications rate and decrease intraoperative blood loss, operation time and length of hospital stay up to 60% versus traditional surgical technologies.

ID: AGS26/1705
P0712: Biportal endoscopic assisted cervical lateral mass screw fixation: surgical technique and clinical outcome

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Introduction: Cervical lateral mass screw fixation is a widely used posterior spinal stabilization technique for treating various cervical spine conditions. There are many advantage such as strong biomechanic, low risk of spinal cord injury and suitable for multilevel fixation but the disadvantage were extensive muscle stripping, large incision, persistence postoperative neck pain, wound dehiscence. The biportal endoscopic spine surgery, originally developed for lumbar spine, has been adapted to cervical spine procedures to minimize surgical morbidity. So biportal endoscopic assisted cervical lateral mass screw fixation is an advance minimally invasive technique that combine biportal endoscopic with traditional cervical lateral mass screw fixation. This approach aims to enhance visualization, reduce soft tissue damage, decrease blood lost while maintaining the stability and efficacy of cervical lateral mass screw fixation. **Material and Methods:** This study included 17 patients with multilevel of cervical spondylotic myelopathy who underwent biportal endoscopic-assisted lateral mass screw fixation between march 2023 and September 2024. A novel multi portal approach was used to facilitate bilateral screw placement with minimal muscle disruption. Clinical outcomes were assessed using Visual Analog Scale (VAS) for neck pain, Neck Disability Index (NDI), length of hospital stay, analgesic consumption, blood lost, complication and radiographic fusion rates at 6 months. **Results:** All patients underwent successful bilateral fixation with no intraoperative neurovascular complications. the average VAS of neck pain day one after operation was 2.3 and NDI scores improved significantly postoperatively ($p < 0.01$). Length of hospital stay3.5 days, all of the patient no need intravenous analgesic and no wound complication. All of cases radiographic fusion was confirmed at 6 months. No cases of screw malposition or hardware failure were observed. **Conclusions:** Biportal endoscopic assisted cervical lateral mass screw fixation is promising minimal invasive technique. this approach may lead better postoperative outcome, include reduce pain, short hospital stay and no wound complication. however further studies are necessary to establish its long-term efficacy, safety profile and optimal indication.

ID: AGS26/1714
P0713: Uniportal versus biportal endoscopic lumbar discectomy and decompression: comparative outcomes and technical pearls

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Introduction: In today's ever-evolving landscape of spine surgery, endoscopic spine surgery has quickly gained traction amongst both surgeons as well as patients. Uniportal and biportal techniques have emerged as viable if not better alternatives than conventional or minimally invasive approaches for discectomy and decompression. However, the relative effectiveness of these two techniques remains debatable. This retrospective study aims to compare the outcomes of uniportal versus biportal endoscopic techniques in lumbar discectomy and decompression. **Material and Methods:** Conducted in a tertiary integrated spine centre, a total of 31 patients who underwent endoscopic lumbar spine surgery were included

across a 13-month period. 11 patients had uniportal surgery (4 discectomies and 7 decompressions) while 20 patients had biportal surgery (12 discectomies and 8 decompressions). Only one and two-level surgeries were included in this study. In total, 38 levels were performed. The main outcome measures included were operative duration, length of hospital stay, and post-operative complications. Statistical analysis was then performed to determine any significant differences between the two approaches. **Results:** Our findings suggest that the duration of surgery per level for biportal discectomy (101.54 ± 28.15 minutes) is significantly shorter compared to uniportal discectomy (123.75 ± 2.5 minutes) ($p < 0.05$). On the contrary for decompression surgery, the duration of surgery is shorter using uniportal compared to biportal technique but this was not statistically significant ($p > 0.05$). There was also no significant difference in the length of hospital stay between the uniportal and biportal groups ($p > 0.05$). All patients reported improvement in symptoms. However, 2 complications were recorded. 1 had a recurrence of back pain after 6 months post-biportal decompression while another had a dura tear during uniportal decompression which was sealed and the patient was discharged well. **Conclusion:** Both endoscopic uniportal and biportal techniques can be effectively utilised for lumbar discectomy and decompression procedures with good outcomes. Both are versatile techniques with their own pros and cons.

ID: AGS26/1721
P0714: Percutaneous versus open short-segment pedicle screw fixation for thoracolumbar burst fractures: clinical and serial radiographic 2-year follow-up

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Introduction: To investigate the clinical and serial radiographic outcomes over a two-year follow-up period between percutaneous pedicle screw fixation (PPSF) and open pedicle screw fixation (OPSF) in the treatment of thoracolumbar burst fractures (TLBF). **Material and Methods:** Patients with TLBF accepted either PPSF or OPSF were included. Available preoperative and postoperative plain radiographs and computed tomography (CT) scans of the thoracolumbar spine within 2 years follow up were required. Clinical outcomes including operative time, blood loss and postoperative hospital stay were assessed. Radiographic outcomes including Cobb angle and lumbar lordosis angle (LLA) were evaluated. **Results:** Fifty-four patients were enrolled. PPSF group has 29 patients (mean age, 51.76 ± 14.30), and OPSF group has 25 patients (mean age, 49.16 ± 13.31). The mean fixation vertebrae were 3.3 ± 0.2. The volume of intraoperative blood loss was significantly lower in the PPSF group (61.9 ± 34.8 mL) compared to the OPSF group (262.7 ± 205.1 mL) ($p < 0.001$). There were no significant differences in operation time ($p = 0.114$) and postoperative hospital stay ($p = 0.447$) between the two groups. There was no significant difference of preoperative Cobb angle between the two groups (PPSF group: 20.7° ± 9.3°; OPSF group: 27.6° ± 6.4°) ($p = 0.238$). Both groups demonstrated a significant reduction in Cobb angle over the 2-year period following surgery. The Cobb angle was significantly lower in the PPSF group (6.7° ± 3.5°) compared to the OPSF group (9.1° ± 6.4°) at two years postoperatively ($p = 0.049$). There were no significant differences in the serial postoperative LLAs and LLA reduction between the groups within the 2-year postoperative period. **Conclusion:** PPSF is recommended as the preferred treatment for TLBF compared to OPSF due to its superior clinical and radiographic outcomes.

ID: AGS26/1731
P0715: Biportal endoscopic posterior cervical foraminotomy (PCF) versus posterior cervical inclinatory foraminotomy (PCIF)

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Introduction: Cervical radiculopathy is commonly treated with posterior cervical foraminotomy (PCF), which decompresses the nerve root while preserving motion segments. Traditional PCF, however, may involve significant facet joint resection, potentially leading to postoperative pain and instability. Biportal endoscopic PCF has emerged as a minimally invasive alternative, offering enhanced visualization and reduced tissue trauma. More recently, posterior cervical inclinatory foraminotomy (PCIF) has been introduced to minimize facet resection by using an oblique drilling trajectory. This study compares the clinical and radiologic outcomes of biportal endoscopic PCF and PCIF, focusing on decompression efficacy, facet preservation, and postoperative recovery. **Material and Methods:** Patients with unilateral cervical foraminal stenosis who underwent either biportal endoscopic PCF or PCIF were retrospectively reviewed. Clinical outcomes were assessed using Visual Analog Scale (VAS) for neck and arm pain and Neck Disability Index (NDI). Radiologic parameters included facet resection rate, and preservation of cervical alignment. Operative time, hospital stay, and complications were also compared. **Results:** Both groups showed significant improvement in VAS and NDI scores postoperatively ($p < 0.01$). PCIF demonstrated superior facet preservation, with a lower facet resection rate (mean 32.2% vs. 47.6%, $p < 0.001$). PCIF had shorter operative time

(mean 60.9 ± 2.6 min vs. 65.7 ± 7.4 min, p = 0.03) and comparable decompression efficacy. No major complications were reported. **Conclusions:** PCIF offers better facet preservation and shorter operative time, while PCF provides efficient decompression. Both techniques are effective for treating cervical radiculopathy, and selection should be tailored to patient anatomy and surgical goals.

ID: AGS26/2007
P0716: Interspinous ligament preservation in midline interspinous fixation: five-year comparative outcomes

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Introduction: The posterior ligament complex contributes to lumbar stability and resists flexion. Interspinous fixation can be performed through a midline approach, but surgeons frequently excise the interspinous ligament to facilitate device seating. The clinical value of preserving the interspinous ligament has not been well defined across longer follow up. This study compared early and five-year outcomes for patients who underwent midline interspinous fixation with preservation of the interspinous ligament versus excision. **Materials and Methods:** A retrospective cohort included consecutive patients who underwent single level lumbar fusion with midline interspinous fixation. Group 1 underwent implantation with preservation of the interspinous ligament. Group 2 underwent implantation after ligament removal. The primary endpoint was change in Visual Analogue Scale pain scores at two weeks and five years. Secondary endpoints were computed tomography confirmed fusion rate, spinous process fracture, implant migration, and time to functional recovery. Comparisons used tests for continuous variables and chi square or Fisher exact tests for categorical outcomes, with significance at $p < 0.05$. **Results:** Eighty-six patients (n = 86) met inclusion criteria (Group 1 n = 42; Group 2 n = 44). Baseline pain severity did not differ. At two weeks, preservation produced lower pain than removal (3.2 versus 4.8, $p < 0.001$), and this difference persisted at five years (2.4 versus 4.1, $p < 0.001$). Fusion was more frequent with preservation (92.8% versus 79.5%, p = 0.048). Spinous process fracture occurred in 0% versus 9.1% (p = 0.038). Implant migration occurred in 0% versus 6.8% (p = 0.11). Median time to functional recovery was shorter with preservation (4.2 weeks versus 6.8 weeks, $p < 0.001$). No device failures were recorded. **Conclusion:** Preserving the interspinous ligament during midline interspinous fixation was associated with superior short-term comfort, higher fusion rate, fewer spinous process fractures, and faster functional recovery through five years. These findings support preservation of the ligament when technically feasible and provide a rationale for midline techniques that respect the posterior tension band.

ID: AGS26/2031
P0717: Enhanced accuracy and safety in MIS TLIF using navigation, intraoperative CT, and robotic guidance

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Introduction: To evaluate the feasibility, accuracy, and clinical outcomes of minimally invasive transforaminal lumbar interbody fusion (MIS TLIF) surgeries performed with navigation, intraoperative CT scanning, and robotic arm guidance. **Material and Methods:** A prospective study was conducted on 101 patients who underwent MIS TLIF between 2023 and 2025. The mean age was 59.4 years (SD ±14.7). Surgical levels included 56 single-level, 25 two-level, 7 three-level, and 2 four-level lumbar fixations. Pedicle screw placement was guided by intraoperative CT-based navigation and robotic arm assistance, without the use of fluoroscopy. Data were collected on screw accuracy, neurological outcomes, revision surgeries, radiation exposure, surgical time, and surgeon workflow. **Results:** No screw malpositioning was observed across all cases, including multilevel fixations. No postoperative neurological deficits related to screw placement occurred, and no revision surgeries were required. Radiation exposure was significantly reduced, with no fluoroscopy necessary during screw insertion. Overall surgical time decreased compared to conventional techniques. After an initial learning curve of 5-10 cases, setup and handling became straightforward and integrated smoothly into routine workflow. The use of navigation and robotic assistance allowed the surgeon to remain focused on neural decompression, improving surgical efficiency and safety. **Conclusion:** MIS TLIF with intraoperative CT navigation and robotic arm guidance is a highly accurate, safe, and efficient technique, even in multilevel fixations. This approach minimizes radiation

exposure, eliminates fluoroscopy, reduces operative time, and enhances surgeon confidence and focus. The technology is feasible for routine clinical use and contributes to improved surgical safety and outcomes.

ID: AGS26/2034
P0718: Full-endoscopic transforaminal thoracic partial pediculectomy for palliative decompression of radicular pain in spinal metastasis: a technical note

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Introduction: Severe radicular pain from thoracic spinal metastases in oncologic patients presents a significant treatment challenge. While minimally invasive surgery (MISS) reduces morbidity, reports on purely endoscopic techniques for palliative decompression in this population are scarce. We present a novel, full-endoscopic transforaminal technique with partial pediculectomy to decompress a thoracic nerve root compromised by a metastatic tumor. **Material and Methods:** We present the case of a 72-year-old female with colon cancer and a metastatic lesion causing severe, debilitating right-sided T9 radiculopathy. The patient's Spine Instability Neoplastic Score (SINS) indicated spinal stability. The procedure involved a full-endoscopic, transforaminal approach at the T9-T10 level. Foraminotomy was achieved via partial resection of the T9-T10 superior articular process and the superior portion of the T10 pedicle to decompress the T9 nerve root. Operative data and health-related quality of life (HRQoL) scores, including the Pain Numeric Rating Scale (NRS) and Oswestry Disability Index (ODI), were documented. **Results:** The total operative time was 115 minutes with an estimated blood loss of only 20 ml. The patient was ambulatory with assistance on the first postoperative day. A significant clinical improvement was observed, with the NRS score decreasing from 10 to 2 and the ODI score decreasing from 100 to 20. The patient was discharged two days post-surgery and proceeded with radiotherapy seven days later. No surgical complications were reported. **Conclusion:** Full-endoscopic thoracic foraminotomy with partial pediculectomy is a feasible and effective minimally invasive technique for palliating radicular pain in carefully selected patients with spinal metastases. This approach provides rapid pain relief and functional recovery, enabling patients to promptly resume essential oncologic treatments like radiotherapy.

ID: AGS26/2060
P0719: The use of endoscopic spine surgery for spinal metastasis: a scoping review of the current literature

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Introduction: Spinal metastases are an increasing clinical challenge, often requiring surgical intervention for pain relief, neurological preservation, and mechanical stabilization. Endoscopic spine surgery (ESS) has emerged as a minimally invasive alternative to traditional open procedures, potentially offering reduced morbidity and faster recovery. However, its application for the specific challenges of metastatic disease, such as tumor vascularity and distorted anatomy, is not well-defined. The extent and nature of the published evidence on this topic are unknown. The objective of this study was to conduct a scoping review to systematically map the existing literature on ESS for spinal metastases, summarize reported techniques and outcomes, and identify critical knowledge gaps. **Material and Methods:** A scoping review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. A comprehensive literature search of PubMed, Scopus, Embase, and the Cochrane Library was conducted for all relevant publications up to September 2025. Inclusion criteria were studies of any design reporting on the use of uniportal or biportal ESS for the treatment of spinal metastases in human subjects. Exclusion criteria included narrative reviews, non-English language publications, and studies describing endoscopic-assisted open surgery or techniques other than true full-endoscopic procedures. Two reviewers independently screened titles, abstracts, and full texts for eligibility. Data regarding study characteristics, patient demographics, tumor types, surgical techniques, and reported advantages and challenges were extracted and charted. **Results:** The search identified 189 records, of which 13 studies met the final inclusion criteria. The evidence base consisted predominantly of case reports and small case series, representing Level IV or V evidence, with a total of 46 patients reported. No randomized controlled trials or direct comparative studies were identified. Both uniportal and biportal ESS techniques were described for neural decompression and separation surgery in the cervical, thoracic, and lumbar spine. The most common primary tumor histologies reported were lung, colon, and prostate cancer. Frequently reported advantages ("pearls") included reduced blood loss, shorter hospital stays, minimal soft tissue trauma, and faster recovery enabling

timely initiation of adjuvant radiotherapy. Key reported challenges ("pitfalls") included difficulties with hemostasis, especially in hypervascular tumors, limited maneuverability for extensive bone resection, and a steep learning curve frequently cited by authors as a significant barrier to adoption. **Conclusion:** ESS is a feasible and emerging minimally invasive surgical option for carefully selected patients with spinal metastases. However, this scoping review confirms that the current body of literature is of low evidentiary quality, lacks comparative data, and is insufficient to establish definitive indications or assess superiority over other surgical techniques. The findings highlight a critical need for multicenter, prospective cohort studies or registries to better define patient selection criteria, evaluate oncological and functional outcomes, and establish evidence-based protocols for the safe and effective application of ESS in the multidisciplinary management of spinal metastases.

ID: AGS26/2130
P0720: Who gets sent where? Cardiovascular burden in endoscopy, tumors in tubular

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Introduction: Surgical approach in lumbar spinal stenosis is often discussed in terms of technique and outcomes, yet referral patterns may shape which patients end up in each group. If certain comorbidities are disproportionately represented in one approach, outcome differences may reflect case mix rather than purely technical factors. This study examined baseline characteristics of patients referred for tubular versus endoscopic decompression at a single institution where one surgeon exclusively performs endoscopy and all others use tubular techniques. **Material and Methods:** We retrospectively analyzed 180 patients who underwent minimally invasive decompression for lumbar spinal stenosis between June 2021 and April 2024. Patient demographics, cardiovascular risk factors, systemic comorbidities, ASA score, and Charlson Comorbidity Index (CCI) were extracted from electronic health records. Comparisons between tubular and endoscopic cohorts were performed using Chi-square, Fisher's exact, and t-tests. **Results:** Patients referred for endoscopic decompression more often carried higher comorbidity burdens, including active smoking (19% vs. 6.3%, $p = 0.014$), hypertension (63.3% vs. 45.5%, $p = 0.018$), coronary artery disease (15.2% vs. 5.0%, $p = 0.020$), congestive heart failure (6.3% vs. 0%, $p = 0.010$), and peripheral vascular disease (6.3% vs. 0%, $p = 0.010$). Median ASA scores were higher in the endoscopic cohort (3 [IQR 2-4] vs. 2 [IQR 1-3], $p = 0.017$). No significant differences were observed in age, sex distribution, BMI, chronic lung disease, or CCI. **Conclusion:** At our center, endoscopic referrals tended to involve patients with greater cardiovascular comorbidity and higher ASA scores. These patterns suggest that surgeon preference and referral bias likely influenced case allocation. When interpreting outcome comparisons between tubular and endoscopic decompression, baseline differences in referral populations must be considered to avoid over-attributing findings to surgical technique alone.

ID: AGS26/2158
P0721: When recovery lingers: factors linked to extended opioid use following tubular and endoscopic decompression

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Introduction: Minimally invasive spine surgery (MISS), including tubular and endoscopic techniques, is increasingly used for the treatment of lumbar spinal stenosis due to its advantages of reduced tissue trauma and faster recovery. However, a subset of patients continues to require opioids beyond one month after surgery, a phenomenon historically more common in traditional open procedures. Prolonged opioid use is associated with poorer outcomes, increased costs, and heightened dependence. This study aimed to identify perioperative and clinical factors associated with extended opioid use following tubular and endoscopic lumbar decompression. **Material and Methods:** A retrospective review of 180 patients who underwent MIS decompression for lumbar stenosis between June 2021 and April 2024 was performed (tubular: $n = 101$; endoscopic: $n = 79$). Data were extracted from electronic health records, including demographic findings, hospital course, prior surgical history, perioperative complications, and anatomic features of pathology. Pearson correlation analyses were used to identify variables associated with opioid use persisting longer than one month. **Results:** Across both techniques, illicit drug use (tubular: $rho = 0.378$, $p = 0.002$; endoscopic: $rho = 0.262$, $p = 0.021$) and longer hospital stays (tubular: $rho = 0.300$, $p = 0.013$; endoscopic: $rho = 0.403$, $p < 0.001$) were consistent predictors of extended opioid dependence. Distinct patterns emerged between techniques. In the tubular group, postoperative infection ($rho = 0.249$, $p = 0.040$) and prior spine surgery ($rho = 0.295$, $p = 0.015$) were strongly correlated with prolonged use. In contrast, within the endoscopic cohort, anatomical factors predominated, with far lateral discs ($rho = 0.268$, $p = 0.018$) and

specific disc levels (L1-L2: rho = 0.268, p = 0.018; L3-L4: rho = 0.224, p = 0.049) linked to persistent opioid needs. **Conclusion:** Prolonged postoperative opioid use after MISS is multifactorial. While illicit drug use and longer hospitalizations were universal predictors, tubular cases were more vulnerable to infection- and history-related risk, whereas endoscopic outcomes were shaped more by anatomical variables. These findings may help optimize patient selection, improve preoperative counseling, and guide perioperative strategies aimed at reducing long-term opioid dependence.

ID: AGS26/2175
P0722: The infinity decompression: a stepwise biportal endoscopic technique for over-the-top lumbar decompression

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Introduction: Over-the-top (OTT) decompression has been widely adopted as a minimally invasive approach for central and bilateral lumbar stenosis. The application of unilateral biportal endoscopy (UBE) offers enhanced visualization, wider working angles, and safer bone and soft-tissue resection compared to tubular or uniportal endoscopic techniques. The objective is to describe a novel, systematic UBE-based OTT decompression technique, named "The Infinity Decompression", due to its continuous 13-step sequence resembling the infinity symbol. **Material and Methods:** The Infinity Decompression was developed as a standardized workflow integrating ipsilateral and contralateral bony recession with progressive ligamentum flavum release. A total of 13 steps were defined, from initial ipsilateral laminotomy to final contralateral flavum release. Key technical pearls include early identification of ipsilateral landmarks, stepwise bone resection tailored to ligamentum flavum insertions, preventive coagulation before flavectomy, and "in one piece" hemi-flavum removal. **Results:** The systematic sequence facilitates reproducible decompression, minimizes the risk of neural or dural injury, and optimizes the working corridor for contralateral access. Preventive measures such as distal-to-proximal undercutting of the base of the spinous process, controlled facetectomy boundaries, and Kerrison-assisted direct cuts enhance safety. In foraminal stenosis, extended contralateral cranial lamina resection allows improved access to the emerging nerve root. **Conclusion:** The Infinity Decompression is a safe, effective, and reproducible UBE approach for central and bilateral lumbar stenosis. By combining logical sequencing with technical refinements, it improves reproducibility, shortens the learning curve, and preserves spinal stability. This method may represent a new paradigm in endoscopic lumbar decompression.

ID: AGS26/2333
P0723: Full-endoscopic posterior cervical discectomy for upward, downward, and recurrent cervical disc herniations: a technical case series

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Introduction: Cervical disc herniation with cranial or caudal migration poses technical challenges for posterior endoscopic discectomy. In addition, recurrent disc herniation after previous decompression is often managed with anterior fusion surgery due to concerns regarding adhesions and neural injury. However, anterior approaches carry risks such as dysphagia or adjacent segment disease. We report three cases of migrated or recurrent cervical disc herniation successfully treated by full-endoscopic posterior cervical discectomy (PECD), including technical modifications such as partial pediculotomy or hemilaminotomy. **Material and Methods:** While PECD is routinely performed for typical cervical disc herniation cases at our institution, these three cases were particularly challenging due to disc migration or recurrence. We retrospectively reviewed three consecutive cases treated with full-endoscopic posterior cervical discectomy at our institution between 2022 and 2025. The cases included: 1) upward-migrated C6/7 disc herniation, 2) downward-migrated C5/6 disc herniation, and 3) recurrent C6/7 disc herniation two years after prior foraminoplasty. All procedures were performed under general anesthesia using a posterior interlaminar approach. Partial pediculotomy or hemilaminotomy was added as necessary to access the migrated or recurrent fragments. Clinical outcomes were assessed by VAS (visual analog scale) for arm pain pre- and postoperatively. MRI and CT were used to confirm decompression. **Results:** All three patients experienced significant improvement in radicular arm pain immediately postoperatively. In the recurrent case, intraoperative findings revealed adhesions and a migrated fragment located caudal to the previous decompression site. A safe corridor was achieved via partial pediculotomy without dural violation. No intraoperative or postoperative complications were observed. At final follow-up (3 months), all

patients-maintained symptom relief without recurrence. Imaging confirmed adequate decompression in all cases. **Conclusion:** Full-endoscopic posterior cervical discectomy is feasible and effective for challenging cases of upward- or downward-migrated, as well as recurrent, cervical disc herniation. With appropriate bony modification, this technique can safely access displaced fragments while avoiding anterior approach-related complications. However, advanced endoscopic skills and careful patient selection are required. Further case accumulation and outcome analysis are needed to validate this approach.

ID: AGS26/2344
P0724: The role of UBE in emergency spine surgery: effective treatment of severe neurological deficits

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Introduction: Neurological deficits affecting the cervical and lumbar spine can lead to significant impairments, such as drop foot or cervicobrachialgia, which severely impact quality of life. These conditions, often caused by nerve compression, present with motor deficits and pain requiring urgent intervention to prevent disability. This report highlights the emergency treatment of two patients using the Unilateral Biportal Endoscopy (UBE) technique. **Material and Methods:** A 56-year-old woman presented with right-sided sciatica, foot and toe weakness (MS grade 0), and numbness. MRI showed lumbar canal narrowing at L4/5. She underwent a 75-minute unilateral biportal endoscopic decompression. A 48-year-old man presented with cervicobrachialgia, decreased arm abduction (MS grade 2/5), and paresthesias. MRI revealed a large C4/5 foraminal disc herniation. He underwent emergency foraminoplasty and herniation removal. **Results:** Both patients experienced rapid symptom relief post-surgery. The first patient's foot movement improved to FM grade 4+ within 6 weeks, with full recovery by 3 months. The second patient's arm strength improved to FM grade 4+/5 at 6 months. Follow-up imaging confirmed effective decompression in both cases. **Conclusion:** These cases demonstrate the feasibility of biportal endoscopy in emergency settings, offering rapid symptom relief and functional recovery. The minimally invasive approach is effective for addressing severe nerve-related deficits, even in urgent scenarios, with excellent outcomes.

ID: AGS26/2345
P0725: UBE-TLIF: minimally invasive fusion with enhanced visualization

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Introduction: Lumbar spinal stenosis (LSS) often presents with foraminal stenosis and/or spondylolisthesis, leading to nerve compression, back pain, and radicular symptoms. When conservative management fails, surgical intervention such as transforaminal lumbar interbody fusion (TLIF) is indicated. Unilateral Biportal Endoscopy (UBE)-assisted TLIF is an emerging minimally invasive technique that enhances visualization and reduces tissue damage while achieving effective decompression and fusion. **Material and Methods:** The UBE-TLIF procedure for LSS at L4/5 consisted of the following steps: 1. Preparation: Patients were positioned prone under general anesthesia, with operative and imaging monitors in direct view. 2. Incisions: Two 10 mm longitudinal incisions were made 25 mm from the symptomatic pedicles. 3. Bone Removal: The base of the lower facet was marked with the drill, and the capsule and interfacetary ligament were detached using an osteotome. The lower facet was broken into three wedges to facilitate removal through the portal. The base of the upper facet was then marked with the drill, followed by vertical osteotomy to complete the process. 4. Discectomy and Cage Placement: Excision of the ligamentum flavum en bloc to ensure complete decompression. The intervertebral disc was then excised, and the endplates were carefully prepared under direct endoscopic visualization to avoid damage and ensure proper cage integration. A TLIF cage was inserted without damaging neural structures, as the dura and exit root were protected with retractors. 5. Neural Decompression: The ligamentum flavum was resected, and epidural vessels coagulated. Continuous saline irrigation improved visibility and reduced neural injury risks. Contralateral decompression followed ipsilateral decompression in bilateral cases. 6. Stabilization: Bilateral percutaneous pedicle screws were placed to stabilize the segment and promote fusion. **Results:** The UBE-TLIF procedure demonstrated effective decompression and stable fusion. Postoperative assessments confirmed proper cage placement and fusion. This technique underscores the importance of meticulous preparation and advanced visualization tools to achieve optimal outcomes with minimal complications. **Conclusion:** UBE-TLIF is a safe, effective, and minimally invasive option for treating LSS with foraminal stenosis or spondylolisthesis. Its potential for rapid recovery and reduced complications underscores its value in modern spinal surgery. Further studies are warranted to establish its broader clinical efficacy.

ID: AGS26/2402
P0726: Exploring the efficacy of minimally invasive spine fixation in thoracolumbar spinal injuries

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Introduction: Traumatic thoracolumbar fractures are common, and surgical fixation is a well-established treatment option, with the aim to achieve spinal stability and preserve neurological function. Pedicle screw fixation using a minimally invasive spine (MIS) surgical approach has emerged as an alternative approach for the treatment of thoracolumbar fractures. The aim of this study is to collect data regarding epidemiology, management, and outcomes of patients treated with MIS pedicle screw fixation for traumatic thoracolumbar fractures in our neurosurgical department. **Material and Methods:** This was a retrospective cohort study including all patients who underwent MIS fixation from July 2021 to June 2024. **Results:** A total of 38 patients were included, 23 males and 15 females; the mean age was 38 years. The majority of injuries were from falls. In 12 cases, the fracture involved a thoracic vertebra and in 10 cases a lumbar vertebra and 16 cases thoracolumbar. 40% (n = 15) of the patients presented with a neurological deficit on admission and 75% (n = 11) of those showed postoperative improvement in their neurology. The average length of hospital stay was 6 days. MIS fixation achieved a satisfactory regional sagittal angle (RSA) postoperatively in all patients. The vast majority of patients had no or mild postoperative pain and achieved a good functional outcome. **Conclusion:** MIS fixation is a safe surgical option with comparable outcomes to open surgery and a potential reduction in perioperative morbidity. MIS surgery achieves a rapid and significant improvement in pain score, functional outcome, Frankel Grade, and RSA.

ID: AGS26/2426
P0727: Challenges and evolving strategies of full-endoscopic foraminotomy in the lower lumbar spine: a narrative review

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Introduction: Lumbar foraminal stenosis (LFS) is a common degenerative condition that frequently involves the L4-5 and L5-S1 segment. Traditional surgical treatments have included microscopic foraminotomy and interbody fusion. With the advancement of endoscopic techniques, full-endoscopic foraminotomy has emerged as a minimally invasive option. However, in the lower lumbar spine, particularly at L5-S1, anatomical barriers such as a high iliac crest, large transverse process, and sacral ala often complicate the surgical approach. **Material and Methods:** We reviewed multiple studies on full-endoscopic foraminotomy, including our institutional research, to evaluate the technical evolution, clinical outcomes, and complications associated with various approaches. **Results:** The transforaminal approach, based on accessing the foraminal space through Kambin's triangle and performing minimal partial resection of the superior articular process tip, has been widely used. Nevertheless, because the procedure is performed within a narrow working space, a relatively high incidence of postoperative dysesthesia has been reported. Furthermore, in lower lumbar segments such as L5-S1, anatomical barriers often make the initial working sheath landing challenging. Several advanced transforaminal techniques have been introduced to overcome these limitations, enabling decompression despite anatomical obstacles; however, these methods are associated with longer operative times and greater technical difficulty. Recently, the interlaminar contralateral approach and the paraspinal approach using a large endoscopic system have been described. The interlaminar contralateral approach, in particular, has demonstrated favorable clinical outcomes with a low complication rate. **Conclusion:** Relying solely on the transforaminal approach may not be optimal for all patients. Instead, tailoring the surgical strategy by incorporating the interlaminar contralateral or paraspinal approach, depending on the anatomical features of each case, can provide more effective and safer decompression for lumbar foraminal stenosis, especially at the L5-S1 level.

ID: AGS26/2490
P0729: Bibliometric analysis of endoscopic and microendoscopic spine surgery publications in spine

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Introduction: Endoscopic spine surgery is an evolving subset of minimally invasive spine surgery that has been increasing in popularity. Advances in specialized instrumentation and

high-resolution imaging have extended its use beyond treatment of lumbar discectomy to encompass spinal stenosis, instability, thoracic and cervical myelopathy, infections, and intradural tumors. Despite its growing popularity, bibliometric trends within high-impact spine journals remain underexplored. This study sought to evaluate patterns of research productivity, citation impact, and geographic leadership in endoscopic and microendoscopic spine surgery publications in *Spine* from journal inception to 2025. **Material and Methods:** The Web of Science Core Collection was searched for full-endoscopic and microendoscopic spine surgery articles published in *Spine* between 1976 and 2024 using keywords. Citation analysis identified top authors (first, last, and any position) and top cited articles. Relative Citation Index (RCI) was calculated as citations divided by total publications per author. Study characteristics were reviewed independently by two investigators, looking at article type, level of evidence (LoE), topic, and country of origin. **Results:** Forty-four articles were identified, all published between 1994 and 2025. The most frequently cited authors in any position were predominantly affiliated with institutions in South Korea (40%) and Germany (40%). Author S.H. Lee was ranked highest among the top 20 authors in any position. Authors in any position featured the highest average citation count (662.6, range 277-1193) and RCI (184.6, range 13.97-723). The top 20 cited articles of all time averaged 222.5 citations, most commonly being case series (40%) and randomized controlled trials (25%), with LoE IV being most common (50%). Lumbar discectomy was the most frequent research focus (45%). In the last decade (2014-2024), top cited studies averaged 61.8 citations, with cohort studies (30%) and randomized controlled trials (20%) dominating the data. Among these works, China (40%) and South Korea (30%) contributed the largest share of recent high-impact studies. Similarly, a large portion (40%) of the top articles of all time were also associated with South Korean institutions. **Conclusion:** This bibliometric analysis reveals the top authors in endoscopic spine surgery offering a better understanding of the current literature that exists in the field. The work particularly underscores a growing international focus on minimally invasive spinal techniques and the need for continued high-quality comparative studies.

ID: AGS26/2498

P0730: A transfacet approach to the lumbar nerve root canal

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Introduction: Intraforaminal and extraforaminal lumbar nerve root compressions are common causes of radiculopathy, most often resulting from disc herniation or stenosis. Conventional surgical approaches, such as posterior midline hemilaminectomy/interlaminotomy with facetectomy or the Wiltse paraspinal approach, may risk postoperative instability or require extensive tissue dissection. To address these limitations, we describe a novel posterior-anterior transfacet approach that enables safe and effective decompression while preserving facet joint integrity. **Material and Methods:** For a period of 2 years, 11 patients with intraforaminal or extraforaminal disc herniations underwent transfacet foraminotomy. Preoperative imaging included MRI in all cases and CT in selected patients. Outcome measures included the North American Spine Society Patient Satisfaction Index (PSI), reoperation rates, and radiographic and biomechanical analyses. Postoperative CT and finite element modeling were employed to assess facet joint integrity and stress distribution. **Results:** The median operative time was 47 minutes with minimal intraoperative blood loss. All patients experienced immediate postoperative pain relief, and 9 were pain-free at discharge. At dismissal, 10 patients reported PSI = 1, and one patient PSI = 3. At last follow-up (median 26 months), 10 patients maintained PSI scores of 1 or 2. Two patients required reoperation due to recurrent herniation. Postoperative CT imaging revealed spontaneous reduction of the drilled facet defect volume by 50-75% within one year. Finite element analysis demonstrated only a transient 9.2% increase in facet stress postoperatively, normalizing at 12 months. **Conclusion:** The posterior-anterior transfacet approach provides a safe, efficient, and stability-preserving alternative for decompression of intraforaminal and extraforaminal lumbar disc herniations. This technique achieves rapid symptom relief, demonstrates spontaneous bony remodeling, and avoids long-term compromise of facet joint strength. Larger prospective studies are warranted to confirm these promising outcomes.

ID: AGS26/2510
P0731: Comparison of minimally invasive spinal surgery with stereotactic radiation with open surgical techniques: outcomes in epidural compression, complications and survival

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Introduction: Metastatic spine disease causes significant neurologic morbidity, and neurosurgical intervention can be technically challenging in achieving sufficient decompression and stabilization to enable oncologic therapy. Both open and minimally invasive surgical approaches are viable for treating spinal metastases. Compared to open approaches, recent evidence suggests minimally invasive spine (MIS) surgery reduces complications, shortens hospital stays, and improves survival. This study evaluates whether MIS surgery provides equivalent decompression to open surgery while lowering complication rates for surgical treatment of spinal metastases. **Material and Methods:** We retrospectively reviewed patients who underwent open versus MIS surgery for metastatic spine disease at two institutions from 2018-2023. Spinal cord compression was assessed pre- and postoperatively using the Epidural Spinal Cord Compression (ESCC) scale on magnetic resonance imaging. Group differences were analyzed with Fisher's exact and Welch's t-test ($p < .05$). One-year survival was estimated with Kaplan-Meier curves. **Results:** One-hundred and fourteen patients were included in this study. Sixty-six (58%) were male. The median age was 61 (32-86). Eighty-nine (78.1%) underwent open surgery while 25 (21.9%) underwent MIS surgery. In the open group, preoperative ESCC scores showed 6 (6.7%) no/low compression, 14 (15.7%) with dural compression, and 69 (77.5%) with cord compression; postoperatively, 41 (46.1%) and no/low compression, 21 (23.6%) had dural compression, 14 (15.7%) had cord compression, and 13 (14.6%) were lost to follow-up. In the MIS surgery group, preoperative ESCC scores showed 9 (36%) with no/low compression, 10 (40%) with dural compression, and 6 (24%) with cord compression; postoperatively, 19 (76%) had no/low compression, 4 (16%) had dural compression, and 2 (8%) had cord compression. MIS surgery was associated with reduced blood loss (155.8 vs. 525.1mL, $p < .01$) and lower complication rates (MIS = 16%, open = 39.3%; $p = .03$). One-year survival was 57% (95% CI 47.3-68.7%) after open surgery and 78% (95% CI 56.1-91.9%) after MIS surgery. Average length of stay was 7.0d for MIS surgery patients, and 19.3d for open surgery patients; this different was not statistically significant. **Conclusion:** This study demonstrates that MIS surgery for treatment of metastatic spine disease is associated with lower blood loss and lower complications while achieving similar rates of surgical decompression in comparison to open surgery. While there was no statistically significant difference in length of stay between groups, the trend towards shorter stays with MIS surgery suggests a potential benefit for patient recovery and resource utilization. Future studies could employ a similar analysis in a larger sample size as to minimize sampling biases. Nonetheless, MIS surgery for metastatic spine disease represents a less invasive alternative for adequately managing metastatic spine disease and warrants further prospective analysis to determine whether MIS approach confers a survival benefit in comparison to open approaches.

ID: AGS26/2540
P0732: Unilateral biportal endoscopic decompression and discectomy for multilevel lumbar disc prolapse in an adolescent: a case report and technical note

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Introduction: Lumbar disc herniation is uncommon in the pediatric population, accounting for < 5% of surgically treated cases. Multilevel disease with severe canal stenosis is even rarer, and surgical management must balance effective decompression with preservation of spinal stability and growth potential. Endoscopic approaches, particularly unilateral biportal endoscopy (UBE), are increasingly recognized as minimally invasive alternatives with favorable outcomes. **Materials and Methods:** A 15-year-old male presented with 2 months of progressive low back pain radiating to the right lower limb, aggravated by ambulation. Neurological examination revealed right L5 weakness (3/5). MRI demonstrated L3-4 and L4-5 disc prolapse with severe canal stenosis, showing interval progression compared to prior imaging. After failure of conservative therapy, UBE decompression and discectomy were performed-right-sided at L3-4 and left-sided at L4-5-using a two-portal endoscopic technique under general anesthesia. **Results:** The procedure achieved adequate decompression with minimal bony resection. Postoperatively, the patient experienced significant relief of radicular pain and improved neurological function (right L5 motor power improved from 3/5 preoperatively to 4/5 at discharge). Early mobilization was initiated on postoperative day one, and independent ambulation was achieved by day two. No perioperative complications occurred. At discharge, the patient was neurologically stable, ambulant with minimal support, and tolerating oral diet. **Conclusion:** UBE decompression is a safe and effective motion-preserving option for managing multilevel lumbar disc prolapse in adolescents. This case highlights its advantages of superior

visualization, minimal soft tissue trauma, and early recovery. Given the rarity of pediatric lumbar stenosis requiring surgery, this report contributes to the limited literature supporting UBE as a valuable minimally invasive technique in complex and age-sensitive cases.

ID: AGS26/2561
P0733: Managing lumbar adjacent segment disease: a description of minimally invasive techniques and algorithm

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Introduction: To manage symptomatic lumbar adjacent segment disease effectively using MIS TLIF techniques. **Material and Methods:** This study presents a tailored, step-by-step guide for managing lumbar adjacent segment disease (ASD) using minimally invasive transforaminal lumbar interbody fusion (MIS TLIF) techniques in patients with prior spinal fusion surgeries, whether open or minimally invasive. Four distinct surgical approaches are outlined, each selected based on the time elapsed since the primary surgery, the level of ASD involvement, and the fusion status of the previously operated segment. The study includes patients who underwent surgical treatment for lumbar ASD between January 2008 and December 2023. **Results:** Eight cases were operated with the four different techniques. The study age group was from 40 to 80 years (Mean age: 68.5 years). None of them had to be converted to open surgery. Patients operated using the described techniques reported significant clinical improvements, with the mean Oswestry Disability Index (ODI) decreasing from 58.47 ± 6.07 to 22.58 ± 3.299, and the Visual Analog Scale (VAS) scores improving from 7.076 ± 1.04 to 1.9 ± 0.77 of the pre-operative symptoms. **Conclusion:** Drawing on their extensive clinical experience, the authors offer valuable insights into innovative minimally invasive posterior techniques for managing lumbar adjacent segment disease.

ID: AGS26/2564
P0734: Technical note: a novel posterior oblique lateral (POL) approach in full endoscopic spine surgery-an alternative to the transforaminal approach

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Introduction: Endoscopic spine surgery for various lumbar pathologies continues to evolve. While the transforaminal route through Kambin's triangle remains a cornerstone, its application is often limited by anatomical variations such as disc height loss, spondylolisthesis, nerve root anomalies, or a high iliac crest. Therefore, we developed the Posterior Oblique Lateral (POL) approach, a novel endoscopic entry, to overcome these anatomical constraints. **Material and Methods:** This technical note describes the POL approach, which begins with docking on the transverse process along a posterior-oblique trajectory, followed by stepwise identification of the superior articular process, facet capsule, and pars before advancing to Kambin's triangle under direct visualization. The technique creates a wider working angle and minimizes early contact with neural structures. We demonstrate its use in three patients with foraminal stenosis, spondylolytic spondylolisthesis requiring fusion, and far-out syndrome. **Results:** The POL approach provided a safe working corridor in all cases, including a critically narrowed Kambin's triangle situation. It offers safe decompression of exiting and traversing roots, facilitated fusion with facetectomy and cage placement, and allowed extraforaminal decompression. All patients experienced symptomatic improvement and recovered without perioperative complications. **Conclusion:** In anatomically constrained cases, the POL approach may serve as a safe and versatile endoscopic alternative by providing a reproducible working corridor that could complement the standard transforaminal approach. It may also lower the risk of exiting nerve root injury and can be performed safely without neuromonitoring under general anesthesia, supporting its potential for routine clinical use.

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P0735: Endoscopic treatment of extradural schwannoma of the l5 nerve root: case report with 2-year follow-up and literature review

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Introduction: Schwannomas are benign tumors arising from Schwann cells of the peripheral nervous system, typically involving the nerve root in either its intra- or extradural portion. Resection of these tumors represents a surgical challenge due to the risk of postoperative neurological deficit. Although endoscopic techniques offer the advantages of minimally invasive surgery, fewer than five cases have been reported to date. In this case, we used the Full Endoscopic Plus approach (uniportal with an accessory portal) for tumor

resection. This is the first reported case with the longest follow-up. **Material and Methods:** A 38-year-old male presented with severe right L5 radicular pain (VAS: 8/10), paresthesia in the L5 dermatome, and motor weakness (M4) with a 24-month history of symptoms. Magnetic resonance imaging (MRI) revealed an extradural schwannoma of the right L5 root. Following surgical planning, tumor resection was performed through an L4-L5 portal, where an L5 hemilaminectomy allowed proximal root exposure, combined with a caudal accessory portal for medial dissection of the L5-S1 foramen with identification of the tumor-nerve root interface. Resection was achieved until negative motor responses were obtained with intraoperative monitoring. Postoperative imaging confirmed complete removal of the lesion. **Results:** The patient was discharged within 24 hours, without motor deficit, and reported significant pain reduction (radicular VAS: 2/10). At the 24-month follow-up, the patient remains asymptomatic (radicular VAS: 0/10), with preserved neurological function (M5), no recurrence on MRI, and no de novo instability. **Conclusion:** This case demonstrates that the Full Endoscopic Plus technique allows radical resection of extradural L5 schwannomas with functional preservation, providing sustained mid-term results. Its success relies on: Optimal portal planning, strict intraoperative neuromonitoring, microanatomical dissection of the tumor-nerve interface. The maximum tumor size suitable for this approach remains to be defined.

ID: AGS26/2626
P0736: Outcome of minimally invasive transforaminal lumbar interbody fusion with tubular microscopic decompression for lumbar degenerative disorders

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Background: Minimally Invasive Transforaminal Lumbar Interbody Fusion (MIS-TLIF) combined with bilateral decompression is increasingly recognized as a reliable surgical option for lumbar degenerative disorders. This technique offers the advantages of reduced tissue disruption, lower perioperative morbidity, and faster recovery compared with conventional open approaches. The present study evaluates clinical and perioperative outcomes of MIS-TLIF in patients treated at a tertiary care teaching hospital. **Methods:** Fifty patients who had Tubular Microscopic Decompression and MIS-TLIF over two years were the subject of a retrospective analysis. Perioperative parameters like operative duration, intraoperative blood loss, length of hospital stay, and complication rates were among the outcome measures, as were pain reduction measured by the Visual Analog Scale (VAS) and functional improvement measured by the Oswestry Disability Index (ODI). Preoperative and postoperative scores were compared to evaluate the effectiveness of surgery. **Results:** After surgery, patients showed a noticeable and statistically significant improvement in their functional status and level of pain. Significant pain relief and functional recovery were demonstrated by the mean ODI scores improving by 30 points ($p < 0.01$) and the mean VAS scores decreasing by 4.5 points ($p < 0.01$) at the 6-month follow-up. The procedure's minimally invasive nature was highlighted by the positive perioperative results, which included an average intraoperative blood loss of 150 mL and a mean hospital stay of 3 days. With a 4% incidence, complications were rare and mostly minor wound-related problems that went away with conservative treatment. **Conclusions:** For lumbar degenerative disorders, MIS-TLIF with bilateral decompression is a safe and successful surgical approach that minimizes blood loss and hospital stay while providing significant improvements in pain management and functional outcomes. This technique has great potential due to its low complication profile and quick recovery, especially when customized to the clinical and anatomical needs of each patient.

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P0737: Extra-foraminal disc herniations: technique & outcomes of transforaminal tubular discectomy using a 14-mm tubular retractor

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Introduction: While Trans-Foraminal (TF) approach with an open technique as well as endoscopic approach have been popular, TF microscopic discectomy using a 14-mm diameter tubular retractor is scarcely known. The objective of this study is to report our experience of TF discectomy with a 14mm tubular retractor system in a consecutive case series of 20 patients with extra-foraminal disc herniations. **Material and Methods:** A consecutive group of 20 patients with extra-foraminal lumbar disc herniations that had failed a trial of conservative treatment, were operated using a far lateral TF approach with a 14 mm tubular retractor system from March

2018 to January 2024. Patient demographics, operative time, blood loss and complications were documented. Pre-operative and post-operative VAS scores for back and leg pain at 6 weeks, 6 months, and 1year were documented. **Results:** A 14mm tube (METRx system, Medtronic Sofamor Danek, Memphis, TN) was successfully utilized in all patients. The mean operative time was 30 ± 10.22 minutes while intra-operative blood loss was 30 ± 15 ml. The levels affected in descending order were L3-L4 (8), L4-L5 (5), L5-S1 (4) and L2-L3 (3). All patients were mobilized out of bed on the same day post-surgery. The VAS score for leg pain improved from 7.65 ± 0.77 to 2.0 ± 0.72 post-operatively while the post-operative VAS score for back pain was 1.23 ± 0.83. Only one patient with a L5-S1 extra-foraminal herniation presented with a recurrence and he was managed conservatively. **Conclusion:** The 14-mm tubular TF discectomy offers a safe and effective technique, providing sustained pain relief and functional improvement while minimizing tissue trauma and preserving integrity.

ID: AGS26/2662
P0738: Manejo del síndrome facetario lumbar mediante crioablación percutánea en un centro médico de tercer nivel

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Introduction: Lumbar facet syndrome is a frequent etiology of chronic low back pain, with an estimated prevalence ranging from 15% to 31% and a lifetime incidence reported up to 52% in certain series (1). Percutaneous cryoablation constitutes a minimally invasive technique that may provide temporary pain relief with a low rate of complications (2). The procedure induces axonotmesis by freezing at -60 °C, while preserving the nerve's connective structures and allowing subsequent regeneration (3). **Objective:** To evaluate the effectiveness of percutaneous cryoablation in patients with lumbar facet syndrome treated at Centro Médico ISSE-MyM Ecatepec between February 2024 and February 2025. **Material and Methods:** Observational, prospective study including 15 patients diagnosed with lumbar facet syndrome. The sample was selected by convenience and was non-probabilistic. **Results:** In the immediate post-operative period, 100% of patients reported pain improvement. Of the ten patients with severe functional limitation (Oswestry Disability Index), four reported no functional limitation, six reported minimal limitation, and five reported moderate limitation at the first postoperative month. **Conclusion:** Percutaneous cryoablation is an effective and safe option for the treatment of lumbar facet syndrome in patients who do not respond to conservative management. Despite the small sample size, the results are promising and highlight the need for studies with larger populations and longer follow-up.

ID: AGS26/2681
P0739: Combined percutaneous and mini-open decompression and fixation for pars defect using a multiaxial facet screw system: technique and case series

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Introduction: Pars interarticularis defects can progress to mechanical back pain and spondylolisthesis. Open fusion remains a standard option but carries morbidity from muscle detachment and wider exposure. A combined mini open decompression and percutaneous fixation strategy may achieve stabilization with less soft tissue disruption. This report describes the technique using a multiaxial facet screw system and presents clinical and radiographic outcomes. **Materials and Methods:** A retrospective review identified four consecutive patients with imaging confirmed pars defects and persistent symptoms after nonoperative management. All underwent targeted neural decompression through a limited midline incision followed by percutaneous placement of multiaxial facet screws across the pars with direct grafting. Two patients received additional interbody fusion and pedicle screw fixation to augment stability, and one patient received a single screw due to bone quality. Pain was measured with Visual Analogue Scale at baseline and at follow up. Fusion was assessed with serial radiographs and computed tomography. Adverse events and reoperations were recorded. **Results:** The cohort included three males and one female (n =4) with a mean age of thirty-six years and a mean body mass index of 30.2. No intraoperative complications occurred. Mean Visual Analogue Scale improved from 6.5 preoperatively to 3.0 at six months (p =

0.032), with further improvement at one year. Fusion was confirmed in all cases. No implant failures or pseudarthrosis were observed. One patient sustained trauma at one year and required revision. Another experienced trauma without the need for additional surgery. Follow up imaging showed progressive healing and maintained stability. **Conclusion:** Combined mini open decompression and percutaneous multiaxial facet screw fixation was feasible and achieved pain reduction and fusion in all cases in this small series. The technique may offer a lower morbidity alternative to open fusion for selected patients with pars defects and warrants evaluation in larger cohorts with longer follow up.

ID: AGS26/2697
P0740: Surgical outcomes and complications for patients undergoing vertebral body tethering with a 5-8 year follow-up

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Introduction: VBT aims to gradually correct scoliosis, using patients' growth, while preserving spine motion. We report outcomes and surgical complications at a minimum of 5 years (range 5-8 years) post VBT in skeletally immature patients. Our hypothesis is that vertebral body tethering (VBT) has acceptable complication rates while maintaining satisfactory curve correction at a minimum follow-up of 5 years. Tether breakages, depending on the timing of their occurrence, do not exert a significant impact on the postoperative curve progression. **Material and Methods:** In this prospective single center cohort study we reviewed 74 idiopathic scoliosis patients who underwent VBT, with a minimum of five-year follow-up. Patients had preoperative, first erect, one-year, two-year and five-year X-rays. Postoperative data at each of these visits were analyzed. Interval increases of $\geq 5°$ in coronal curve angle from the smallest postoperative measure prompted segmental interscrew angle measurements to detect tether breakage, suspected with a $\geq 5°$ increase. **Results:** All 74 patients were skeletally immature, mean age at surgery is 11.8 ± 1.3 years and the mean follow-up time is 63.4 ± 8.4 months. VBT was performed on an average of 7.4 vertebral levels. Instrumented Cobb angle was 48.7° ± 9.2° preop, 17.1° ± 12.3° at the 2-year postop and 25.7° ± 14.0° at the 5-year postop. Unplanned Return to the Operating Room (UPROR) occurred in 12 patients (16,2%). Four patients needed either partial or complete release of the tether due to overcorrection, 2 patients needed revision of VBT due to curve progression, 4 patients required posterior spinal fusion (PSF) due to curve progression. One patient needed revision of VBT followed by PSF. Two patients developed a small dural tear recognized postoperatively and treated with a blood patch. Forty-nine patients (66%) had a suspected broken tether at the last follow up. The mean time of the 1st tether breakage is 38.1 ± 15 months. Without UPROR, 66% (49/74 pts) had a curve < 40° at a minimum of 5 years post-op after a single surgical event. **Conclusion:** In our cohort 66% (49 patients) had a suspected radiological tether break after 5 years and 7% (5 patients) required PSF. VBT offers a significant correction in the coronal and transverse planes postoperatively with a reoperation rate of 16.2%.

ID: AGS26/2704
P0741: In-vitro investigation and the effect of endoscopes on spinal epidural pressure changes with a dynamic irrigation pump

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Introduction: Over the past few decades, full-endoscopic spinal surgery has become an increasingly utilized technique with expanding clinical indications. With its growing prevalence, unique complications have been reported that may be related to elevated epidural pressure, including headaches, neck pain, seizures, intracranial hemorrhage, and retinal hemorrhage. During full-endoscopic procedures, continuous irrigation with pressurized isotonic saline is employed to maintain a clear surgical field. However, this irrigation may induce pressure changes in the epidural space. The present study aimed to measure these potential pressure alterations and to investigate the influence of different endoscope designs and irrigation modes of dynamic irrigation pumps on pressure changes at various spinal epidural levels. **Material and Methods:** Two cryopreserved cadavers were used in this experimental study. Measurement needles were inserted into predetermined epidural sites along the spine. Continuous irrigation was performed under three different pump settings using two endoscopes with distinct designs. The pressure conditions examined included Arthro mode-low pressure, Arthro mode-medium pressure, and Spine mode. Pressure values were measured with PeakTech P 5150 differential pressure meters and simultaneously transferred to a laptop via USB connection. All data were exported to Microsoft Excel

for detailed analysis. **Results:** When comparing the three irrigation settings, the lowest pressure levels were observed under Spine mode, ranging between 37-42 mmHg, which were distinctly lower than those recorded under Arthro mode settings. Certain surgical maneuvers-such as introducing an instrument through the working channel or temporarily blocking the endoscope outflow-were found to cause rapid epidural pressure fluctuations across different spinal levels. In addition, comparisons between the two endoscopes revealed that Model X consistently demonstrated lower pressure levels than Model Y under Arthro mode-low and medium pressure settings. In Spine mode, both endoscopes produced similar pressure patterns, though Model X showed slightly higher values than Model Y. These variations are likely attributable to differences in endoscope design and the mechanisms of the irrigation pump. **Conclusion:** Epidural pressure alterations induced by continuous irrigation during full-endoscopic spinal surgery may contribute to potentially serious complications. Surgical maneuvers, endoscope design, and irrigation pump settings play a pivotal role in determining the magnitude of these pressure changes. Awareness of these contributing factors and appropriate preventive measures are essential to ensuring patient safety and minimizing the risk of pressure-related adverse events during full-endoscopic procedures.

ID: AGS26/2733
P0742: Unilateral biportal endoscopic resection of intradural extramedullary tumors: case series and systematic review

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Introduction: Endoscopic spinal surgery has transformed the management of spinal disorders by providing minimally invasive alternatives with reduced morbidity compared to open approaches. Among these, unilateral biportal endoscopy (UBE) has emerged as a versatile technique, combining the visualization benefits of endoscopy with the surgical freedom of microsurgery. Originally developed for degenerative lumbar conditions, UBE allows independent movement of the endoscope and instruments through two portals, minimizing tissue trauma and optimizing outcomes. While its application in lumbar decompression and fusion is well established, the use of UBE for intradural extramedullary tumors, such as meningiomas, has not been reported. This study presents the first clinical series of intradural extramedullary tumor resections using UBE and a systematic review of the literature. **Material and Methods:** We conducted a case series of three patients undergoing UBE-assisted resection of intradural extramedullary tumors. Patient selection was based on clinical and radiological findings consistent with spinal cord compression symptoms. The surgical technique employed a unilateral biportal posterior approach with continuous saline irrigation, as described in standard UBE protocols. Postoperative outcomes were assessed clinically and radiologically. In parallel, a systematic review was performed in accordance with PRISMA guidelines. Searches were conducted in PubMed, Scopus, and Web of Science using combinations of the terms: *"unilateral biportal endoscopy," "UBE," "spinal tumor," "intradural extramedullary,"* and *"meningioma."* Studies were included if they reported clinical application of UBE for tumor resections. No restrictions were applied regarding year or language of publication. **Results:** Case 1: A patient with a history of neurofibromatosis presented with left C7 paresis (4/5), cervicalgia, and C7-predominant paresthesias. MRI revealed a cervical intradural extramedullary lesion with dural tail, suggestive of meningioma. UBE-assisted resection was performed without complications, and the patient was discharged after 24 hours with improved neurological function. Case 2: A thoracic lesion at T2-T3 presented with ataxia, distal paresthesias from T4 caudally, paresis (L2-S1, 4-/5), and dysesthesia evolving over three months. UBE resection was uneventful, with immediate postoperative relief of dysesthesia and progressive motor recovery within 72 hours. Case 3: A 1 × 1 cm thoracic lesion at T10, radiologically consistent with meningioma, was associated with girdle-like paresthesias. UBE-assisted removal achieved complete resection with symptomatic improvement postoperatively. **Systematic Review:** Literature search identified no prior reports of cervical or thoracic intradural extramedullary tumor resections performed with UBE. Existing studies focused predominantly on degenerative conditions, stenosis, and lumbar pathology. Our findings therefore represent the first reported application of UBE for this indication. **Conclusions:** This report constitutes the first documented series of intradural extramedullary tumor resections using UBE. The favorable outcomes observed-including rapid recovery, minimal complications, and short hospitalization-highlight the potential of UBE as a minimally invasive alternative for select spinal tumors. By replicating the surgical freedom of open microsurgery while minimizing tissue trauma, UBE may redefine management strategies for these lesions. Our cases establish proof-of-concept and lay the groundwork for further clinical studies, potentially expanding the role of UBE beyond degenerative conditions into oncological applications. These findings represent a milestone in minimally invasive spinal oncology and suggest that UBE could become a valuable addition to the neurosurgical armamentarium.

ID: AGS26/2744
P0743: Uniportal versus biportal endoscopic surgery for lumbar pathologies: an umbrella review

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Introduction: Endoscopic lumbar surgery can be performed through either a single working portal (uniportal) or two separate portals (biportal), yet it remains unclear which approach offers superior operative efficiency and safety. Conflicting findings across recent systematic reviews warrant an umbrella review to consolidate the highest-level evidence and guide surgical decision-making. **Methods:** We performed an umbrella review of systematic reviews and meta-analyses comparing unilateral biportal with uniportal full-endoscopic lumbar surgery in adults with spinal stenosis or disc herniation. MEDLINE, Embase, Web of Science, Scopus, the Cochrane Database of Systematic Reviews, Epistemonikos and LILACS were searched from inception to 1 September 2025 without language or publication-status limits; PROSPERO and reference lists were also screened. Two reviewers independently selected studies, extracted pooled effect estimates for operative time, intra-operative blood loss and overall complications, and assessed quality with AMSTAR-2. Study overlap was quantified with the Corrected Covered Area. Log-transformed pooled effects were synthesised using a Hartung-Knapp random-effects model, providing 95% prediction intervals, I^2 and small-study bias tests (Egger or Peters). Analyses were repeated after de-duplicating primary studies, and certainty of evidence was graded with GRADE. **Results:** Six eligible meta-analyses contributed 763 biportal and 654 uniportal cases (five on lumbar spinal stenosis, one on disc herniation). For stenosis, two high-quality reviews showed a mean operative-time saving of 10-16 minutes with biportal surgery, whereas a smaller review found no difference. In disc-herniation surgery, biportal techniques were 17 minutes slower on average. Differences in blood loss were clinically trivial, ranging from a 3 mL reduction to a 10 mL increase. No review demonstrated a statistically robust difference in overall complications (pooled odds-ratio range 0.60-1.38; representative estimate 0.68, 95 % CI 0.45-1.01). Heterogeneity was low to moderate ($I^2 \leq 18$ %), and evidence certainty was graded moderate due to inconsistency in operative-time findings. **Conclusion:** Current evidence, from six meta-analyses pooling more than 1 400 cases, suggests that biportal endoscopic surgery offers a modest operative-time advantage over uniportal techniques for lumbar spinal stenosis, but this benefit is not consistent across pathologies and disappears in disc-herniation cohorts. Differences in intra-operative blood loss are clinically negligible, and complication rates do not differ meaningfully between approaches. Overall certainty is moderate, limited chiefly by inconsistency in time outcomes. Well-designed primary trials with uniform outcome reporting are still needed to clarify whether the small efficiency gains of biportal surgery translate into faster recovery, reduced costs or improved long-term function.

ID: AGS26/2748
P0744: Better alignment, higher risks: open TLIF compared to minimally invasive TLIF

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Introduction: Transforaminal lumbar interbody fusion (TLIF) is widely used to treat degenerative lumbar spine disorders. Minimally invasive (MI) techniques were introduced to reduce perioperative morbidity, but their impact on radiographic correction compared to open TLIF remains debated. This study compared perioperative safety, radiographic outcomes, and long-term complications of single level MI versus open TLIF. **Material and Methods:** We retrospectively reviewed 62 patients who underwent single level TLIF between 2021 and 2024 at a tertiary academic medical center (32 open and 30 MI). Baseline demographics and surgical indications were comparable, although spondylolisthesis was more frequent in the MI group (86.7 percent versus 56.2 percent, p=0.008). Clinical, radiographic, and perioperative data including operative time, estimated blood loss (EBL), hospital stay, complications, rates of adjacent segment disease (ASD), and extent of sagittal alignment correction were analyzed with parametric and nonparametric tests.

Results: MI TLIF demonstrated significant reductions in operative time (138.9 versus 186.2 minutes, p = 0.001), EBL (51.5 versus 185.1 mL, p < 0.001), and total length of stay (4.1 versus 7.7 days, p = 0.036). The rate of drain placement was also lower in the MI group (0 percent versus 75 percent, p < 0.001). Intraoperative durotomy occurred more frequently with open TLIF (18.8% versus 0%, p = 0.013). At follow up, ASD was significantly more common in the open group (50.0 percent versus 23.3 percent, p = 0.03). Radiographically, open TLIF achieved greater correction of both global lordosis (4.9 degrees versus 0.7 degrees, p = 0.047) and segmental lordosis (4.9 degrees versus 2.5 degrees, p = 0.045). Other complication rates including pseudarthrosis, infection, and reoperation were low and comparable across groups. Functional outcomes and symptom improvement were also similar across groups. **Conclusion:** MI TLIF offers selective advantages in reducing operative morbidity, shortening hospitalizations, and lowering rates of ASD while maintaining comparable functional outcomes. Open TLIF provides superior restoration of sagittal alignment and may be more favorable when deformity correction is the primary goal. Surgical approach should be tailored to the patient's pathology and clinical objectives.

ID: AGS26/2749
P0745: Endoscopic treatment of Chiari type-1: systematic review and metanalysis

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Introduction: Conventional posterior-fossa decompression with wide suboccipital craniectomy and duraplasty is effective for Chiari malformation type I but is associated with notable morbidity, including cerebrospinal-fluid (CSF) leak, pseudomeningocele and prolonged recovery. Advances in visualization technology have enabled **endoscope-assisted and fully endoscopic** decompressive techniques that aim to minimize tissue disruption, reduce blood loss and shorten operative time while preserving clinical efficacy. However, published experience remains fragmented and small-scale. A systematic synthesis of peri-operative outcomes is therefore warranted to clarify the current safety profile and technical feasibility of these minimally invasive approaches. **Methods:** A systematic review was undertaken in accordance with PRISMA-2020 guidelines. MEDLINE (via PubMed), Embase, Web of Science, Scopus and the Cochrane CENTRAL database were searched from inception to 23 September 2025 using the keywords *"Chiari I"*, *"posterior fossa decompression"*, *"endoscope-assisted"*, *"fully endoscopic"* and related synonyms. Reference lists of included papers were screened manually. Eligible studies were English-language clinical reports (any design) that described endoscope-assisted or fully endoscopic posterior-fossa decompression for symptomatic Chiari I and detailed at least one peri-operative outcome of interest. When multiple publications reported overlapping cohorts, the study with the **larger** patient number was retained. Two independent reviewers screened titles/abstracts, evaluated full texts, and extracted data on: author, year, sample size, operative time, estimated blood loss, number and nature of complications, need for duraplasty, study design, and type of endoscopic approach. Disagreements were resolved by consensus. Because of small heterogeneous samples, quantitative pooling was limited to simple **weighted means** for continuous variables and aggregate counts for dichotomous outcomes; no formal meta-analysis or between-group statistical testing was attempted. Risk of bias was appraised with the NIH Study-Quality tools for case series and the JBI checklist for case reports. **Results:** Four studies met the eligibility criteria, encompassing 41 patients who underwent minimally invasive posterior-fossa decompression for Chiari I. Thirty-eight procedures (93%) used an endoscope-assisted technique and three (7%) a fully endoscopic approach. As for Operative metrics, the weighted mean operative time was 117 min (range of study means 101-192 min). Endoscope-assisted cases averaged 110 min, whereas the two fully endoscopic reports required a mean of 192 min. Intraoperative blood loss, documented for the endoscope-assisted cohorts only, yielded a weighted mean of 56 mL (study means 30-72 mL); both fully endoscopic papers described negligible or unquantified loss. When analyzing *Complications*, A total of 7 procedure-related events (17%) were reported, all within the largest endoscope-assisted series and confined to dural tears (n = 4) or inadequate decompressions requiring secondary intervention (n = 3). No neurological deficits, infections, or mortality occurred. The fully endoscopic cases were complication-free. As for the use of Duraplasty, Routine duraplasty was avoided in 40 of 41 patients (98%); one illustrative fully endoscopic case incorporated a planned patch graft, while grafting in the endoscope-assisted series was restricted to repair of inadvertent dural tears. **Conclusion:** Current evidence, driven by a single 23-patient cohort, indicates that endoscope-assisted decompression achieves short operative times, minimal blood loss, and low morbidity, although minor dural complications persist. Fully endoscopic techniques appear feasible and similarly blood-sparing but are based on only three reported cases and demand longer operating times; larger prospective series are required to validate these preliminary findings.

ID: AGS26/2784
P0746: Modified transfacet approach in full endoscopic lumbar interbody fusion: a one-year outcome report

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Introduction: Full-endoscopic lumbar interbody fusion (FE-LIF) represents a significant evolution in minimally invasive spine surgery, aiming to reduce approach-related morbidity. Our novel technique, the modified transfacet approach facilitates direct decompression and cage insertion under continuous endoscopic visualization. However, there remains a need for robust data on its mid-to-long term efficacy. This study aimed to evaluate the one-year clinical and radiological outcomes of patients underwent single-level FE-LIF using this specific technique for degenerative lumbar spondylolisthesis. **Material and Methods:** This retrospective cohort study included 41 patients who underwent single-level FE-LIF at a single institution between January 2023 and June 2024. Key demographic and perioperative data, including operative time, estimated blood loss (EBL), and length of stay (LOS), were collected. Clinical outcomes were assessed using the Visual Analog Scale (VAS) for back and leg pain and the Oswestry Disability Index (ODI) at preoperative, 1-day, 1-month, 6-month, and 12-month follow-ups. The primary radiological outcome, fusion status, was evaluated at 12 months using CT scans and graded according to the Bridwell classification, with grades I and II considered solid fusion. **Results:** The cohort had a mean age of 61.9 years and a mean BMI of 26.2 kg/m^2. The mean operative time was 143.9 ± 12.0 minutes, with an average EBL of 91.3 ± 22.6 mL and a mean LOS of 3.1 ± 0.8 days. Significant improvements were observed across all clinical metrics ($p < 0.001$). VAS back pain decreased from 7.78 ± 0.65 preoperatively to 1.07 ± 0.57 at one year, while VAS leg pain decreased from 7.80 ± 0.84 to 0.85 ± 0.53. Functional outcomes showed marked improvement, with the ODI score decreasing from 67.61 ± 2.87% to 10.29 ± 2.08% at the final follow-up. At one year, the CT-confirmed fusion rate (Bridwell Grade I or II) was 95.1% (39 of 41 patients). **Conclusion:** In this cohort, FE-LIF via the modified transfacet approach provided significant and sustained improvements in pain and functional disability at one year. Consistent with a high radiographic fusion rate and favorable perioperative metrics, we can conclude that the technique is safe and effective for alternative minimal invasive surgery in selected patients with degenerative lumbar spondylolisthesis.

ID: AGS26/2788
P0747: Would you recommend your spine surgery? Postoperative satisfaction versus reality

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Introduction: Patient satisfaction is a key driver of surgical recommendation, yet little is known about which spine surgeries patients actually recommend, or whether satisfaction always translates into recommendation. This study aimed to identify patient and surgical factors associated with recommending surgery to others, as well as discrepancies between satisfaction and recommendation. **Material and Methods:** We conducted a multicenter retrospective cohort study using registry data from 13 tertiary referral hospitals (2017-2021). Adults (> 18 years) who underwent surgery for degenerative or deformity conditions were included; revision, trauma, and tumor cases were excluded. Demographics, surgical details, and EuroQOL-5D (EQ-5D) scores were collected. Procedures were grouped into eight categories: cervical deformity (CD), thoracolumbar deformity (TLD), posterior cervical decompression (PCD), anterior cervical fusion (ACF), posterior cervical fusion (PCF), thoracolumbar disc herniation surgery (TLDH), posterior thoracolumbar decompression (PTLD), and posterior thoracolumbar fusion (PTLF). Combined anteroposterior procedures were categorized as posterior. Satisfaction and recommendation were assessed at 1 year postoperatively using 7-point Likert scales. A discrepancy between satisfaction and recommendation (DSR) was defined as a recommendation score ≥2 points lower than satisfaction. Logistic regression analysis was performed to identify risk factors for DSR, adjusting for age, sex, BMI, smoking history, surgical procedure, interbody fusion, osteotomy, use of endoscopy, and baseline EQ-5D. **Results:** A total of 7,415 patients (mean age 65 ± 14 years, 60% male) were included: CD (n = 16), TLD (n = 175), PCD (n = 1031), ACF (n = 288), PCF (n = 236), TLDH (n = 1326), PTLD (n = 2576), PTLF (n = 1767). Endoscopy was used in 2689 (36%) cases. Overall, 82% reported satisfaction (≥ "Somewhat satisfied"), and 77% would recommend their surgery (≥ "Somewhat recommend"). Recommendation rates varied by procedure: CD (88%), TLD (59%), PCD (70%), ACF (76%), PCF (69%), TLDH (88%), PTLD (78%), PTLF (74%). DSR rates were: CD (13%), TLD

(15%), PCD (7%), ACF (8%), PCF (9%), TLDH (7%), PTLF (11%). Female patients had higher odds of DSR (aOR = 1.7, $p < .001$), while endoscopic surgery was associated with lower odds (aOR = 0.52, $p < .001$). **Conclusion:** Recommendation rates differed substantially across procedures, with TLD and PCF lowest. Female patients were more likely to experience DSR, indicating that reported satisfaction does not always align with willingness to recommend. Endoscopic surgery was linked to reduced DSR. Enhancing patient counseling and minimizing surgical invasiveness may improve patient perception and reduce satisfaction-recommendation discrepancies.

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P0748: Endoscopic versus open lumbar decompression: a propensity-matched national cohort study of 50,000 patients with 90-day follow-up

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Introduction: Endoscopic lumbar decompression has emerged as a minimally invasive alternative to conventional open decompression for degenerative lumbar disease. While prior studies suggest potential benefits in perioperative recovery, large-scale evidence comparing safety outcomes between endoscopic and open approaches remains limited. This study compared 90-day complication rates, reoperation, and healthcare utilization between endoscopic and conventional lumbar decompression using a real-world national database. **Material and Methods:** We conducted a retrospective cohort study using the TriNetX Research Network, which aggregates de-identified electronic health records from 105 U.S. healthcare organizations. Adults undergoing lumbar decompression were identified using procedure codes for percutaneous endoscopic lumbar decompression and discectomy (endoscopic cohort) or conventional open decompression (non-endoscopic cohort). Patients with fracture, infection, tumor, deformity, or concurrent alternative decompression codes were excluded. The TriNetX platform applies a 20-year look-back for index events; no patients were excluded by this criterion. Outcomes were assessed from day 1 through day 90 following the index procedure. Primary outcomes were incidental durotomy, cerebrospinal fluid (CSF) leak or pseudomeningocele, and unplanned reoperation. Secondary outcomes included emergency department revisit, inpatient readmission, length of stay, discharge disposition, meningitis, wound disruption, venous thromboembolism, and myocardial infarction. Superficial and deep surgical site infections were not analyzed due to export limitations. Propensity score matching was performed 1:1 using age, sex, race/ethnicity, comorbidities, and surgical indication as covariates. Measures of association are reported as risk ratios with 95% confidence intervals; significance was set at $p < 0.05$. **Results:** After matching, 25,242 patients were included in each cohort. Endoscopic decompression demonstrated significantly lower rates of incidental durotomy (0.3% vs 0.5%, RR 0.55, $p < 0.001$), CSF leak or pseudomeningocele (0.2% vs 0.5%, RR 0.45, $p < 0.001$), and unplanned reoperation (0.1% vs 1.8%, RR 0.06, $p < 0.001$) compared with open decompression. Healthcare utilization was slightly higher with endoscopic decompression (7.2% vs 6.8%, RR 1.07, $p = 0.041$). Meningitis was also more frequent in the endoscopic cohort (0.4% vs 0.3%, RR 1.44, $p = 0.018$). No significant differences were observed in wound disruption (0.7% vs 0.8%, $p = 0.269$), deep vein thrombosis (0.8% vs 0.7%, $p = 0.193$), or myocardial infarction (0.4% vs 0.2%, $p = 0.356$). **Conclusion:** In this large matched cohort with 90-day follow-up, endoscopic lumbar decompression was associated with statistically lower rates of incidental durotomy, CSF leak, and unplanned reoperation compared with conventional open decompression. However, the absolute differences were small (e.g., durotomy 0.3% vs 0.5%) and unlikely to be clinically meaningful. Endoscopic cases showed slightly higher healthcare utilization and meningitis, but no increases in systemic complications were observed. Overall, these findings support the safety of endoscopic approaches, though their advantages over open decompression appear modest in magnitude.

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P0749: Clinical and radiological outcome of endoscopic interlaminar decompression for Grade I stable degenerative Spondylolisthesis

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Introduction: Traditional Decompression laminectomy for grade 1 degenerative spodylolisthesis can cause postoperative instability due to loss of posterior ligamentum complex. Decompression and fusion is a more morbid procedure resulting in loss of motion segments. Endoscopic interlaminar decompression can preserve the posterior stabilising structures as well the motion segment. This study aims to analyse the clinical and radiological outcome after interlaminar endoscopic decompression for grade 1 degenerative spondylolisthesis. **Materials and Methods:** We retrospectively studied

26 patients of grade 1 degenerative spodylolisthesis with mean age of 63.3 years ,18 females and 8 males. Listhesis was at L45 in 22 patients, L5S1 in 3 patients and L34 in 1 patient. The average follow up was 1.7 years. All patients w Had pre and post operative VAS and ODI scores. Radiological parameters include slip grade, slip angle, slip percentage, disc height and disc index were measured in lateral radiographs. **Results:** All patients had significant improvement in VAS and ODI scores postoperatively at immediate ,6 months and 1 year follow up. There was no significant difference in the radiological parameters, grade of slip, slip angle, percentage of slip, disc height and disc index. No patients required fusion till the end of follow up. **Conclusion:** Interlaminar endoscopic decompression is a safe and effective procedure for grade 1 lumbar spondylolisthesis.

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P0750: Endoscopic versus open lumbar discectomy: a two-year prospective randomized trial

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Introduction: Lumbar disc herniation is a leading cause of back and radicular pain, often requiring surgical management when conservative treatment fails. Traditional open discectomy remains the gold standard, yet minimally invasive endoscopic approaches are increasingly employed. The study hypothesis was that endoscopic discectomy provides faster recovery and reduced tissue disruption, albeit with a potentially higher reoperation rate compared with conventional open discectomy. **Materials and Methods:** This prospective randomized clinical trial enrolled 200 patients with single-level lumbar disc herniation. Patients were assigned to conventional open discectomy (n = 100) or endoscopic discectomy (n = 100). Magnetic resonance imaging (MRI) of the lumbar spine was performed preoperatively, immediately postoperatively, and at 1, 3, 6, 12, 18, and 24 months. Clinical outcomes were assessed at each follow-up visit using the visual analogue scale (VAS) for back and leg pain, the Core Outcome Measures Index (COMI), and the Oswestry Disability Index (ODI). **Results:** The endoscopic group demonstrated a higher reoperation rate compared with the open group. However, patients undergoing endoscopic discectomy returned to work earlier. Functional outcomes, as measured by COMI and ODI, were comparable between both groups throughout the two-year follow-up. Radiological evaluation revealed fewer postoperative changes in the spinal canal, paraspinal soft tissues, and subcutaneous layers in the endoscopic cohort, and smaller surgical scars were confirmed clinically. **Conclusion:** Endoscopic discectomy is associated with faster recovery and reduced soft tissue disruption but carries a higher risk of reoperation compared with conventional open discectomy. These findings support the role of endoscopic techniques as a viable alternative to open surgery, particularly in patients prioritizing early return to function.

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P0751: Unilateral biportal endoscopy: reframing its classification within full-endoscopic spine surgery

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Introduction: Endoscopic spine surgery (ESS) has evolved considerably in recent years. The AOSpine consensus paper standardized nomenclature for working-channel endoscopic procedures, classifying unilateral biportal endoscopy (UBE) as "endoscopy-assisted." However, this classification may not fully reflect current evidence and surgical practice, where UBE demonstrates characteristics consistent with full-endoscopic spine surgery (FESS). **Material and Methods:** We critically reviewed the AOSpine consensus definitions, the etymological and conceptual foundations of "endoscopy," and recent literature on UBE. Comparative analysis with uniportal working-channel techniques and analogous multiportal endoscopic procedures (arthroscopy, transnasal endoscopy) was performed to assess whether UBE fulfills the defining criteria of FESS. **Results:** UBE provides direct, continuous, and exclusive endoscopic visualization within a fluid-irrigated environment, using small incisions and high-resolution optics. This fulfills the essential criteria of FESS, distinguishing it from endoscopy-assisted or hybrid approaches that rely on complementary visualization modalities. Clinical studies demonstrate favorable outcomes, ergonomic benefits, cost-efficiency, and a shorter learning curve. Comparable multiportal procedures in other fields are universally recognized as full-endoscopic, reinforcing the conceptual validity of UBE as FESS. **Conclusion:** UBE fulfills the fundamental requirements of full-endoscopic spine surgery. Reclassifying UBE as FESS would enhance semantic precision, scientific communication, and clinical adoption, aligning terminology with evolving surgical practice and supporting evidence-based research in ESS.

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P0752: Two-year radiological fusion outcomes following biportal endoscopic transforaminal lumbar interbody fusion using banana-shaped interbody cages

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Introduction: Biportal endoscopic transforaminal lumbar interbody fusion (BESS-TLIF) is an emerging minimally invasive technique. This study aimed to evaluate the two-year radiological fusion outcomes of single-level BESS-TLIF using a specific banana-shaped, porous titanium interbody cage. **Material and Methods:** This retrospective study reviewed 51 patients who underwent the specified procedure. The primary endpoint was the radiological fusion rate, assessed by computed tomography (CT) over 24 months using a three-grade system. Factors influencing fusion, particularly bone graft composition (demineralized bone matrix [DBM] only vs. DBM with I-FACTOR), were also analyzed. **Results:** The final complete fusion rate at two years was 96.1%. Bony fusion occurred predominantly in the posterior and intracage regions. The only significant factor influencing fusion was the bone graft material. The 'DBM with I-FACTOR' group achieved complete fusion significantly faster than the 'DBM only' group (log-rank test, $p < 0.001$), with a higher final fusion rate (100% vs. 83.3%, $p = 0.045$). **Conclusion:** Single-level BESS-TLIF using a banana-shaped, porous titanium cage provides favorable two-year radiological fusion rates. The selective addition of I-FACTOR as an oste-oinductive supplement can significantly accelerate the time to achieve solid arthrodesis.

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P0753: Lumbar UBE program outcomes: case-mix and early outcomes from a consecutive single-team series

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Introduction: Unilateral biportal endoscopy (UBE) is a minimally invasive technique for lumbar degenerative disease that uses two small portals and standard endoscopic instruments to achieve targeted discectomy and decompression with limited muscle trauma. Its growing adoption reflects reproducible visualization, preservation of paraspinal musculature, and the potential for fast mobilization and short hospital stay. **Material and Methods:** Retrospective audit of consecutive lumbar UBE cases performed by the same surgical team from May 2024 to February 2025. Descriptives are presented as median for continuous variables and proportions for categorical variables. Primary endpoints at ≥ 6-month follow-up were validated patient-reported outcomes (VAS back/leg, modified Macnab) and reoperation at the index level. Secondary endpoints included operative time, estimated blood loss (EBL), 90-day adverse events (dural tear, infection, new neurologic deficit, readmission), conversion to open surgery, time to independent ambulation without aids, length of stay, and early VAS at 3 months. **Results:** Ninety-one patients were analyzed (median age 58.0 years; 51.6% men). The primary diagnosis was lumbar disc herniation in 56.0% (51/91) and lumbar stenosis in 44.0% (40/91). Among disc herniations, protrusions predominated (92.2%, 47/51), with extrusions 5.9% (3/51) and multiple herniations 2.0% (1/51), corresponding to 51.6%, 3.3%, and 1.1% of the total cohort, respectively. Among stenosis cases, central stenosis comprised 67.5% (27/40), foraminal 30.0% (12/40), and mixed 2.5% (1/40)-i.e., 29.7%, 13.2%, and 1.1% of the overall sample. Early postoperative outcomes were favorable: conversion to open surgery 0%, index-level reoperation 0%, EBL < 30 mL, median modified Macnab 1.2 (1 = excellent), mean VAS at 3 months 2.0, mean time to independent ambulation 14 hours, and 100% discharge ≤ 24 hours. **Conclusion:** This consecutive UBE series was dominated by protrusive herniations and central stenosis and demonstrated rapid recovery with no conversions, excellent early patient-reported status, and universal 24-hour discharge. Taken together with contemporary evidence, these real-world results support UBE as a safe, efficient option that achieves clinical outcomes comparable to open/microscopic surgery while facilitating early mobilization and streamlined perioperative care.

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P0754: Lumbar corpectomy and fusion through minimal invasive oblique approach for osteoporotic burst fracture under 3D navigation

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Introduction: Compression fractures of the lumbar spine are common conditions in the elderly population. After conservative treatment proves ineffective, some patients may

undergo minimally invasive surgery using vertebral augmentation with bone cement. However, in cases where vertebral fragmentation is severe, surgical removal of the fractured vertebra and reconstruction with a mobile artificial vertebra may be necessary. We assess the safety and accuracy of navigation-assisted oblique lumbar surgery, potential challenges, and overall benefits of the procedure. We also aim to evaluate whether combined anterior and posterior fusion can reduce the number of fused segments. **Material and Methods:** From 2022 to 2024, four patients with L3 vertebral burst fractures underwent navigational-assisted oblique lumbar surgery for vertebra removal and artificial implantation in a hybrid operating room. Simultaneously, patients underwent posterior fusion of the adjacent segments, with two cases utilizing bone cement-enhanced pedicle screws. Under general anesthesia, patients were positioned laterally. Employing a lateral approach that minimizes disruption to the abdominal and lumbar muscles, we, guided by navigation, removed the fragmented L3 vertebra and implanted a titanium expandable artificial vertebra (see Figures). Follow-up lumbar X-ray imaging was conducted at seven days, one month, three months, and six months post-surgery to assess implant stability and bone fusion. Prognosis was evaluated using back pain indices and the ODI functional scale. **Results:** Two patients experienced significant improvement in both pain Visual Analog Scale (VAS) and Oswestry Disability Index (ODI), along with a notable enhancement in lumbar lordosis angle. However, for the remaining two patients, one exhibited no change, while the other experienced a deterioration in symptoms. The unsatisfactory outcomes were attributed to cage subsidence and screw loosening, prompting revision surgery for one patient due to intractable pain. **Conclusion:** Lumbar corpectomy performed through an oblique approach under 3D navigation is a secure procedure that contributes to reduced radiation exposure. Nevertheless, cage subsidence remains a prevalent issue, particularly among osteoporotic patients, potentially resulting in surgical failure. Based on our cases, we recommend the use of cement-augmented screws for posterior fixation to address this challenge and enhance the overall efficacy of the procedure.

ID: AGS26/3031
P0755: Unilateral parapedicular kyphoplasty technique: a single-center series of 85 cases

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Introduction: Kyphoplasty and vertebroplasty are standard minimally invasive options for vertebral compression fractures. The conventional transpedicular approach is effective but technically challenging in patients with narrow or anatomically difficult pedicles. It also requires bilateral pedicle entry to achieve symmetrical cement filling, which increases invasiveness and carries a risk of medial pedicle perforation with cement leakage into the spinal canal. The parapedicular approach has been proposed as an alternative that allows unilateral access to the vertebral body while still providing bilateral cement distribution. This study aimed to assess the feasibility, safety, and outcomes of unilateral parapedicular kyphoplasty through cadaveric dissections and a clinical series. **Materials and Methods:** Four formalin-fixed cadavers were dissected to evaluate the parapedicular entry trajectory. After anatomical preparation, instruments were advanced via the parapedicular route under fluoroscopic guidance, and positioning was confirmed. For the clinical part, we retrospectively reviewed 85 patients treated with unilateral parapedicular kyphoplasty between 2021 and 2024 at a tertiary center. The cohort included 15 patients with metastatic lesions and 70 with osteoporotic fractures. All procedures were performed under sedation with patients prone. The entry point was located about 6 cm lateral to the midline at the level of the superior endplate. A Jamshidi needle was advanced at a 45° angle toward the pedicle-vertebral junction, allowing access to the vertebral midline. A working cannula was inserted, biopsy specimens obtained, and polymethylmethacrylate cement injected under fluoroscopy. Cement volumes were 3-6 ml in thoracic and 3-8 ml in lumbar vertebrae. **Results:** Cadaveric dissections confirmed safe access to the vertebral body midline without pedicle violation. In the clinical series, cement distribution was adequate and bilateral in all patients despite unilateral entry. Postoperative visual analog scale (VAS) scores showed significant improvement, reflecting effective pain control. Only one complication occurred: a pneumothorax, which was managed with chest tube insertion, and the patient was discharged on day three. All other patients were discharged on postoperative day one without incident. No symptomatic cement leakage, neurological deficits, or vascular complications were observed. Both metastatic and osteoporotic subgroups benefited from the technique, with favorable outcomes and rapid recovery. **Conclusion:** Unilateral parapedicular kyphoplasty provides a safe and effective alternative to the traditional transpedicular approach. It reduces the risk of medial pedicle perforation and cement leakage while enabling bilateral cement filling through a single entry. The technique avoids the need for bilateral pedicle access, thereby simplifying the procedure and minimizing morbidity. Furthermore, it is applicable to thoracic vertebrae (except T1-T3, where scapular anatomy may limit access) as well as lumbar levels. This single-center series demonstrates that unilateral parapedicular kyphoplasty is feasible, reproducible, and clinically effective. Larger prospective studies

with longer follow-up are warranted to confirm its role in the management of vertebral compression fractures.
Keywords: kyphoplasty, vertebroplasty, parapedicular approach, osteoporosis, vertebral compression fracture

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P0756: Navigating the learning curve in uniportal endoscopic spinal surgery: overcoming complications and strategies for succes

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Introduction: Uniportal endoscopic spinal surgery offers a minimally invasive approach with potential for enhanced patient outcomes. However, the technical complexity introduces a significant learning curve that can initially affect outcomes. This study evaluates a single surgeon's transition to endoscopic spine surgery, focusing on outcome optimisation over time. **Methods:** A retrospective review was conducted of 400 consecutive uniportal endoscopic spine surgeries performed by a single surgeon from October 2019 to May 2025. The data analysed included demographics, procedural details, clinical outcomes including Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Roland-Morris Disability Questionnaire (RMDQ), and EuroQol five-dimension questionnaire (EQ-5D) and complication rates. Patients were stratified into groups of 100 cases to evaluate trends across the learning curve. **Results:** Of the 400 patients the average age was 53.6 ± 17 years, ratio of male to female was 176:224 and BMI 30 ± 7 kg/m^2. Operative time, estimated blood loss and mean hospital length of stay all decreased from the first 100 cases to the final 100 cases. The overall complication rate declined from 15% to 3%, with only one intraoperative complication in the last 100 cases. Interlaminar cases initially had higher complication rates, but these improved significantly over time. Transforaminal cases showed fewer complications throughout. Patient reported outcomes exhibited marked improvement: ODI from 48.2 to 18.7, RMDQ from 14.1 to 5.3, and EQ-5D index scores rose from 0.52 to 0.83. **Conclusion:** This study demonstrates uniportal endoscopic spinal surgery can be safely and effectively integrated into clinical practice despite a steep learning curve. Improvements in efficiency, complication rates, and patient outcomes underscore the importance of mentorship, iterative technique refinement, and consistent outcome tracking in successful adoption

ID: AGS26/3099
P0757: Cardiac safety of antepsoas oblique lumbosacral interbody fusion: incidence and risk factors for perioperative abnormal electrocardiograms in minimally invasive spine surgery

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Introduction: Cardiac complications are serious perioperative complications in spine surgery. The minimally invasive antepsoas (MIS-ATP) approach to lumbar fusions involves limited neurovascular mobilization, yet the evidence regarding its associated cardiovascular risks remain unknown. Therefore, the objective of this study is to assess the incidence and risk factors for abnormal perioperative Electrocardiogram (ECG) after MIS-ATP fusion. **Material and Methods:** A retrospective review of 454 patients who underwent MIS-ATP fusions at a single academic medical center between 2007 and 2020 was conducted. Demographics, comorbidities, preoperative echocardiography (ECHO) data, postoperative ECG findings were collected. Preoperative visible L1-L4 aortoiliac calcification was assessed by three graders. Analysis was performed via t-tests, ANOVA, Chi-square, and Fisher's exact tests. Multivariate logistic regression was conducted to identify independent predictors of abnormal ECG. **Results:** Common cormorbidities included: preoperative vascular calcification (49.7%), hypertension (HTN) (59.5%), and diabetes (24.4%). Postoperative ECG abnormalities were present in 83 patients (18.3%), most frequently: repolarization changes (5.7%), conduction/bradyarrhythmias (3.7%), and atrial arrhythmias (2.6%). Regression analysis identified advanced age (OR 1.07), HTN (OR 2.10), ECHO abnormalities (OR 2.02), DVT/PE history (OR 7.18), and staged > 3-level procedures as risk factors (OR 3.23) ($p < 0.05$ for all). Preoperative beta-blocker, statin, and anticoagulant use were protective (OR 0.44, $p = 0.020$). **Conclusion:** MIS-ATP was associated with a relatively low rate of perioperative ECG abnormalities despite high prevalence of vascular calcification. Careful risk stratification and perioperative optimization can help maintain MIS-ATP's strong safety profile in higher-risk populations.

ID: AGS26/3100
P0758: Clinical and radiological outcomes of unilateral biportal endoscopic TLIF with percutaneous pedicle screw fixation in grade 1 isthmic spondylolisthesis: a 1-year follow-up study of 16 patients

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Background: Isthmic spondylolisthesis at the lumbosacral junction frequently requires surgical stabilization. While open transforaminal lumbar interbody fusion (TLIF) remains effective, it is associated with extensive soft tissue trauma, blood loss, and prolonged recovery. Unilateral biportal endoscopic (UBE) TLIF combined with percutaneous pedicle screw fixation has emerged as a minimally invasive alternative that may reduce perioperative morbidity while maintaining fusion reliability. **Methods:** We retrospectively evaluated 16 patients with Grade 1 isthmic spondylolisthesis at L5-S1 who underwent UBE-TLIF with percutaneous pedicle screw fixation between January 2022 and May 2025. A standardized unilateral facetectomy, predominantly via the left-sided approach, was performed in all cases. Operative parameters, perioperative hematologic changes, complications, and radiological outcomes were assessed. Clinical outcomes were measured using the Visual Analog Scale (VAS) for leg pain and the Oswestry Disability Index (ODI) preoperatively and at 3, 6, and 12 months. **Results:** The mean age was 43 years (range, 28-64). All patients underwent single-level fusion at L5-S1. The mean operative time was 180 minutes, with an average blood loss of 100-200 mL. Hematocrit decreased by 4-5%, and hemoglobin reduction did not exceed 1 g/dL, reflecting the limited hematologic impact of the procedure. All patients were mobilized on the first postoperative day, and the mean length of hospital stay was 2.4 days. Preoperative VAS improved from 7.2 ± 1.0 to 1.6 ± 0.8 at 12 months ($p < 0.001$), and ODI improved from 64% to 20% ($p < 0.001$). At 1-year follow-up, no cases of implant loosening, retropulsion, or postoperative instability were observed. Radiographic evaluation demonstrated solid fusion in 14 patients (87.5%), while 2 patients (12.5%) showed incomplete anterior fusion without symptoms or need for revision. No neurological complications occurred. **Conclusion:** UBE-TLIF with percutaneous pedicle screw fixation, performed with a unilateral facetectomy approach, is a safe and effective minimally invasive technique for Grade 1 isthmic spondylolisthesis at L5-S1. At 1-year follow-up, the procedure provided rapid mobilization, short hospitalization, excellent clinical improvement, stable instrumentation, and high fusion rates, with minimal blood loss and negligible complications. These findings highlight the reliability and safety of endoscopic fusion in appropriately selected patients.

Table 1. Patient and Surgical Characteristics

Total patients	16
Mean age	43 (28-64)
Level fused	L5-S1 (all patients)
Facetectomy	Unilateral (mostly left-sided)
Mean operative time	180 minutes
Mean blood loss	100-200 mL
Hematocrit decrease	4-5%
Hemoglobin decrease	≤ 1 g/dL
Hospital stay	2.4 days (mean)

ID: AGS26/3109
P0759: Intraoperative changes in modified root coronal angle following biportal endoscopic lumbar decompressive foraminotomy and discectomy for lumbar foraminal stenosis

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Introduction: The standard treatment for lumbar foraminal stenosis (LFS) is paraspinal decompressive foraminotomy (PDF); however, approximately 20% of patients experience unsatisfactory outcomes. Several prognostic factors have been identified, including the lumbosacral junction, reduced posterior disc height, altered foraminal morphology, and a narrow coronal root angle (CRA). CRA is radiologic parameter defined as the obtuse angle between the exiting and traversing nerve roots on MR or CT coronal images. Previous studies have reported that CRA changes following removal of ventral pathologies. This study aimed to investigate intraoperative changes in the CRA during biportal endoscopic PDF (BE-PDF) and to evaluate whether these changes are related to clinically improvement. **Material and Methods:** This retrospective study included 92 patients who underwent BE-PDF for moderate to severe LFS. Intraoperatively, the modified coronal root angle (mCRA)-defined as the acute angle between the inferior margin of the exiting nerve root and the upper endplate of the caudal vertebra-was measured immediately after flavectomy (mCRA1) and again after removal of the ventral pathologies (mCRA2). Clinical outcomes were assessed using the Oswestry Disability Index (ODI) preoperatively and at 1 year postoperatively. Patients were stratified into two groups based on whether the ODI improved by ≥13 points compared with the preoperative value,

according to the minimal clinically important difference (MCID). Radiographic parameters, including preoperative lumbar lordotic angle (LLA), disc lordotic angle (DLA), and posterior disc height (PDH), were also measured. The relationships between mCRA and other radiographic parameters were analyzed for statistical significance between the two groups. **Results:** A total of 92 patients were included in the final analysis. The mean ODI score improved from 59.21 preoperatively to 25.79 at 1 year postoperatively. Patients were categorized into Group A (n = 74), who achieved the MCID, and Group B (n = 18), who did not. The mean mCRA1 was 28.25° in Group A and 30.17° in Group B, with no statistically difference. However, the mean mCRA2 was 32° in Group A and 38.03° in Group B, demonstrating a statistically significant difference ($p = 0.01$). Furthermore, the intraoperative change in mCRA (mCRA1-mCRA2) was 3.75° in Group A and 7.86° in Group B, which was also significant ($p < 0.001$). Radiological parameters, including LLA, DLA, and PDH, are comparable between the two groups ($p > 0.05$). **Conclusion:** Our results indicate that intraoperative changes of mCRA are significantly related to clinical outcomes, implying its potential utility as an adjunctive marker of decompression adequacy.

ID: AGS26/3188

P0760: Full endoscopic cervical discectomy achieves favorable outcomes in acute sequestered disc herniations: a retrospective series of 18 patients

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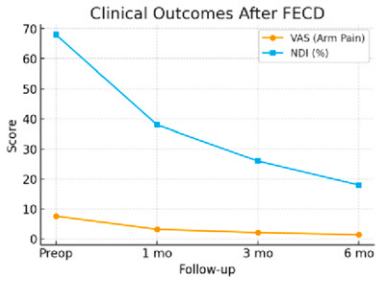
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Background: Acute sequestered cervical disc herniations frequently cause disabling radiculopathy or myelopathy. Although anterior cervical discectomy and fusion (ACDF) is the conventional treatment, fusion-related complications have led to interest in motion-preserving techniques. Full endoscopic cervical discectomy (FECD) is a minimally invasive alternative that may provide comparable efficacy while preserving cervical mobility. **Methods:** We retrospectively analyzed 18 patients who underwent FECD for acute sequestered cervical disc herniations between January 2022 and June 2024. All patients presented with acute neurological deficits and MRI-proven sequestration. Exclusion criteria were trauma, infection, and neoplastic lesions. All procedures were performed under general anesthesia using a full endoscopic interlaminar system (Richard Wolf GmbH, Knittlingen, Germany). Demographics, affected levels, laterality, operative time, complications, and clinical outcomes were evaluated. Outcomes included Visual Analog Scale (VAS) for arm pain and Neck Disability Index (NDI), assessed preoperatively and at 1, 3, and 6 months postoperatively. **Results:** The mean age was 37 years (range, 24-52). The most frequently affected level was C6-7 (n = 9), followed by C5-6 (n = 6) and C3-4 (n = 3). Twelve patients (66.7%) had left-sided herniations. The mean operative time was 62 minutes (range, 45-85). Preoperative VAS for arm pain averaged 7.6 ± 1.2, improving to 1.4 ± 0.8 at 6 months ($p < 0.001$). Mean NDI improved from 68% preoperatively to 18% at 6 months ($p < 0.001$). Radicular pain completely resolved in all patients, and no recurrent herniations were observed during follow-up. No neurological or systemic complications occurred, and postoperative cervical stability was preserved.

Table 1. Patient and Surgical Characteristics

Total patients	18
Mean age	37 (24-52)
C6-7	9 patients
C5-6	6 patients
C3-4	3 patients
Left-sided herniations	12 (66.7%)
Right-sided herniations	6 (33.3%)
Mean operative time	62 min (45-85)

Figure 1. Clinical Outcomes (VAS and NDI over Time)



Conclusion: FECD is a safe and effective motion-preserving technique for acute sequestered cervical disc herniations. In this 18-patient series, the procedure achieved complete resolution of radicular pain, significant functional recovery, and excellent early outcomes without recurrence or major complications. FECD may be considered a strong alternative to fusion surgery, particularly in young and active patients.

ID: AGS26/3205

P0761: Radiographic and clinical findings of expansion cages in transforaminal lumbar interbody fusion (TLIF): a comparative monocentric study

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Introduction: Minimally invasive transforaminal lumbar interbody fusion (TLIF) has become a widely accepted surgical option for the treatment of lumbar instability, degenerative spondylolisthesis, and recurrent disc herniation. Expandable cages are specifically designed to restore disc height and optimize sagittal alignment while reducing tissue trauma. Despite their increasing use, there is still debate about whether different cage designs or surgical guidance approaches influence outcomes. The present study investigates the clinical, radiological, and proportional alignment results of mini-open TLIF with expandable cages in a consecutive single-center cohort. **Material and Methods:** We retrospectively analyzed 333 patients treated with mini-open TLIF and expandable cages at our institution January 2021 and January 2025. Demographic data, comorbidities, surgical details, and intraoperative parameters were recorded. Clinical assessment included the Numerical Rating Scale (NRS), Oswestry Disability Index (ODI) and SF-36, collected preoperatively, at discharge, and at the last available follow-up. Radiological evaluation was performed with standing X-rays, MRI, and CT scans at baseline, immediately after surgery, and during follow-up. Parameters included sagittal alignment (SS), lumbar lordosis (LL), and evidence of cage subsidence. The Global Alignment and Proportion (GAP) score was calculated postoperatively in patients with complete radiological data. Adverse events and complications were systematically documented. Statistical analyses included paired t-tests for repeated measures and Wilcoxon signed-rank tests where appropriate, with significance set at $p < 0.05$. **Results:** Clinical outcomes demonstrated marked and statistically significant improvements. Mean NRS decreased from 8.3 ± 1.9 preoperatively to 5.2 ± 3.0 postoperatively and 4.1 ± 3.4 at follow-up (paired t-test, $p < 0.001$). ODI improved from 0.5 ± 0.2 at baseline to 0.3 ± 0.2 postoperatively ($p < 0.001$), reflecting substantial functional recovery. SF-36 scores confirmed a consistent improvement in all domains, with a mean value of 0.6 ± 0.3 at follow-up. Radiological analysis showed stable sagittal correction over time. At follow-up, mean SS was 40.4 ± 11.5°, and LL 52.6 ± 12.7°. Cage subsidence was negligible, and no significant differences were observed among the various cage designs. Comparative subgroup analysis did not reveal any clear superiority of a specific cage type regarding clinical scores, radiological correction, or subsidence rates. The GAP score was calculated in 62 patients with complete datasets. When proportions were applied to the entire cohort, approximately 260 patients (78%) were classified as proportioned (GAP 0-2), and 73 patients (22%) as moderately disproportioned (GAP 3-6). Importantly, no cases of severe disproportionality (≥ 7) were detected. This distribution indicates that the majority of patients achieved sagittal alignment proportional to their pelvic parameters. **Conclusion:** Mini-open TLIF with expandable cages offers significant pain relief, functional recovery, and stable correction of sagittal parameters, with negligible cage subsidence across designs. Differences among cage configurations did not significantly influence outcomes. GAP score analysis confirmed that most patients reached proportional sagittal alignment, supporting the reliability and safety of expandable cages in minimally invasive lumbar fusion. These findings suggest that the procedure ensures both effective clinical improvement and restoration of proportional spinopelvic balance, making expandable cages a valuable option in the management of lumbar instability.

ID: AGS26/3217
P0762: Comparative analysis of OLIF versus OLLIF in degenerative disc disease of lumbar spine

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Background: Minimally invasive lumbar interbody fusion techniques, such as Oblique Lumbar Interbody Fusion (OLIF) and Transkambin fusion (TKF), have gained prominence for treating lumbar degenerative diseases. This study aims to compare their functional and radiological outcomes over one year. **Methods:** A total of 40 patients diagnosed with lumbar degenerative disease were enrolled, with 20 undergoing OLIF and 20 undergoing TKF. Functional outcomes were assessed using the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) for back and leg pain preoperatively and at one-year follow-up. Radiological outcomes, including disc height restoration, segmental lordosis, and fusion rates, were evaluated through X-ray and CT scans. Perioperative parameters such as operative time, estimated blood loss, and hospital stay were also analyzed. **Results:** Both OLIF and TKF groups demonstrated significant improvement in ODI and VAS scores at one year ($p < 0.05$). However, the OLIF group showed superior disc height restoration ($p = 0.03$) and segmental lordosis improvement ($p = 0.02$). The fusion rate at one year was comparable between the two groups (OLIF: 90%, TKF: 85%, $p = 0.4$). The TKF group had a significantly shorter operative time ($p = 0.01$), reduced intraoperative blood loss ($p = 0.02$), and a shorter hospital stay ($p = 0.03$). Complication rates were low in both groups, with transient nerve irritation occurring in two OLIF patients and one TKF patient. **Conclusion:** Both OLIF and TKF provide effective pain relief and functional improvement at one year. OLIF offers superior radiological outcomes, particularly in restoring disc height and segmental alignment, making it a preferred choice in cases requiring better sagittal realignment. TKF, on the other hand, demonstrates advantages in surgical efficiency, reduced operative time, blood loss, and hospitalization. These findings suggest that the selection between OLIF and TKF should be based on individual patient characteristics, surgical goals, and surgeon expertise.

ID: AGS26/3225
P0763: Transmass and paramass approaches for rare cervical lesions with tailored stabilization: a three-case technical report

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Introduction: Bow-Hunter syndrome (BHS) is a rare form of vertebrobasilar insufficiency (VBI) caused by mechanical compression of the vertebral artery, most often triggered by head rotation. While the majority of cases occur at the craniovertebral junction, postoperative subaxial variants are exceedingly uncommon. We present a patient who developed a novel BHS-like syndrome characterized by cervical deformity and vertical vascular compression following posterior cervical surgery involving facet cage placement and decompression. **Case Description:** A 50-year-old male with ankylosing spondylitis underwent posterior cervical decompression with bilateral facet cage placement at C4–6 in another hospital for cervical stenosis and spondylolisthesis. Due to persistent symptoms, a revision procedure was performed, during which the right-sided cages were removed. Two weeks later, the patient began experiencing recurrent vertigo and syncopal episodes exclusively when transitioning to a sitting position. On admission, neurological examination revealed tetraparesis (upper extremities 2/5, lower extremities 3/5). CT angiography demonstrated coronal imbalance and listhesis with a dominant right vertebral artery loop at C4–5. Symptom relief was observed with the application of a large Philadelphia cervical collar providing partial traction, further supporting the diagnosis of posture-dependent vertebrobasilar insufficiency. **Results:** The patient subsequently underwent anterior cervical discectomy and fusion (ACDF) from C4 to C7, with PEEK cages restoring alignment and decompressing the vertebral artery. Postoperatively, all syncopal and vertigo episodes resolved completely. Follow-up CT angiography demonstrated correction of the coronal deformity and elimination of vertebral artery loop compression, while MRI confirmed resolution of foraminal narrowing. **Conclusion:** This case illustrates a rare postoperative variant of Bow-Hunter syndrome in which vertebral artery compression was induced by cervical deformity following posterior cervical surgery. Unlike classical BHS, symptoms were triggered not by head rotation but by vertical loading during postural change (sitting). Recognition of this unusual mechanism is critical, as timely anterior decompression and fusion achieved both radiographic correction and complete clinical recovery. Surgeons should maintain a high index of suspicion for vertebrobasilar insufficiency in patients—particularly those with underlying rheumatologic disease—who present with unexplained vertigo or syncope after posterior cervical procedures.

ID: AGS26/3230
P0764: Two-year outcomes of unilateral biportal endoscopic spine surgery for lumbar disc herniation: a prospective cohort study

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Introduction: Lumbar disc herniation (LDH) is a leading cause of radiculopathy and disability. Unilateral Biportal Endoscopy (UBE) has emerged as a minimally invasive alternative to open discectomy, with promising outcomes. However, long-term data from low- and middle-income countries are limited. This study evaluates two-year outcomes of UBE in a tertiary spine center in Pakistan. **Material and Methods:** A prospective cohort of 100 patients aged 20-60 years with single-level LDH unresponsive to conservative treatment underwent UBE between January 2023 and December 2024. Patients with prior surgery, instability, trauma, or infection were excluded. Outcomes were assessed using the Oswestry Disability Index (ODI), Visual Analog Scale (VAS), and Modified Macnab criteria at regular intervals up to 2 years. **Results:** The cohort was 65% male, with a mean age of 41.2 years. Mean ODI improved from 58.6 to 18.4 ($p < 0.001$). VAS scores for leg and back pain improved from 7.8 and 6.2 to 2.1 and 1.9, respectively ($p < 0.001$). According to Macnab criteria, 80% had excellent, 12% good, 5% fair, and 3% poor outcomes. Mean hospital stay was 2 days; most resumed work within 6-8 weeks. Complications were minimal and managed conservatively. **Conclusion:** UBE is a safe, effective, and minimally invasive option for LDH, offering excellent functional recovery and high patient satisfaction, with outcomes aligning with global standards.

ID: AGS26/3320
P0765: Learning curve of biportal endoscopic spine surgery

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Introduction: The benefits of unilateral biportal endoscopy (UBE) for lumbar disc herniation surgery have been demonstrated in numerous studies. However, the main challenge in adopting this innovative technique is the learning curve. The aim of this study was to evaluate the outcomes of a series of

lumbar disc herniation cases operated on during our learning phase. **Material and Methods:** We conducted a retrospective study between October 2023 and March 2025, including patients with lumbar disc herniation treated by UBE. Outcome measures to assess the learning curve were: operative time, Visual Analog Scale (VAS) scores for leg and back pain, Oswestry Disability Index (ODI), time to symptom resolution and return to work, and perioperative complications. **Results:** Our series included 40 patients who underwent biportal endoscopic surgery for lumbar disc herniation, with a mean age of 47.9 years. The L4-L5 level was involved in 64% of cases and L5-S1 in 30%. Two patients had combined L4-L5 and L5-S1 herniations. The herniation was median or paramedian in 33 cases and foraminal or extraforaminal in 7. The approach was interlaminar in 28 cases (15 left, 13 right) and paraspinal in 12. The mean operative time was 140 minutes. Conversion to open surgery was required in 3 cases. Analysis revealed a learning curve cutoff at 22 cases: mean operative time in the early phase (≤22 cases) was 160 minutes compared to 110 minutes in the late phase (subsequent 18 cases). Clinically, VAS leg and back pain scores improved from 7 to 2, and mean ODI decreased from 83% to 32.8%. Complete symptom resolution occurred immediately postoperatively in 16 patients, within 45 days in 9, within 3 months in 5, and within 6 months in 7. Three patients had persistent postoperative symptoms; one underwent repeat endoscopic decompression. Return to work occurred within 3 months. Only one complication was recorded: a dural tear, repaired by open surgery. **Conclusion:** Biportal endoscopic spine surgery is a rapidly expanding minimally invasive technique with growing indications. Its reduced tissue disruption supports its integration into the routine practice of orthopedic spine surgeons.

ID: AGS26/3352
P0766: Minimal invasive and transkambin approach for lumber fusion - Empowering next generation neurosurgeon without mandatory fellowship

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Introduction: Minimally invasive and endoscopic approaches have transformed spinal surgery by reducing muscle trauma, blood loss, and postoperative pain compared with traditional open methods. However, their adoption is often limited by a steep learning curve, raising the question of whether formal subspecialty fellowship training is essential for young neurosurgeons. **Methods:** This review synthesizes evidence from systematic reviews, meta-analyses, and expert consensus, evaluating operative time, blood loss, hospital stay, fusion rates, pain relief, functional outcomes, and complication profiles. Special attention is given to the learning curve, technical considerations, and the integration of fundamental neurosurgical skills that may enable safe initiation of minimally invasive spinal techniques without prolonged fellowship training. **Results:** Minimally invasive approaches are now well established in clinical practice, demonstrating outcomes comparable to open surgery but with reduced blood loss, complications, hospital stays, and faster recovery. Although operative times are often longer during the early stages of adoption, this reflects the technical demands of the procedures rather than inherent limitations. With increasing surgical experience, operative times typically shorten and may become comparable to, or even less than, conventional open techniques. A critical determinant of success lies in understanding that every complex surgical procedure is composed of smaller, reproducible technical steps. Surgeons who are already proficient in elements such as nerve decompression, discectomy, or interbody cage placement can leverage these existing skills to accelerate their transition to minimally invasive techniques. By approaching the procedure as a modular sequence of familiar maneuvers, the learning curve is effectively flattened, risk is reduced, and patient safety is maintained. **Conclusion:** Adopting a stepwise integration strategy in implementation of Minimally invasive techniques in the practice - initially applying parts or steps of the minimally invasive techniques in less complex cases and progressively advancing to more challenging scenarios-has been shown to enhance confidence and outcomes while reducing complication rates. Such structured progression highlights that formal fellowship training, while beneficial, may not always be mandatory if appropriate foundational neurosurgical expertise is present and applied in a step wise fashion while implementing new surgical techniques in the clinical practice.

ID: AGS26/3365
P0767: Minimally invasive versus open sacroiliac joint fusion: complications and reoperation rates in a national database analysis

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Introduction: Minimally invasive sacroiliac joint fusion (MMI) is increasingly used to reduce perioperative morbidity compared with open techniques. Using a national claims

database, we compared patient characteristics and outcomes between MMI and open sacroiliac fusion. **Materials and Methods:** We performed a retrospective cohort study using the PearlDiver Mariner database, identifying adults who underwent SI fusion via CPT 27279 or 27280. Baseline demographics and comorbidities were compared, and complications were assessed within 90 days and up to 10 years postoperatively. Two-sided p-values were used for comparisons. **Results:** We identified 19,600 patients in the MMI cohort and 10,085 in the Open cohort. Patients in the MMI cohort were slightly older on average (59.57 ± 13.16 vs 58.30 ± 13.12 years, $p < 0.001$) and had a higher proportion of females (69.9% vs 67.9%, $p < 0.001$). Several comorbidities were more prevalent in the open cohort, including congestive heart failure (17.1% vs 13.4%, $p < 0.001$), chronic obstructive pulmonary disease (33.3% vs 31.3%, $p < 0.001$), coronary artery disease (33.1% vs 31.5%, $p = 0.007$), and hypertension (78.1% vs 76.9%, $p = 0.017$), while obesity was more common in the minimally invasive cohort (54.0% vs 50.6%, $p < 0.001$). Within 90 days, the minimally invasive cohort had significantly lower rates of acute kidney injury (1.2% vs 2.5%, $p < 0.001$), deep vein thrombosis (0.6% vs 1.8%, $p < 0.001$), hematoma (0.2% vs 0.7%, $p < 0.001$), pneumonia (1.0% vs 2.1%, $p < 0.001$), pulmonary embolism (0.1% vs 0.5%, $p < 0.001$), blood transfusion (0.3% vs 1.5%, $p < 0.001$), and urinary tract infection (3.4% vs 5.6%, $p < 0.001$), while cardiac arrest was rare and similar between groups (0.1% vs 0.2%, $p = 0.052$). At 1 year, reoperation was lower in the minimally invasive cohort (0.2% vs 0.4%, $p = 0.005$) and wound infection was also lower (1.0% vs 1.9%, $p < 0.001$). Beyond 1 year, reoperations were rare and not significantly different between cohorts ($p \approx 0.055$), whereas late wound infection at 5-10 years remained lower after minimally invasive fusion (0.1% vs 0.5%, $p < 0.001$). **Conclusion:** In this large national cohort, MMI SI fusion was associated with lower early complication rates and lower 1-year reoperation and wound infection compared with open SI fusion, despite small differences in baseline characteristics. These findings support the potential safety advantages of minimally invasive SI fusion while underscoring the need to interpret results in the context of observational data and possible confounding.

ID: AGS26/3388
P0768: Clinical and radiological outcomes of oblique lateral lumbar interbody fusion

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Introduction: Oblique lateral lumbar interbody fusion (OLLIF) is a novel operation for fusions of the lumbar spine from T12-S1. In OLLIF, the disk is approached from an oblique lateral angle guided by electrophysiological monitoring and biplanar fluoroscopy; the disk space is accessed through Kambin's triangle. **Material and Methods:** We present perioperative, clinical, patient-reported and radiological outcomes from a series of 303 OLLIF procedures on 568 levels performed by the same surgeon. **Results:** For a single-level OLLIF, mean surgery time was 56.6 ± 37.7 minutes, with a blood loss of 42.2 ± 31.1 mL, fluoroscopy time of 198.8 ± 87.2 seconds and a hospital stay of 2.2 ± 1.7 days. At the one-year follow-up, 10-point pain scale scores improved from 8.6 ± 1.3 to 4.1 ± 3.0 ($p < 0.001$). Total Oswestry disability index score improved from 56.6% ± 15.3% to 38.6% ± 21.4% ($p < 0.001$). At the one-year follow-up, 15 (5%) patients had mild nerve root irritation defined as sensory symptoms and motor weakness better than 4/5. Only one patient had neuropraxia due to weakness (3/5). There was one case (0.3%) of superficial wound infection and one case of bleeding into the psoas major. Reoperation within one year was performed for 14 (4.7%) patients. Interbody fusion was achieved in 98.7% of levels. **Conclusion:** While OLLIF has previously been described, this study is the first to present clinical, patient-reported, and radiological outcomes of OLLIF. Review of the literature shows that OLLIF produces perioperative outcomes, complication rates, and fusion rates that compare favorably with similar procedures. We establish that OLLIF is a safe, efficient and efficacious procedure for fusions of the lumbar spine.

ID: AGS26/3420
P0769: Quantifying radiation exposure in minimally invasive spinal surgery: a single-surgeon study of minimally invasive surgery-oblique lateral lumbar interbody fusion (MIS-OLLIF) with double C-Arm technique

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Introduction: In the advancement of spinal surgery, minimally invasive techniques such as the oblique lateral lumbar interbody fusion (OLLIF) have emerged, offering improved clinical outcomes and the use of dual C-Arm intraoperative imaging. Despite the benefits, the radiation exposure to surgeons and staff from this dual-source imaging has not been thoroughly examined. This study aims to quantify the radiation exposure received by surgeons during OLLIF procedures, filling a gap in current research that primarily focuses on single-source imaging. **Material and Methods:** Over

12 months, radiation doses were measured across 121 surgeries at four locations. Data analysis included average radiation exposure per surgery and variations across surgical sites. **Results:** The findings showed an average radiation emission of 198.78 mGy per OLLIF surgery, with the surgeon receiving approximately 0.06 mSv per surgery. Cumulative doses for the surgeon were below the safety thresholds set by European and American standards. The significance of these findings lies in their contribution to the understanding of occupational safety in spinal surgery. **Conclusion:** The results indicate that with proper protective measures, such as lead aprons, the radiation exposure from the OLLIF technique is manageable within occupational limits. This study highlights the importance of monitoring radiation exposure and may influence the development of new guidelines and protective strategies in the field. Future research could expand the cohort of surgeons to validate these findings, develop new protective strategies, and explore radiation exposure in more complex multi-level fusions.

ID: AGS26/3431
P0770: Perioperative outcomes of minimally invasive sacroilliac joint fusion using hollow screws through a lateral approach: a single surgeon retrospective cohort study

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Introduction: Sacroiliac joint (SIJ) pain is a common cause of lower back pain and a significant source of disability in the United States. There is no consensus on the best surgical treatment for SIJ pain that is not responsive to conservative therapy. Minimally invasive fusion of the SIJ using hollow fenestrated screws from a lateral trajectory is a newer technique for SIJ fusion. **Material and Methods:** This study presents perioperative and patient-reported outcomes amongst 62 patients who underwent SIJ fixation with hollow fenestrated screws. **Results:** We find that mean disability on the Oswestry disability index improved from 52.2% to 34.9% at one-year post-op. Mean operative time was 34±9 minutes and blood loss was 22 ± 35ml. Only six patients required overnight hospitalization. There were two cases of complications requiring operative intervention. **Conclusion:** We conclude that SIJ fixation using hollow fenestrated screws is a safe and effective procedure for the fixation of the SIJ. Further investigation is warranted to determine the best surgical treatment for SIJ pain.

ID: AGS26/3481
P0771: Minimally invasive SI joint fusion improves pain and disability with low reoperation rates: a meta-analysis of randomized control trials and prospective cohort studies

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Introduction: Low back pain is a leading cause of disability worldwide, and the sacroiliac joint (SIJ) is implicated as a primary pain generator in up to 25% of cases. However, diagnosis of SIJ-mediated pain is difficult due to overlapping symptomatology with lumbar spine and hip pathology, and is often one of exclusion confirmed by diagnostic injections. Minimally invasive SIJ fusion has emerged as a treatment option for patients with confirmed SIJ dysfunction who fail nonoperative care, yet variability remains regarding reported effectiveness and reoperation rates. **Objective:** To conduct a meta-analysis of high-level prospective evidence studies evaluating changes in Visual Analogue Scale (VAS), SI joint pain scores, Oswestry Disability Index (ODI) outcomes, and adverse events (SAE) requiring an additional operation. **Methods:** A systematic review and meta-analysis were performed according to PRISMA guidelines. Eleven studies met inclusion criteria based on study design, quality of evidence, and reporting of patient-reported outcomes. Demographic data, baseline characteristics, and outcomes were extracted. Meta-analyses were conducted to calculate pooled estimates of VAS and ODI improvements, and pooled reoperation rates. **Results:** Eleven studies reporting on 1,181 sacroiliac joint fusions were included, with a mean follow-up of 27.8 months. Meta-analysis showed a VAS improvement of 45.5 points (95% CI: 38.6-52.3) and an ODI improvement of 23.3 points (95% CI: 21.0-25.7), both exceeding established MCID thresholds ($p < 0.001$). The meta-analysis of reoperation rates for implant-related serious adverse events was 3% (95% CI: 2%-4%). **Conclusion:** Minimally invasive SIJ fusion yields large, clinically meaningful, and reproducible improvements in pain and disability with a low reoperation rate if performed in the appropriate patient population. Outcomes are most favorable when patient selection is rigorous and SIJ dysfunction is accurately identified as the primary pain generator, underscoring the importance of standardized diagnostic pathways in optimizing surgical benefit.

Navigation

ID: AGS26/16
P0772: Navigated robotic spine surgery: a one-year prospective multicenter analysis of complications and revision rates in 688 thoracolumbar fusions

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Introduction: The merging of computerized preoperative planning, robotic guidance, and real-time 3-dimensional navigation into one advanced enabling technology has the potential to optimize screw placement and improve surgical outcomes. In the Prospective Robotic-Guided Registry of Spine Surgery (PRoGRSS), outcomes were tracked for cases using an integrated robotic-assisted navigation system for spine surgery. The purpose of this study is to determine surgical complication and revision surgery rates at 12 months following thoracolumbar surgery using this platform. **Material and Methods:** In this prospective multicenter cohort, PRoGRSS includes adults undergoing navigated robotic thoracolumbar surgery from 2020-2024. Cases were enrolled by 6 surgeons at 4 centers spanning 3 US regions. Each surgeon's experience using navigation and robotics was advanced. Surgical complications and revision surgeries were collected to 12 months and reported as proportions. **Results:** Of 688 surgeries, the median age was 60 years and 50% were females. There were 5,078 executed screws using robotic guidance with navigation confirmation. Half of cases were staged or single day, with 16% revision cases. Screw placement was split evenly between percutaneous and open approaches, with 35% pelvic fixation, 51% decompressions, 78% pedicle and 22% cortical screws. Intraoperatively, 97% had no adverse events. None of the 3% intraoperative adverse events (2.3% durotomy, 0.5% vascular injury, 0.3% loss of motor signals, and 0.1% small pneumothorax) were robot related. Cumulatively, 9% had surgical complications (0.2% were robot related) and 3% underwent a revision surgery up to 12 months. **Conclusion:** Experienced users of an integrated navigation and robotic spine platform achieved low complication and revision surgery rates for thoracolumbar spine surgery. Our real-world data found 3% intraoperative adverse events (0% robot related), 9% postoperative surgical complications (0.2% robot related), and 3% revision surgeries up to 12 months. By improving implant accuracy and spinal alignment with computerized planning and navigated robotic guidance, thoracolumbar fusion patients have the potential to achieve successful outcomes.

ID: AGS26/17
P0773: One-year fusion rates following navigated robotic-guided thoracolumbar spine surgery

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Introduction: The merging of computerized preoperative planning, robotic guidance, and real-time 3-dimensional navigation into one advanced enabling technology has the potential to optimize implant placement, spinal alignment, and improve surgical outcomes in thoracolumbar fusions. In the Prospective Robotic-Guided Registry of Spine Surgery (PRoGRSS), outcomes were tracked for cases using an integrated robotic-assisted navigation system for spine surgery. The purpose of this study is to determine radiographic fusion rates at 12 months following thoracolumbar surgery using this platform. **Material and Methods:** In this prospective multicenter cohort study, PRoGRSS includes adults undergoing navigated robotic thoracolumbar surgery from 2020-2024. Cases were prospectively enrolled by 6 surgeons at 4 centers spanning 3 US regions. Each surgeon's prior experience using navigation and robotics was advanced. Radiographs were collected at 12 months as part of a pre-specified plan for analysis. Two of the sites collected dynamic radiographs at 12 months and fusion was analyzed by a third party using validated motion detection software. Fusion was defined as $< 2°$ of angular motion. **Results:** Of a subgroup of 143 cases from 2 sites with 1 year follow up, 692 screws (83% pedicle, 17% cortical) were implanted using navigated robotic guidance. The posterior approach was 77% percutaneous and 23% were open with a midline incision. Of these, 118 cases with dynamic radiographs were available for fusion analysis at 12 months, including 234 individual levels of fusion. In this cohort, the average age was 54 years, 53% were females, 13% were nicotine users, 55% were obese, 95% had a CCI < 2, and 44% had a primary diagnosis of spondylolisthesis. Of 234 levels, 98% had $< 2°$ of angular motion and were considered to be fused, whereas 2% were not fused at 12 months. **Conclusion:** Experienced users of an integrated navigation and robotic spine platform achieve high fusion rates 1 year following thoracolumbar spine surgery. Although achieving fusion depends on several factors, improving implant accuracy

and spinal alignment with computerized planning and navigated robotic guidance may improve the success of spinal fusion and contribute to higher fusion rates.

ID: AGS26/64
P0774: Enhancing the success rate of percutaneous pedicle fixation: geometric analysis of needle angles and lengths with the introduction of a flat planning grid system

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Introduction: Precise needle placement is a critical requirement in percutaneous pedicle screw fixation, directly influencing screw trajectory, bone purchase, and overall surgical safety. However, achieving accurate placement can be particularly challenging for trainees and early-career surgeons, especially in anatomically complex cases. Misjudgment of insertion angles or trajectory length may result in suboptimal fixation or cortical breach. To address these challenges, this study explores the geometric relationship between needle length and insertion angle and introduces a novel, radiographically compatible flat planning grid system aimed at enhancing intraoperative accuracy and standardization. **Material and Methods:** A trigonometric model was developed to simulate horizontal reach based on three commonly used needle lengths: 80 mm, 120 mm, and 140 mm. Calculations were made across a full angular spectrum ranging from 5° to 85°, generating a geometric dataset that illustrates how angle and length combinations influence the needle's horizontal advancement. Based on these calculations, a two-dimensional flat grid system was designed for overlay integration into standard fluoroscopic X-ray views. The grid system provides reference lines corresponding to known angle-length combinations, allowing surgeons to visually estimate and adjust trajectory in real-time during percutaneous screw placement. **Results:** Key findings from the geometric simulation and planning system development include:

• **Horizontal Reach:** Longer needles (particularly the 140 mm type) substantially increase horizontal reach at shallow angles. For example, at 30°, a 140 mm needle covers a reach of approximately 121 mm compared to 69 mm for an 80 mm needle-an advantage in patients with large soft tissue envelopes or high BMI.

• **Angle Optimization:** Entry angles less than 45° showed the most predictable and linear horizontal behavior, making them ideal for safe and reproducible needle insertion. These angles also allow better tactile control and reduce the risk of cortical breach, particularly useful in teaching scenarios.

• **Visual Planning Tool:** The developed flat grid planning system offers simple, real-time intraoperative guidance using known anatomical landmarks and the needle tip as reference. This method reduces variability in initial needle positioning, enhances reproducibility, and may shorten the learning curve for surgical trainees. **Conclusion:** This study demonstrates the practical value of combining geometric modeling with radiographic visualization to optimize percutaneous pedicle screw placement. The proposed flat planning grid is a low-cost, high-impact tool that enables precise estimation of insertion depth and angle, tailored to the chosen needle length. It supports both surgical accuracy and intraoperative confidence, especially in educational or minimally invasive spine surgery settings. Future validation in cadaveric models and clinical workflows may confirm its benefit in reducing procedural errors and improving training outcomes.

ID: AGS26/118
P0775: Robot-assisted positioning for percutaneous endoscopic interlaminar discectomy

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Introduction: During percutaneous endoscopic Interlaminar discectomy (PEID),a range of technologies including medical robotics, visual navigation, and spatial registration have been proposed to expand the application scope and success rate of minimally invasive surgery.The use of robotic technology in surgery is conducive to improving accuracy and reducing risk. This study aims to introduces a precise and efficient targeting method tailored for robot-assisted positioning under C-arm fluoroscopy inPEID. **Material and Methods:** This study conducted a retrospective analysis of 107 patients with LDH who underwent surgical treatment at our hospital from February 2023 to February 2024(average age: 43.3 ± 13.3 years; 61 males and 43 females). The method entails constructing a specialized end-effector capable of simultaneous fluoroscopy calibration and robot-to-image-space registration. The average time of surgical procedure and average number of fluoroscopy exposures were collected. Preoperative and postoperative last follow-up data were collected, including assessment scores of the Japanese Orthopaedic Association (JOA) and Visual Analog Scale (VAS).Paired t-tests were employed to compare differences in each clinical outcome between the preoperative and follow-up time. **Results:** These techniques effectively reduce both radiation exposure and operation time. Clinical data reveals that the average time for robot-assisted positioning stands at 2.5 ± 0.7 minutes, with anteroposterior and lateral radiographs demonstrating accuracies of 2.4 ± 2.8 mm and 3.1 ± 3.7 mm, respectively, during robot-assisted positioning. Postoperative VAS scores for back pain and leg pain were significantly lower than preoperative scores (1.2 ± 1.8 vs. 4.1 ± 2.3, 0.9 ± 2.0 vs. 5.9 ± 1.8; $p < 0.05$, $p < 0.05$, respectively). Postoperative JOA scores were significantly higher than preoperative scores (26.1 ± 3.5 vs. 14.5 ± 4.9; $p < 0.05$). **Conclusion:** Through the evaluation of the

system in robot-assisted positioning during PEID, this study substantiates the accuracy and reliability of the proposed method in clinical applications.

ID: AGS26/152
P0776: Accuracy of navigated pedicle screw placement using robotic-assisted compared to hand-guided screw technique: a prospective monocentric study

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Introduction: Posterior stabilization with pedicle screw-rod system +/- intervertebral cage for the treatment of degenerative spondylolisthesis (DS) has firmly established itself as a reference technique. Navigated pedicle screw placement (NPSP) represents the standard-of-care, and besides the hand-guided (HG) procedure, this can also be provided by robotic-assistance (RA). This study aims to compare the precision of these two techniques. **Material and Methods:** We prospectively included all patients undergoing surgical treatment for DS Meyerding Grade I from February-October 2024. Patients were dichotomized into those undergoing NPSP (LoopX®, BrainLab) with HG or RA (Cirq® Robotics, BrainLab) technique. We fused and metrically compared pre- and postsurgical CT images in a navigation software in a blinded fashion. Screw placement accuracy was measured by comparison of the implanted screw position with the planned trajectory by deviation in mm at the entry point in the craniocaudal (DEcc) and mediolateral plane (DEml), deviation at the screw tip in the craniocaudal (DTcc) and mediolateral plane (DTml), and angular deviation of the pedicle screw axis in ° (AD) as well as by Gertzbein Robbins-System (GRS) and statistically analyzed. **Results:** We analyzed 111 screws in 28 patients (10 women, 18 men, w/m ratio 0.56, median age 61.5, range 19-78 years). 14 patients were treated with the RA technique placing 53 screws, and 14 with the HG technique placing 58 screws overall. No differences were observed in age ($p = 0.22$), gender ($p = 0.13$), BMI ($p = 0.97$), and ASA score ($p = 0.88$). Between implanted and planned pedicle screws, mean DEml in the RA group was 2.6±1.4mm and 2.1±1.2mm in the HG group, mean DTml in the RA group was 2.7 ± 1.5 mm and 2.6 ± 1.6 mm in the HG group, mean DEcc in the RA group was 2.5 ± 1.1 mm and 2.2 ± 1.1 mm in the HG group, mean DTcc in the RA group was 2.4 ± 1.3 mm and 2.1 ± 1.0 mm in the HG group, and mean AD in the RA group was 3.5 ± 2.2° and 3.4 ± 2.1° in the HG group. Altogether, there was a trend for a slightly higher screw placement inaccuracy in the RA group, with statistical significance only for the mean DEml ($p = 0.037$). However, considering the GRS classification, in RA group 52 (96%) were Grade A and 2 (4%) Grade B and in HG group 54 (93%) were Grade A and 4 (7%) Grade B with no statistical difference between groups ($p = 0.46$) meaning an adequate screw positioning in all cases. **Conclusion:** Accuracy in pedicle screw placement significantly differs only regarding DEml in favor of the HG cohort. However, according to GRS all screws were placed adequately, and no intraoperative revision was required.

ID: AGS26/232
P0777: Comparison of navigated expandable vertebral cage with conventional expandable vertebral cage for minimally invasive lumbar/ thoracolumbar corpectomy

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Introduction: The thoracolumbar burst fracture is one of the most common spinal injuries. If the patient has severe symptoms, corpectomy is indicated. Currently, minimally invasive corpectomy with a navigated expandable vertebral cage is available thanks to spinal surgical technology. The aim of this study is to retrospectively compare clinical and radiographic outcomes of conventional and navigational minimally invasive corpectomy techniques. **Material and Methods:** We retrospectively evaluated 21 patients who underwent thoracolumbar minimally invasive corpectomy between October 2016 and January 2021. Eleven patients had a navigated expandable cage (group N) and 10 patients had a conventional expandable cage (group C). Mean follow-up period was 31.9 months for group N and 34.7 months for group C, ranging from 12 to 42 months in both groups. Clinical and radiographic outcomes are assessed using values including visual analogue scale (VAS) for back pain and Oswestry disability index (ODI). This data was collected preoperatively and at 6, 12, and 24 months postoperatively. **Results:** Surgical time and intraoperative blood loss of both groups were not significantly different (234 min vs. 267 min, 656 mL vs. 786 mL). Changes in VAS and ODI were similar in both groups. However, lateral cage mal-position ratio in group N was lower than that of group C (relative risk 1.64, Odds ratio 4.5) and postoperative cage sinking was significantly lower in group N ($p = 0.033$). **Conclusion:** Clinical outcomes are not significantly different, but radiographic outcomes of lateral cage mal-position and postoperative cage sinking were significantly lower in the navigation group.

ID: AGS26/321
P0778: Comparison of the accuracy between TINAVI robot-assisted and free-hand pedicle screw placement

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Introduction: Currently there is no studies comparing the accuracy between TINAVI (China's self-developed robot) robot-assisted pedicle screw placement and free-hand pedicle screw placement in spinal surgery. The aim of this study is to compare the accuracy of screw placement between the two surgical procedures in the treatment of adolescent lumbar spondylolysis. **Material and Methods:** The clinical data of 65 adolescents with lumbar spondylolysis who underwent surgery in Xi'an Honghui Hospital from January 2021 to January 2023 were analyzed retrospectively, including 20 males and 45 females with an age of 23.8 ±5.3. The distribution of spondylolysis included 2 cases of L3, 13 cases of L4, 50 cases of L5. According to the Meyerding classification of spondylolisthesis degree, there were 52 cases of grade I, 5 cases of grade II and 8 cases without spondylolisthesis. All patients were treated with double segmental pedicle screw reduction and autogenous iliac bone graft. According to different screw placement methods, they were divided into TINAVI orthopaedic robot-assisted screw placement group (robot group, n = 32) and free-hand screw placement group (free-hand group, n = 33). The satisfactory rate of pedicle screw placement and cortical penetration rate were calculated according to Neo standard, and the superior articular process invasion rate of screw was calculated by Babu standard. **Results:** There was no significant difference in preoperative general data between the two groups ($p > 0.05$). All patients completed the operation successfully and no serious operative complications occurred. A total of 128 screws were implanted in the robot group, and the rate of the screw placement satisfaction, cortical penetration and articular process invasion were 98.2%, 3.1% and 2.3%, respectively, while 132 screws were implanted in the free-hand group. The rate of screw placement satisfaction, cortical penetration and articular process invasion were 90.9%, 9.1% and 7.6% respectively, and there were significant differences between the two groups ($p < 0.05$). **Conclusion:** Compared with free-hand screw placement, TINAVI orthopaedic robot-assisted screw placement can improve the accuracy of pedicle screw placement in adolescents with lumbar spondylolysis.

ID: AGS26/336
P0779: Intraoperative 3D imaging with MRI fusion-based navigation: a true GPS in spine surgery

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Introduction: Spine surgery requires precise planning and execution to ensure optimal outcomes. This study explores the use of intraoperative 3D imaging with MRI fusion-based navigation (F-Navigation) to enhance accuracy and safety in various spine procedures. **Material and Methods:** To evaluate the accuracy and safety of F-Navigation in spine surgery, including cervical laminectomy, posterior endoscopic cervical foraminotomy (PECF), spinal tumor excision, and infective thoracolumbar spondylodiscitis. A prospective review of 102 patients undergoing spine surgery with F-Navigation was conducted. A fusion software integrated intraoperative 3D images with preoperative MRI using predetermined protocols. **Results:** F-Navigation demonstrated high accuracy in identifying both bony and soft tissue anatomy. The system enabled precise localization of pathology in 98% of cases (100/102). F-Navigation facilitated: - Precise decompression of the spinal cord in cervical laminectomy, - Accurate targeting of the C junction in posterior endoscopic foraminotomy, - Precise trajectory into the disc space for biopsy and debridement in spondylodiscitis, - Complete resection of tumor margins while preserving critical neural structures. **Conclusion:** Intraoperative 3D imaging with MRI fusion-based navigation (F-Navigation) is a valuable tool in spine surgery, enhancing accuracy, safety, and clinical outcomes. Further studies are necessary to evaluate long-term outcomes, compare F-Navigation with other navigation systems, and investigate cost-effectiveness.

ID: AGS26/378
P0780: Proximal facet joint violations in augmented reality-guided versus freehand pedicle screw placement

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Introduction: Augmented reality (AR)-guided navigation has been shown to improve pedicle screw placement accuracy. While proximal facet joint violations (FJVs) is a known risk factor for adjacent segment degeneration, no study to date has directly compared FJV rates between AR-guided and conventional freehand (FH) pedicle screw placement. This study compares the incidence and severity of proximal FJVs between AR-guided and conventional FH pedicle screw placement. The secondary objective was to evaluate potential associations between FJVs and patient-specific or surgical factors. **Material and Methods:** Adult patients who underwent lumbar or sacral pedicle screw placement using either

AR-guided or conventional FH techniques were included. Proximal FJVs were evaluated on postoperative computed tomography (CT) and classified using the modified Park and Shah systems. Demographic and surgical variables were recorded, and generalized linear mixed models were used to analyze associations with FJV occurrence. **Results:** A total of 412 proximal facet joints in 206 patients were analyzed, with 103 patients in each group. The incidence of proximal FJVs was significantly lower in the AR group (7.8%, n = 15) compared to the FH group (17.0%, n = 36) ($p < 0.001$). In both cohorts, FJVs occurred mostly at the L5 level and were predominantly unilateral. Among all violations, most of these findings were classified as modified Park grade 1 (n = 29, 7.0%) or grade 2 (n = 21, 5.1%). One grade 3 violation (0.2%) was observed in the FH group. Baseline demographic and operative characteristics were comparable between groups. **Conclusion:** These findings demonstrate that AR-assisted pedicle screw placement was associated with significantly fewer proximal FJVs compared to the FH technique. The highest violation rate was observed at the L5 level in both groups. Further studies are warranted to confirm these findings across diverse populations and surgical settings.

ID: AGS26/379
P0781: The impact of surgeon experience and technique optimization in robotic-assisted sacropelvic screw placement

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Introduction: Robotic-assisted (RA) sacropelvic screw placement (SPSP) uses computed tomography (CT) for planning and registration but exposes patients to ionizing radiation. Three-dimensional (3D) magnetic resonance imaging (MRI) provides a radiation-free alternative. Given the technical demands of SPSP, surgeon experience may influence efficiency and accuracy. This study evaluates MRI-guided RA SPSP in human cadavers, compares a non-fellowship-trained (NFTS) and a fellowship-trained spine surgeon (FTS), and examines the effect of technique refinements. **Material and Methods:** Human specimen underwent preoperative 3D MRI of the sacropelvic region. Bilateral S1 pedicle, S1-alar-iliac (AI), and S2AI screws were placed under RA guidance by a NFTS and a FTS. Procedural timing and screw accuracy were recorded and evaluated on post-operative CT using the Gertzbein-Robbins scale (GRS). **Results:** All 48 planned screws were placed in eight cadaveric specimens without workflow disruptions. Median S1 pedicle screw insertion times were identical for the NFTS and FTS at 2.7 min. S1AI/S2AI screw insertion times were longer for the NFTS (6.8 min, IQR 4.9-7.7) than for the FTS (4.3 min, IQR 3.3-5.9; $p = 0.014$). Accuracy was high, with 95.8% of screws graded as GRS Grade A. Two GRS Grade E breaches, both due to skiving, occurred early in the NFTS series. Technique refinements, including routine tapping and reduced insertion speed, were introduced after early cases. Operative times declined over successive sessions for both surgeons. **Conclusion:** 3D MRI-guided RA SPSP achieved submillimetric accuracy and consistent procedural performance across the two different experience levels. Structured workflows and technique refinements improved procedural efficiency and support MRI-based navigation as a radiation-free alternative for complex sacropelvic fixation.

ID: AGS26/452
P0782: Analysis of the influence of surgical experience on accuracy of pedicle screw placement: a comparative study using fluoroscopy and 3D-navigation

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Introduction: Dorsal instrumentation using a fixateur interne is a frequently applied method for surgical stabilization of thoracic spine instabilities. However, precise placement of pedicle screws proves to be technically demanding. Inaccurate screw placement poses the risk of injury to neurovascular structures. Therefore, a high level of accuracy should be aimed for, which can be increased by using navigated procedures. The influence of surgical experience is another important factor to be considered. The following study compares fluoroscopy with a 3D-navigated procedure on accuracy of thoracic pedicle screw placement regarding the influence of surgical experience. **Material and Methods:** Four fresh frozen human specimens were dorsally instrumented with pedicle screws from T6-T12. Two specimens were instrumented by an experienced spine surgeon, while the other two were instrumented by a young resident. A 3D-navigation system was used unilaterally, and fluoroscopy was used contralaterally. The same C-arm cone beam CT was used for both procedures. Screw accuracy was evaluated according to the Gertzbein and Robbins classification (Grades A-E). Screws graded A and B (perforations < 2 mm) were considered accurate. Additionally, screws located in the costovertebral joint with a screw-pedicle ratio > 1.0 were considered as accurate (Grade CV). The time required per screw was compared across the systems and surgeons. **Results:** A total of 56 thoracic pedicle screws were placed. Each surgeon placed

28 screws. The experienced surgeon misplaced one screw achieving an overall accuracy of 96.43%. The accuracy for the experienced surgeon with fluoroscopy was 92.86% and with navigation 100% ($p > 0.99$). The resident surgeon misplaced three screws, resulting in an overall accuracy of 89.23%. The accuracy for the resident with fluoroscopy was 78.57% and 100% with navigation ($p = 0.22$). No statistical significance was found in the comparison of the surgeons for navigation ($p > 0.99$) and fluoroscopy ($p = 0.596$). The average time per screw needed for the experienced surgeon was 1.78±0.14 minutes using navigation and 2.35 ± 0.32 minutes using fluoroscopy ($p = 0.031$*). For the resident, the time per screw needed was 3.11 ± 0.2 minutes using navigation and 5.36 ± 0.51 minutes using fluoroscopy ($p < 0.001$*). Statistical analysis showed significant differences between the surgeons regarding time demand per screw with navigation ($p < 0.001$*) and fluoroscopy ($p < 0.001$*). **Conclusion:** This study indicates that navigation and experience influence the placement of thoracic pedicle screws. The overall high accuracy supports the safety of navigated procedures. Especially the resident surgeon achieved higher accuracy using navigation which indicates to be a helpful technique for this demanding procedure.

ID: AGS26/695
P0783: Screw fusion as correction of atlantoaxial and craniocervical instability using O-arm system versus C-arm procedure - A single review of 270 patients

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Introduction: A prospective analysis of the surgical treatment and results of 270 patients with benign and malignant craniocervical, atlantoaxial lesions operated during 12 years period (2011-2022) at our department was performed. The aim of the analysis was to assess, the fusion rate and the clinical outcome in patients after correction of craniocervical and atlantoaxial instability, comparing O-Arm System procedures versus C-arm procedure. **Material and Methods:** We analyzed 175 patients with traumatic lesions, 21 patients with inflammatory lesions, and 74 patients with craniocervical tumors. We performed 312 operations. Because of craniocervical/cervical instability we made dorsal or/and ventral fusion in all of 270 patients. In order to improve screw placement accuracy, we performed intraoperative O-Arm in 238 cases (88.14%). In 32 cases (11.86%) we used C-arm. **Results:** We analysed the significant operative outcome factors: the operative duration was 2h. in O-Arm operations and 4h in X-ray procedures and the blood loss was 220 ml in O-Arm and 500ml in C-Arm procedures. The mean screw length (prognostic fusion rate factor) in C1/C2/C3 vertebras was 30 mm in O- Arm procedures and 24 mm in C-Arm procedures. The most common operative complications were: CSF leak - in 2 cases, postoperative infection - in 8 cases, screw misplacement - in 3 C-arm procedures, and 2 cases of early operative mortality. The 24-monts follow-up of 230 patients showed good recovery in 74% of patients, moderate disabling-14% of patients, severe disabling -5% of patients, vegetative state - 3% of patients, death -4% of patients with malignant lesions or in bad general condition. **Conclusion:** Using of O-Arm increase significant operative screw placement accuracy, and preserve intraoperative nerve and vertebral artery injury. The fusion rate in O-arm procedures is 88% and 71% in C-Arm procedures. The clinical outcome in O-arm procedures is better than C-Arm procedures. The complication rate in O-arm procedures was significantly reduced (6,5%) comparing to C-arm procedures (14%). Recently because of the improvement of neuroimaging techniques, surgical techniques and neurointensive care the results of treatment of these lesions are recently better.

ID: AGS26/714
P0784: Expanding the role of navigation in minimally invasive spine surgery: case series beyond screw placement

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Introduction: Navigation is a tool with proven benefits in spinal surgery. Strong evidence supports its superior accuracy in pedicle screw placement compared to free-hand techniques. However, novel applications of spinal navigation can also enhance minimally invasive procedures beyond instrumentation, improving surgical precision while reducing muscle trauma and blood loss. **Material and Methods:** We present five cases where spinal navigation was applied to minimally invasive approaches for diverse spinal pathologies. Navigation was used to refine surgical trajectories, minimize approach-related morbidity, and ensure precise targeting of lesions.

Results: • **Case 1:** A 68-year-old female with prior L4-S1 fusion and recurrent radiculopathy due to foraminal stenosis underwent tubular extraforaminal foraminoplasty.

• **Case 2:** A 37-year-old male with right T10 radiculopathy caused by a T9-T10 thoracic disc herniation underwent tubular transpedicular microdiscectomy.

• **Case 3:** A 19-year-old female with left T10 radiculopathy due to a T9-T10 osteoid osteoma underwent en bloc resection via posterior tubular approach.

• **Case 4:** A 47-year-old male with a dorsal osteoid osteoma underwent complete resection through a navigation-guided minimally invasive approach.

• **Case 5:** A 50-year-old female with a D9-D10 thoracic disc herniation causing spinal cord compression underwent removal via a tubular minimally invasive approach. All patients experienced symptomatic improvement, with no perioperative complications. **Conclusion:** Spinal navigation is a powerful tool beyond screw placement. It expands the scope of minimally invasive surgery by enabling accurate and safe approaches across a spectrum of spinal disorders, from degenerative stenosis to thoracic disc herniations and rare oncologic lesions. Broader adoption of navigation in complex minimally invasive procedures may further reduce morbidity and improve patient outcomes.

ID: AGS26/814
P0785: Intraoperative spiral computed tomography and modern navigation system. Role and application possibilities in spine surgery

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Introduction: Priority during interventions on the spine and spinal cord is patient safety. For this purpose, various intraoperative imaging systems are used. The purpose of the work is to evaluate the effectiveness of using an intraoperative spiral computed tomograph combined with a navigation system, and to describe the features of intraoperative CT visualization and navigation in the surgical treatment of spinal diseases. **Material and Methods:** In the period from September 2017 to June 2025 more than 4,500 surgical interventions on spinal cord injury, degenerative diseases of the spine, tumors of the spine and spinal cord using intraoperative CT and a navigation system were performed. **Results:** The use of intraoperative CT increases the effectiveness of surgical intervention, allowing to assess the volume of decompression, extent of tumor resection during surgery, increases the accuracy of implant placement, thereby minimizing the risk of intraoperative complications, increasing patient safety and reducing treatment costs. The use of intraoperative CT and a navigation system allows transcutaneous surgical procedures to be performed in hard-to-reach areas, increasing the accuracy of instrument placement, improving the quality of surgical treatment and patient safety. **Conclusion:** An undeniable advantage of using intraoperative CT with a navigation system is the ability to control the radicality of removal of bone tumors and tumors with an ossified component "in real time", as well as the possibility of the most targeted placement of interbody implants and transpedicular screws. This technology significantly simplifies surgical treatment in conditions of complex anatomical landmarks (thin root of the vertebral arch, scoliotic or post-traumatic spinal deformity, osteopenia) and the use of two-dimensional images does not allow adequate visualization of the area of surgical interest, reducing operating time and minimizing radiation exposure to the surgical team and the patient.

ID: AGS26/1058
P0786: Novel use of a reference frame of navigation attached to percutaneous pedicle screws: accuracy and radiation profile with 3D C-arm navigation

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Background: Intraoperative 3D C-arm imaging combined with navigation has improved percutaneous pedicle screw (PPS) placement. Conventionally, reference frames (RF) are fixed to spinous processes or the pelvis, but their stability can be limited. We explored a novel technique of attaching the RF directly to the inserted PPS. **Materials & Methods:** We analyzed 140 patients who underwent LLIF for lumbar degenerative scoliosis, spondylolisthesis, or spinal stenosis (68 males, mean age 70±10 years, BMI 25±5). Patients were allocated to: (1) C-arm group (fluoroscopy only) and (2) 3D-Navi group (3D C-arm with navigation). Within the 3D-Navi group, outcomes were compared between cases with and without PPS-mounted RF. Evaluated parameters included operative time, blood loss, fluoroscopy time, and perioperative transfusion. Radiation indices (Air Kerma area product, cumulative Air Kerma, number of CT-like scans) and screw placement accuracy (postoperative CT) were assessed. **Results:** The 3D-Navi group demonstrated significantly reduced fluoroscopy time compared with the C-arm group, with further reductions in the PPS-RF subgroup. Although Air Kerma indices did not differ significantly, the PPS-RF subgroup required fewer and more consistent CT-like scans. PPS insertion accuracy was higher in the 3D-Navi group. **Conclusion:** Attaching the RF to PPS provides stable fixation independent of spinous or pelvic bone quality, is applicable when multiple adjacent screws are inserted, and adapts better to alignment changes. This technique may enhance PPS accuracy while contributing to reduced occupational radiation exposure.

ID: AGS26/1175

P0787: The use of spinal navigation technologies for spinal fusion in LMICs: a mixed methods analysis from the Tanzania experience

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Introduction: In high-income countries, spinal navigation systems have been associated with reduced radiation exposure, improved screw placement accuracy and time, fewer wound complications, shorter patient hospital stays, and higher patient satisfaction in the immediate postoperative period. Introducing this technology to low and middle-income countries (LMICs) could replicate these benefits but may have unique challenges. We aimed to understand the experience of neurosurgeons after the introduction of the Brainlab Kick 2.0 Navigation System for spinal instrumentation in Dar es Salaam, Tanzania and to analyze the learning curve of the surgeons with the utilization of the device. **Material and Methods:** This is an exploratory sequential mixed methods study. Semi-structured face-to-face interviews were conducted with neurosurgeons and trainees at Muhimbili Orthopaedic Institute (MOI) in Tanzania during December 2023. Study participation was voluntary. Neurosurgeons were asked to reflect on their experience with the introduction and utilization of Brainlab spine navigation at the institution. Data analysis was performed using an inductive approach. All transcripts were coded using Dedoose v9.0, and specific categories were then formulated. The learning curve was then evaluated by collecting the duration of screw placement and stage of implementation for every Brainlab case from April 2023-December 2024. **Results:** Eleven neurosurgeons and trainees with between 1 to 20 years of experience were interviewed. Each interview lasted on average thirteen minutes. Three key themes were found: 1) Know-how description with spinal neuronavigation system, 2) Recognition of spinal navigation advantages, 3) Overcoming challenges with healthcare technology. Over an 18-month period of Brainlab navigation use, 56 cases were attempted, with 48 (86%) successful cases. Success rates improved over time ($p = 0.048$). The average screw placement time was 65 minutes (SD: 25), and the mean operative time was 213 minutes (SD: 53). No major screw misplacement issues were reported. Screw placement time significantly decreased during Phase III (takeoff phase) of the learning curve ($p = 0.033$). **Conclusion:** In general, neurosurgeons at MOI had mixed feelings with their experience using the spinal navigation system mainly due to challenges encountered and lack of knowledgeable personnel to help the team. However, the recognized advantage of such technology is a motivation to keep improving their experience. Based on screw placement duration, there was also an improvement in successful technology use over time.

ID: AGS26/2496

P0788: Navigation-assisted full-endoscopic spine surgery for complex lumbar pathologies: a preliminary report and case series

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Introduction: Full-endoscopic spine surgery (FESS) has become an increasingly accepted minimally invasive alternative to conventional open or mini-open approaches. Its advantages include reduced postoperative pain, shorter hospital stays, lower complication rates, and faster functional recovery. Despite these benefits, FESS can be technically demanding, particularly in revision cases, multilevel disease, or when pathology involves deep or anatomically complex regions such as the foraminal or extraforaminal zones. In these situations, precise localization and orientation are crucial for safe and effective decompression. Traditionally, intraoperative fluoroscopy has been used to assist with localization; however, fluoroscopy is limited by two-dimensional imaging, cumulative radiation exposure, and potential inaccuracies in complex cases. Intraoperative CT-based navigation has emerged as a valuable adjunct, providing real-time, three-dimensional (3D) volumetric imaging with high accuracy, reduced radiation to the surgical team, and the ability to update intraoperative images without significantly prolonging operative time. The purpose of this study was to evaluate the feasibility, safety, and outcomes of integrating real-time 3D navigation into FESS for various complex lumbar pathologies, including revision surgeries and foraminal disc herniations. **Material and Methods:** Five patients with lumbar spine disease were retrospectively reviewed after undergoing FESS assisted by

real-time 3D navigation between 2024 to 2025. Navigation data were registered intraoperatively and used to determine trajectory, orientation, and target localization. Surgical procedures included transforaminal endoscopic lumbar decompression (TE-LRD), bilateral revision interlaminar endoscopic lateral recess decompression (IE-LRD) at L5-S1, and minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) at L4-5 combined with lumbar endoscopic unilateral laminotomy for bilateral decompression (LE-ULBD) at L5-S1. Primary outcomes included feasibility of navigation integration, operative time, and intraoperative blood loss. Secondary outcomes included complication rates, postoperative pain (VAS), functional improvement (Oswestry Disability Index, ODI), health-related quality of life (EQ-5D-5L), and subjective patient satisfaction. Representative cases were supplemented with intraoperative images and surgical videos to demonstrate technical workflow and key advantages of navigation-assisted FESS. **Results:** All five patients underwent successful decompression and/or fusion with significant improvement in clinical symptoms. The cohort included challenging cases, such as revision surgery for recurrent stenosis and foraminal disc herniation at L5-S1. Navigation consistently provided accurate delineation of anatomical landmarks and facilitated safe access to pathological targets, particularly in narrow or scarred surgical corridors. The mean operative time was 207 ± 103.6 minutes, and the mean estimated blood loss was 69 ± 82.5 mL. No intraoperative or postoperative complications were observed. At follow-up, the mean EQ-5D-5L score was 0.95, with one subjective patient satisfaction 90%. Symptom resolution and functional recovery were comparable to conventional endoscopic procedures, but navigation offered added precision and confidence in technically demanding scenarios. **Conclusion:** Real-time 3D navigation is a valuable adjunct for FESS, particularly in complex lumbar pathologies where anatomical orientation is challenging. The technique enables accurate intraoperative guidance, enhances surgical precision, and supports safe and effective decompression without increasing operative risk or significantly prolonging surgical time. Our findings demonstrate the feasibility and safety of integrating navigation into endoscopic spine surgery. While limited by small sample size, this study provides preliminary evidence that navigation-assisted FESS can achieve excellent clinical outcomes while reducing technical uncertainty in difficult cases. Larger prospective studies are warranted to further validate these results and establish standardized protocols for its application in advanced endoscopic spine surgery.

ID: AGS26/2675
P0789: Surgical ingenuity that outsmarts navigation errors: stepwise and marker-guided switch techniques for cervical screws

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Introduction: Intraoperative navigation has revolutionized spine surgery, yet its Achilles' heel remains: navigation images cannot be corrected in real-time during screw insertion. Even small deviations may lead to suboptimal or dangerous trajectories. We introduce two novel, Surgical Ingenuity techniques - the Stepwise method and the Marker-Guided Switch Navigation method-that make real - time correction possible and thereby enhance accuracy in cervical screw fixation. **Material and Methods:** Patients undergoing posterior cervical fixation with pedicle screws, paravertebral foramen screws (PVFS), and lateral mass screws (LMS) were included. Stepwise method: Screws were intentionally under-inserted by ∼2 mm, verified with intraoperative O-arm CT, and then advanced step by step to the ideal cortical position, minimizing navigation error. Marker-Guided Switch Navigation: Metallic fiducials were placed on mobile lamina/spinous processes and registered. During drilling, tapping, and insertion, a navigated instrument alternated between the fiducial and the planned trajectory, enabling real-time detection and immediate correction of navigation drift. **Results:** Stepwise was applied in the majority of cases, and Marker-Guided Switch Navigation in a smaller subset (22 screws). In total, over 100 screws across both techniques were successfully placed with high accuracy and without neurovascular complications or need for revision surgery. **Conclusion:** These techniques directly address the critical weakness of navigation-lack of real-time correction during screw insertion. Stepwise and Marker-Guided Switch Navigation provide

practical, skill-driven innovations that enhance accuracy and safety across all cervical screw types.

ID: AGS26/2923
P0790: The role of intraoperative navigation in the management of distal junctional failure in adult spinal deformity surgery

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Introduction: Distal junctional failure (DJF) is a relevant complication after long thoracolumbar fusions for adult spinal deformity (ASD), with reported prevalence up to 20%. Sacroiliac junction involvement often leads to S1 screw loosening or breakage, necessitating revision. Iliac fixation provides additional distal stability but requires precise screw placement, which may be technically demanding. Intraoperative navigation has been introduced to enhance accuracy and optimize biomechanical outcomes. **Material and Methods:** A retrospective review was conducted on 22 patients who underwent revision surgery for DJF between 2020 and 2023. The mean age was 66.9 years (range 57-77), with a female predominance (15/22, 68%). All patients had prior instrumented thoracolumbar fusion for degenerative ASD. DJF was confirmed by standing full-spine radiographs, CT, and MRI. In all cases, iliac fixation was performed with intraoperative navigation, which was also applied for the revision or replacement of S1 screws. Radiographic assessment included lumbar lordosis, PI-LL mismatch, pelvic tilt, sagittal vertical axis, and global sagittal alignment parameters, with focus on the mismatch between L1 pelvic angle (L1PA) and T4 pelvic angle (T4PA). Primary outcomes were screw accuracy and implant survival; secondary outcomes included pain (VAS), spinopelvic alignment, and complication rates. **Results:** Navigation enabled accurate iliac screw placement in all patients. At 24-month follow-up, iliac screw loosening occurred in only one patient (4.5%). All revised S1 screws remained radiographically stable. Lumbar lordosis improved from 34.5° ± 9.2 to 46.8° ± 8.7 ($p < 0.01$). PI-LL mismatch decreased from 18.2° ± 6.5 to 7.6° ± 5.1 ($p < 0.01$). Sagittal vertical axis improved from 62 mm ± 21 to 28 mm ± 15 ($p < 0.01$). The L1PA-T4PA mismatch was significantly reduced, from a mean of 9.8° ± 4.7 preoperatively to 3.9° ± 2.8 at 12 months ($p < 0.01$), indicating a more balanced sagittal alignment. VAS scores decreased from 6.7 ± 1.4 preoperatively to 3.0 ± 1.1 at 12 months ($p < 0.01$). No major intraoperative complications (neurovascular injuries, iliac fractures) were reported. The overall reoperation rate at 12 months was 4.5% (1/22). **Conclusion:** Intraoperative navigation for DJF revision with mandatory iliac fixation ensured accurate screw placement, improved construct stability, and enhanced clinical outcomes. The significant correction of spinopelvic parameters and the reduction of the L1PA-T4PA mismatch highlight the role of navigation in restoring global sagittal balance. This strategy appears to lower the risk of secondary failure and reoperation, supporting its value as a reliable option in revision ASD surgery.

ID: AGS26/2972
P0791: Contribution of 3D imaging in the surgical planning of a T4 thoracic spine fracture

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Introduction: Upper thoracic spine fractures are rare but surgically demanding due to the narrow pedicles, difficult exposure, and proximity to vital structures. Accurate preoperative planning is essential to ensure safe fixation and optimal alignment. Three-dimensional (3D) reconstruction enhances fracture assessment and guides implant strategy compared to conventional imaging. **Material and Methods:** We report the case of a 36-year-old male with a high-energy trauma resulting in a T4 burst fracture (AO Spine B2). Preoperative CT and 3D reconstruction were performed. The 3D model provided detailed visualization of vertebral comminution, pedicle morphology, and canal dimensions, allowing precise planning of screw trajectories and construct length. The patient underwent posterior fixation from T2 to T6 using pedicle screws. **Results:** 3D imaging facilitated accurate identification of screw entry points and trajectories, reducing intraoperative uncertainty and operative time. Surgery was uneventful, with restoration of sagittal alignment and stable fixation. At follow-up, radiographs confirmed maintained construct stability without loss of correction or instrumentation-related complications. **Conclusion:** 3D imaging is a valuable adjunct in the preoperative planning of complex thoracic spine fractures. By improving visualization of fracture morphology and optimizing implant placement, it enhances surgical accuracy and safety. Routine integration of 3D reconstruction may improve outcomes in challenging levels such as T4.

ID: AGS26/2973
P0792: Role of 3D imaging in surgical planning for thoracic scoliosis

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Introduction: Scoliosis surgery requires precise understanding of vertebral rotation, pedicle morphology, and sagittal alignment. Conventional radiographs and 2D CT may underestimate three-dimensional deformities, increasing the risk of screw malposition. Three-dimensional (3D) reconstruction enhances visualization and supports tailored surgical planning. **Material and Methods:** A 14-year-old female with progressive idiopathic thoracic scoliosis (apex T7-T9) underwent preoperative evaluation with standing radiographs, CT, and 3D reconstruction. The 3D model was used to assess vertebral rotation, pedicle size, and sagittal alignment. Posterior spinal fusion from T5 to T10 with segmental pedicle screw fixation was planned using the 3D analysis to determine optimal screw trajectories and fusion levels. **Discussion:** 3D imaging revealed pedicle asymmetry and rotational deformity at the apex that were underestimated on 2D CT. Preoperative planning based on 3D reconstruction allowed accurate screw selection and trajectory, reducing intraoperative uncertainty and fluoroscopy time. Surgery was performed without complications. Postoperative imaging demonstrated correction of the main curve from 42° to 18° and restoration of sagittal alignment. At 12-month follow-up, correction was maintained with solid fusion and no neurological or mechanical complications. **Conclusion:** 3D reconstruction is a valuable adjunct in scoliosis surgery, providing detailed assessment of vertebral morphology and pedicle anatomy. It enhances surgical accuracy, facilitates safe deformity correction, and should be integrated into preoperative planning even in non-severe scoliosis cases.

ID: AGS26/2974
P0793: real-time augmented reality in perioperative for low-cost navigation

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Introduction: The cervical region's anatomy is intricate due to the proximity of vital organs to the osteo-ligamentous structures of the cervical spine. This complexity renders any surgical approach delicate, with significant risks of vascular and neurological complications. Preoperative planning and a comprehensive understanding of the patient's specific anatomy are crucial for ensuring successful surgical outcomes. We have adopted a new technique: pedicle screw navigation using augmented reality. **Materials and Methods:** The patient, diagnosed with cervicarthrosis at levels C3-C7 accompanied by cervical myelopathy and neurological signs, was indicated for a posterior arthrodesis with pedicle screws and decompression. Preoperative planning involved performing a cervical spine CT scan followed by 3D reconstruction using specialized software. This produced a 3D model of each vertebra, reflecting the patient's unique anatomy. Subsequently, we prepared the screw trajectories on the reconstruction. A detailed examination of the entire reconstruction allowed for a comprehensive 3D model of the cervical spine with the intended construct. During the surgical procedure, the surgeon utilized augmented reality glasses to visualize the cervical spine reconstruction in 3D. This enabled real-time observation of screw trajectories, cuts, and the construct without manual manipulation. Evaluation was based on operative time, accuracy of screw placement relative to preoperative planning, and radiological assessment (CT scan). **Results:** The surgical procedure lasted 150 minutes. The placement of screws was facilitated by viewing the 3D model, which minimized manual adjustments and reliance on image intensification. Postoperative outcomes were uncomplicated: no neurological complications, resolution of paresthesias, and significant reduction in cervicobrachial neuralgias. The postoperative CT scan confirmed accurate screw positioning. **Discussion:** Augmented reality navigation achieved satisfactory results, comparable to those predicted during preoperative planning, with high precision in screw trajectories. The 3D reconstruction of the spine reduced operative time and enabled real-time visualization of predefined screw paths, facilitating easier manipulation of the construct. **Conclusion:** The integration of new technologies such as augmented reality and artificial intelligence represents the future of surgery. These innovations provide excellent results with minimal risk and render surgical procedures more reproducible.

ID: AGS26/2976
P0794: A low-cost 3D-printed guide for pedicle screw navigation in the lower cervical spine

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Introduction: Posterior cervical spine osteosynthesis is increasingly popular for providing stable arthrodesis along with decompression and release. Currently, pedicle screw placement is the standard practice for achieving spine stability. However, the complexity of this anatomical region and the presence of vital structures pose significant challenges. Cervical pedicles are anatomically smaller compared to thoracolumbar pedicles, making the surgical procedure more delicate and prolonged with a notable risk of postoperative complications. To address this issue, we have adopted a novel approach: 3D reconstruction and 3D-printed guides. **Materials and Methods:** This preliminary retrospective study involved two cases of cervical spondylosis from C3 to C7,

with signs of myelopathy on imaging. The surgical indication was posterior spinal fusion with pedicle screws and decompression. Surgical planning began with cervical spine CT imaging followed by 3D reconstruction to understand the patient's anatomy and pre-plan screw trajectories. Custom 3D-printed guides were then created for each vertebra based on the pre-established screw paths. Evaluation metrics included operative time, bleeding, postoperative complications (particularly neurological), and screw positioning accuracy compared to preoperative planning using radiological control (CT). **Results:** The average operative time was 160 minutes. Image intensifier use was required only twice. No blood transfusions were necessary postoperatively. Postoperative outcomes were uncomplicated: no neurological issues, resolution of paresthesias, and a significant reduction in cervical radiculopathy. Postoperative CT scans demonstrated screw placement accuracy of 90% (with screws deviating by 4° transversely and 5° frontally). The average postoperative hospital stay was 4 days. **Discussion:** Pedicle screw placement in the cervical spine is challenging due to anatomical complexity and the small size of the pedicles. Precise screw positioning is crucial for achieving solid arthrodesis and avoiding complications. This technique has demonstrated the feasibility of achieving intra-pedicular screw placements that closely match preoperative plans, thereby mitigating potential complications such as neurological damage to the spinal cord and roots or vascular injury to the vertebral artery. The procedure duration was reduced with lower risk of infection and minimal reliance on image intensification. **Conclusion:** The combination of 3D reconstruction and intraoperative augmented reality navigation has yielded excellent results with precise anatomical accuracy, minimizing complications. This approach facilitates the surgical procedure, making it more reproducible and manageable.

ID: AGS26/3113
P0795: Intraoperative navigation improves pedicle screw accuracy and lowers staff radiation at the cost of early time overhead: a three-year thoracolumbar cohort (2022-2024)

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Introduction: Thoracolumbar fractures are the most common localization of spinal trauma. Accurate pedicle screw placement is essential for biomechanical stability and the prevention of neurological injury. Conventional fluoroscopic guidance has limitations in accuracy and exposes the surgical team to ionizing radiation. Intraoperative navigation (O-arm/3D CT) enables higher accuracy of screw placement and significantly reduces staff radiation exposure, although it may prolong operative time. **Material and Methods:** We retrospectively analyzed 284 patients operated between 2022 and 2024 for degenerative conditions and thoracolumbar trauma. In 2022, 86 patients were treated, in 2023 a total of 92, and in 2024 a total of 106 patients. Patients were divided into two groups based on intraoperative guidance: conventional fluoroscopy and navigation. The primary outcome was pedicle screw accuracy on postoperative CT scans using the Gertzbein-Robbins classification. Secondary outcomes included perioperative complications, revision rates, operative time, and radiation exposure for both staff and patients. **Results:** The proportion of procedures performed with navigation increased from 30% in 2022 to 70% in 2024. Navigation demonstrated superior accuracy of screw placement (97.5% accurately placed screws, 142/146) compared to fluoroscopy (91.0%, 126/138; $p < 0.01$). Revision for malposition was required in 1.4% of the navigation group versus 4.3% of the fluoroscopy group. Operative time was longer in the navigation group by an average of 15 minutes in 2022, but this difference decreased to 5 minutes in 2023, and by 2024 operative time was nearly equivalent between groups. Staff radiation exposure was negligible in the navigation group, while patient radiation dose was higher compared to fluoroscopy. **Conclusion:** Intraoperative navigation significantly improves pedicle screw accuracy, reduces revision rates, and almost eliminates radiation exposure for surgical staff. Although initially associated with longer operative time, the learning curve effect led to near parity with fluoroscopy by the third year. Despite higher patient radiation doses, navigation demonstrates clear clinical benefits and may represent a new standard of care in thoracolumbar trauma surgery.

ID: AGS26/3260
P0796: Accuracy of pedicle screw placement: navigation versus free-hand technique - Literature review

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Introduction: Pedicle screw placement is a cornerstone of posterior spinal fixation. Malposition may lead to neurological injury, vascular complications, and construct failure. Navigation-assisted techniques have been developed to improve placement accuracy compared to conventional free-hand methods, particularly in anatomically challenging regions. **Material and Methods:** A systematic review of PubMed and Google Scholar was conducted using the keywords: "pedicle screw," "navigation," "free-hand," "accuracy," "posterior spinal fixation," and "complications."

Studies comparing navigated versus free-hand pedicle screw placement in cervical, thoracic, and lumbar spine were included. Data on placement accuracy, cortical breaches, neurovascular complications, operative time, and clinical outcomes were extracted and analyzed.
Results: • Navigated pedicle screw placement consistently shows higher accuracy across all spinal levels, especially in complex anatomical regions.
• Navigation significantly reduces cortical breaches and neurovascular injury.
• Free-hand placement remains effective in experienced hands but shows higher variability and increased risk in cases of altered anatomy or deformity.
• Operative time may be slightly longer with navigation; however, reduced revision rates and improved safety justify its use.
• Preoperative CT planning and intraoperative imaging further enhance placement precision and complement navigation techniques. **Conclusion:** Navigation-assisted pedicle screw placement provides superior accuracy and safety compared to free-hand techniques, particularly in anatomically complex or deformed spines. Integration of navigation and imaging guidance is recommended to optimize outcomes in posterior spinal fixation.

Nonoperative clinical treatments

ID: AGS26/58
P0797: The spine - The holistic way to the universe

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Introduction: The spine is a subject of interest since Ancient Times, dating back to Egypt, Greece and probably even older ages. The "Father" of spine is believed to be Hippocrates, who not only accurately described the anatomy of the spinal cord but also mentioned for the first time the spinal alignments - scoliosis, lordosis, kyphosis. The Hippocratic times, however, were also related to the holistic approach to the diseases, taking into consideration the dietary, environment and Gods. His medications were based on natural components, very similar to the current homeopathic medicine. On the other hand, in spirituality the spine is linked to the foundation of life, and link between conscious and unconscious. The present study has the aim to emphasize the relation of the holistic approach to the spinal diseases and the currently available data on the changes of white matter tracts and behavior. **Material and Methods:** The study is conducted based on literature search on world engines such as Medline, Cochrane and Wiley for studies reporting white matter changes in patients with spinal disease and their behavioral changes. Additionally, data on spiritual medicine was retrieved for additional information. **Results:** Several studies describe brain and spinal white matter changes, related to the level of spinal disease/injury and duration of disease. As known, white matter tracts are related to cognition and behavior. In this term, meditation and spiritual practices are related to functional and structural changes, assessed with MRI imaging, as well as with pain and anxiety relief. Additionally, the metabolomics established high quality studies on the synergy of diet and nutrition in spinal diseases Finally the homeopathic medicine is used in variety of clinical trials showing beneficial effects of homeopathy over placebo for pain relief, but no data were available of white matter structures. **Conclusion:** Even though Hippocratic Era has passed, variety of fields such as spirituality, spine surgery, alternative medicine, divided into categories, approach the same issue. Neither one, however, is able to treat the spinal disease/injury alone. Therefore, we believe that the approach to the spinal diseases should be holistic, as should be the care for each patient.

ID: AGS26/210
P0798: Spinal involvement in chronic recurrent multifocal osteomyelitis

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Introduction: Chronic recurrent multifocal osteomyelitis (CRMO) is a rare autoinflammatory bone disorder that frequently affects the spine in pediatric patients, causing persistent pain, structural deformities, and potential neurological complications. Vertebral involvement is reported in 28-81% of cases, most commonly in the thoracic spine. Diagnosis is challenging due to nonspecific symptoms and similarities with infectious spondylodiscitis or malignancies. Whole-body MRI is the most informative non-invasive method for early detection and follow-up, while histopathological evaluation is occasionally required to exclude infection or tumor. **Material and Methods:** This abstract is based on a synthesis of published literature on pediatric spinal CRMO and a 10-year retrospective clinical observation of children with confirmed CRMO and vertebral involvement. Data from international studies on prevalence, clinical features, imaging, and treatment were integrated with our long-term single-center experience, focusing on treatment strategies and surgical

indications. **Results:** Literature data show that NSAIDs are effective in approximately 60-70% of patients, bisphosphonates in up to 90.9%, and TNF-α inhibitors in about 66.7%. Our own 10-year clinical experience confirms that conservative management is effective in the vast majority of cases, with surgery required only for severe complications such as progressive deformity, spinal instability, or neurological compromise. Earlier treatment strategies, based on general principles for chronic osteomyelitis, often led to unnecessary surgical interventions without improved outcomes. The integration of imaging-based monitoring with stepwise pharmacological therapy reduced surgical morbidity and improved long-term functional results. **Conclusion:** Pediatric spinal CRMO requires early recognition, whole-body MRI evaluation, and a tailored conservative treatment strategy. Surgical intervention should be reserved for well-defined complications, representing a paradigm shift from earlier aggressive surgical approaches. This approach aligns with the non-infectious, inflammatory nature of the disease and minimizes unnecessary operative risks.

ID: AGS26/431
P0799: Can long-term corrective cast and brace treatment avoid growth-friendly surgery in early-onset scoliosis? - Indications and limitations

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Introduction: The optimal management of early-onset scoliosis (EOS) remains controversial, particularly regarding the balance between growth-friendly surgery (GFS) and the risks of multiple surgical interventions. At our institution, we aim to avoid GFS in patients with EOS by extending alternatively repetitive cast and brace treatment (ARCBT) into the school-age years whenever possible, completing treatment with a single final fusion (FF). This study retrospectively assessed the feasibility, efficacy, and limitations of this strategy. **Material and Methods:** We reviewed 24 EOS patients who underwent at least two cycles of ARCBT and were followed until triradiate cartilage closure, which was used as a threshold for considering FF. Data collected included age at presentation, number of casts, Cobb angle progression, treatment status at triradiate closure, and final outcomes. **Results:** The cohort included 7 idiopathic scoliosis (IS), 7 syndromic scoliosis (SS), and 10 neuromuscular scoliosis (NMS) cases (10 males, 14 females). Mean age at initial presentation was 4.8 ± 2.3 years. Casting began at 5.6 ± 2.4 years, with initial Cobb angle improving from 47.2 ± 9.6° to 24.7 ± 6.9° (47.4% correction). Patients underwent an average of 7.2 casts during treatment. Mean follow-up was 6.8 ± 2.4 years to triradiate closure and 11.8 ± 4.2 years to final follow-up. Four patients required surgery before triradiate closure due to curve progression: GFS in 2 SS and early FF in 1 SS and 1 NMS. Their mean Cobb angle improved from 98.0 ± 14.6° to 49.0 ± 5.1°, although progression occurred in both GFS cases. Among 20 patients who reached triradiate closure without surgery, mean Cobb angles were IS: 53.7 ± 16.6°, SS: 77.8 ± 28.8°, and NMS: 66.9 ± 22.1°, with no statistically significant differences among groups. FF was later performed in 10 patients (IS: 5, SS: 2, NMS: 3), achieving correction from 77.4 ± 11.8° to 35.4 ± 15.3°, which was maintained at final follow-up. The remaining 10 patients (IS: 2, SS: 2, NMS: 6) remained non-surgical, with final Cobb angle of 70.4 ± 32.2°. In 5 patients with curves > 70°, surgery was not performed due to severe comorbid progression (n = 3) or parental refusal (n = 2). **Conclusion:** All IS patients avoided GFS through extended ARCBT. Some SS and NMS patients also reached FF without GFS; however, others may have had suboptimal outcomes due to delayed surgical intervention. Extending ARCBT into school age appears to be a feasible strategy for selected EOS patients, but careful patient selection and timely surgical decision-making are essential to optimize long-term outcomes.

ID: AGS26/853
P0801: Impact of a standardized preoperative protocol for anxiety management and prone positioning in PKP patients: a prospective intervention study on surgical efficiency and patient satisfaction

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Introduction: PKP patients are typically elderly individuals experiencing severe pain and anxiety. Suboptimal preoperative preparation can prolong operative time, increase intraoperative risks, and negatively impact the patient experience. This study evaluates the effect of a nurse-led, standardized preoperative protocol on improving these metrics. **Material and Methods:** From January to June 2023, 120 patients scheduled for PKP were consecutively enrolled and assigned to an intervention group (n = 60) or a usual care group (n = 60). The usual care group received routine preoperative nursing. The intervention group additionally received a standardized protocol administered by an experienced spine nurse: 1) Structured interview and anxiety mitigation using

the Self-Rating Anxiety Scale (SAS) followed by targeted psychological support; 2) Preoperative prone position acclimatization training on a hospital bed to gradually increase tolerance. Time for intraoperative positioning, instances of intraoperative vital sign fluctuation, total operative time, and patient satisfaction scores (0-10) at 24 hours postoperatively were recorded and compared. **Results:** Preoperative SAS scores were significantly lower in the intervention group (45.3 ± 6.7 vs. 55.8 ± 8.4, $p < 0.01$). Compared to the usual care group, the intervention group required less time for positioning in the operating room (5.2 ± 1.1 vs. 8.7 ± 2.3 min, $p < 0.01$), exhibited fewer episodes of vital sign fluctuation (1.2 ± 0.5 vs. 2.8 ± 1.1, $p < 0.01$), and showed a trend towards shorter operative time (29.5 ± 4.8 vs. 31.9 ± 5.6 min, $p = 0.06$). Patient satisfaction was significantly higher in the intervention group (8.9 ± 0.7 vs. 7.1 ± 1.3, $p < 0.01$). **Conclusion:** A nurse-led standardized preoperative protocol, by effectively reducing patient anxiety and facilitating positional acclimatization, significantly optimizes surgical workflow, enhances intraoperative safety, and greatly improves patient satisfaction. This model highlights the critical value of nursing intervention in perioperative PKP care and is readily transferable to hospitals at various levels.

ID: AGS26/947
P0802: Rehabilitation strategies following posterior cervical decompression for cervical spondylotic myelopathy: a narrative review and framework for clinical practice

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Introduction: While posterior surgical approaches, including laminectomy and laminoplasty, stop the progression of CSM, many patients continue to experience persistent neurological deficits and diminished physical function. Postoperative rehabilitation is increasingly recognized as crucial for optimizing outcomes but core elements like timing and best-practice protocols remain poorly defined. The aim of the study was to synthesize evidence surrounding rehabilitation interventions after posterior cervical decompression for cervical spondylotic myelopathy (CSM) and to identify key priorities for the development of standardized perioperative programs. **Material and Methods:** Comprehensive review of PubMed, Ovid, Embase, and Web of Science was performed for therapeutic English-language studies from 1990 to August 4, 2025, evaluating rehabilitation after posterior cervical decompression for CSM. **Results:** 29 studies were included. Consistent participation in multidisciplinary programs, including physical and occupational therapy, gait/balance work, and progressive strengthening, was associated with improved function, performance, and patient satisfaction. Particularly, early initiation was linked to larger neurological and functional gains. Hand dexterity and low-intensity aerobic activity offered benefit during the collar phase. Extended collar use was not associated with superior outcomes and may risk muscle atrophy. Adjunctive options such as functional electrical stimulation and SEM gloves demonstrated potential as complements to standard therapy, but literature remains preliminary. **Conclusion:** A staged, multidisciplinary, and patient-centered rehabilitation approach, initiated early and integrating mobility, hand dexterity, and balance training, is supported by current evidence and may optimize postoperative recovery in CSM. High-quality randomized trials are needed to confirm optimal timing, sequence, and use of emergent technologies in this population.

ID: AGS26/1110
P0803: The effects of brace treatment on sagittal pelvic parameters in adolescent idiopathic scoliosis patients with Lenke type 5 curves and Risser stage 4-5

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Introduction: It is well-established that Risser stage 4 marks the near completion of spinal growth, whereas Risser stage 5 indicates full skeletal maturity. Some studies have reported the application of bracing at these later stages, primarily for cosmetic concerns, though improvements in angular parameters have also been documented. This study aimed to evaluate the impact of brace treatment on sagittal spinopelvic alignment in adolescents with Lenke type 5 idiopathic scoliosis and Risser stage 4-5 skeletal maturity. We sought to assess whether bracing, despite late skeletal maturity, could induce meaningful structural changes in spinopelvic parameters and the Cobb angle. **Material and Methods:** A retrospective analysis was conducted on 81 patients diagnosed with Lenke type 5 scoliosis. Patients were grouped into brace-treated (n = 34) and non-braced (n = 47) cohorts. Radiographic evaluations of pelvic and spinal coronal, sagittal parameters - including Main thoracic (MT) curve, Thoracolumbar (TL) curve, pelvic incidence (PI), pelvic tilt (PT), sacral slope (SS), lumbar lordosis

(LL), and thoracic kyphosis (TK) - were performed at baseline, 6 months, and 24 months. Changes were analyzed using the Wilcoxon and Mann-Whitney U tests. **Results:** In the braced group, the mean reduction in the main thoracic (MT) curve during the first 6 months was 3.03°, followed by a slight increase of 0.38° between months 6 and 24. The overall net reduction in MT over 24 months was 2.65°, which was statistically significant ($p = 0.0001$). For the thoracolumbar (TL) curve, a decrease of 4.15° was observed in the first 6 months, followed by an increase of 1.09° between 6 and 24 months. The net 24-month change was a 3.06° reduction, which was also statistically significant ($p = 0.0059$). In the braced group, significant improvements were observed in sagittal parameters PT (+1.82°, $p = 0.0022$), LL (-8.5°, $p = 0.0003$), and TK (-4.94°, $p = 0.0020$) over 24 months. SS decreased initially but returned to baseline, showing no long-term significance. PI remained stable. Correlation analysis revealed strong positive associations between LL and both PI ($r = 0.58$, $p < 0.001$) and PT ($r = 0.50$, $p < 0.001$). **Conclusion:** Brace treatment may lead to favorable modifications in coronal, sagittal and related pelvic alignment, even in skeletally mature patients. These findings support bracing use in even late Risser stage AIS cases to improve overall postural balance and pelvic orientation.

ID: AGS26/1260
P0804: Efficacy of Schroth exercises in management of adolescent idiopathic scoliosis within Asia

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Introduction: The Schroth method in the management of Adolescent Idiopathic Scoliosis (AIS) consists of sensorimotor, postural and breathing exercises aimed at recalibration of normal postural alignment, static/dynamic postural control, and spinal stability. It involves exercises customised to the patient's spinal curve, and can be prescribed on its own or to complement bracing regimes. This study was conducted to investigate the efficacy of Schroth exercises in the absence of bracing in management of AIS within a school screening programme. **Materials and Methods:** A retrospective study was conducted on prospectively collected database of AIS patients seen at a single tertiary hospital in Singapore from 2022 to 2025. Inclusion criteria were patients diagnosed with AIS, aged between 10 to 18 years old, and participated in supervised Schroth exercises with the physiotherapists with no other ongoing or prior interventions such as bracing or surgery. Only patients completing a minimum of four sessions of Schroth exercises, typically monthly, were included. Reasons for exclusion were most commonly not achieving the minimum frequency or duration of Schroth exercises, with others being concurrent bracing or a lack of follow-up data. A control group involving AIS patients doing normal exercises, wearing a brace or having no intervention was also analysed for comparison. Cobb angle and Angle of Trunk Rotation (ATR) were measured in both groups, while SRS-22 (Scoliosis Research Society-22 patient questionnaire) scores were collected from the Schroth group. **Results:** A total of 50 AIS patients were included in the study (70.0% females, mean age 13.60 ± 1.42 years, BMI 18.27 ± 3.66, Risser 2.6 ± 1.2). They attended 5.5 ± 0.5 sessions of Schroth exercises across 6.2 ± 4.2 months. Improvements in thoracic ATR ($p = 0.028$, CI [0.09, 1.57], Cohen's $d = 0.32$) and lumbar ATR ($p = 0.042$, CI [0.03, 1.53], Cohen's $d = 0.30$) were statistically significant, but change in Cobb angle was not significant ($p = 0.396$, CI [-1.41, 0.57], Cohen's $d = 0.12$). Improvement in quality of life was also represented by a significant improvement in SRS-22 scores ($p = 0.001$, CI [-0.23, -0.06], Cohen's $d = 0.65$). Analysis of patients who defaulted on physiotherapy showed that school commitments and examinations played a major role in compliance to the sessions. **Conclusions:** Schroth exercises are effective in improving ATR and SRS-22 scores, while effective in maintaining Cobb angle. The improvement in ATR and SRS-22 scores provides evidence that Schroth exercises should be considered in patients with slightly more mature spines, in addition to standardised treatment. Qualitative studies can also be carried out amongst those excluded from the study to investigate their reasons for not attending supervised Schroth exercise sessions on a regular basis.

ID: AGS26/1411
P0805: Postoperative physical therapy utilization for cervical disc replacement: an analysis of practice patterns, predictors, and comparison to anterior cervical discectomy and fusion

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Introduction: Cervical disc replacement (CDR) is increasingly used as an alternative to anterior cervical discectomy and fusion (ACDF) for managing cervical degenerative disease. It

provides potential benefit, particularly in younger patients with 1-2 level disease and good bone quality, with its motion-preserving properties. While postoperative physical therapy (PT) is commonly employed following ACDF and has been linked to improved patient-reported outcomes, PT utilization patterns after CDF remain poorly understood due to limited research and absence of established guidelines. This study aimed to identify patterns and predictors of postoperative PT utilization after CDR and compare to its usage following ACDF. **Material and Methods:** Patients who underwent one- to two-level CDR from 2010 to April 2023 were identified in the PearlDiver national database via CPT codes. Patients with trauma, malignancy, infection, or revisions within one year were excluded. PT utilization was assessed between 1 week to 1 year postoperatively. Multivariable logistic regression was performed to identify independent predictors of PT utilization following CDR, controlling for age, gender, Elixhauser Comorbidity Index (ECI). Patients who underwent one- to two-level ACDF acted as a control group. Chi-squared and independent T-tests compared proportion of patients who attended PT, time to first PT visit, and number of total PT visits between CDR and ACDF cohorts. **Results:** Among 33,558 patients who underwent one- to two-level CDR, 7,115 (21.2%) patients utilized PT in the first year postoperatively. Patients who engaged in PT were older (47.34 vs 47.06 years), had more comorbidities (ECI 3.48 vs 3.0), more likely female (41.4% vs 53.8%), and had higher mean family income ($85,187 vs $82,686) (all $p < 0.05$). The strongest predictors of PT utilization included diagnosis of radiculopathy (OR: 1.64), myelopathy (OR: 1.51), fibromyalgia (1.50), mean family income > $75,000 (OR: 1.44), education status > 75%ile (OR: 1.43), and Midwest region (OR: 1.39) (all $p < 0.001$). Factors associated with decreased PT utilization included Medicare insurance (OR: 0.65), age > 70+ (OR: 0.73), Southeast region (OR: 0.80), male gender (OR: 0.85), education status < 25%ile (OR: 0.88), and outpatient surgery (OR: 0.89). When compared to ACDF, a similar number of CDR patients utilized postoperative PT (21.2% vs 21.7%), but they initiated PT earlier (75.2 vs 90.6 days) and attended less PT visits (10.14 vs 10.93 visits) (all $p < 0.05$). **Conclusion:** Less than one-quarter of patients engaged in postoperative physical therapy usage following one- to two-level CDR. These patients tend to have a higher comorbidity index and higher socioeconomic status. Preoperative diagnoses, comorbidities, education status, and insurance type predicted PT utilization. Compared to ACDF patients, CDR patients initiated PT earlier and required fewer visits, despite utilizing PT at a similar rate. Identifying predictors of PT use and differences compared to ACDF highlights the absence of standardized rehabilitation protocols. These findings emphasize the need for evidence-based guidelines to optimize recovery and reduce variability in postoperative care.

ID: AGS26/1423
P0806: Patterns of physical therapy utilization following microdiscectomy

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Introduction: Lumbar microdiscectomy (MD) is a minimally invasive surgery for symptomatic disc herniation refractory to conservative management. Physical therapy (PT) after MD may aid recovery by initiating mobilization and strengthening, but optimal use and application of protocols remain unclear. This study investigates the frequency, timing, and predictors of PT utilization on a national, multicenter level following MD. **Material and Methods:** The PearlDiver Mariner national database was used to identify patients undergoing MD from 2010-2022 using CPT codes. Patients were stratified using CPT codes for postoperative PT interventions specifically for ICD-9/10 diagnosis codes related to lumbar disc degeneration. Patients under 18, with malignancy, infection, trauma, rheumatoid arthritis, revisions within one year, or less than 1 year follow-up were excluded. PT utilization was assessed between 7-365 days postoperatively. Patient demographics, comorbidities, time to PT, and preoperative PT utilization were collected. Statistical analyses included ANOVA, chi-squared tests, univariate and multivariate logistic regression to identify significant predictors of PT use. **Results:** Among 372,376 patients in this national cohort, 89,970 (24.2%) received postoperative PT following MD surgery. Patients utilizing PT were slightly younger (52.8 ± 14.6 years), disproportionately female (49.9%), had higher comorbidity scores (ECI 3.31 ± 2.92), and greater mean family income ($77,937 ± $21,722). Timing of PT initiation varied: 38% started PT within 6 weeks postoperatively, 68% by 12 weeks, 79% by 18 weeks, 84% by 24 weeks, and 100% by one year, with commercial insurance enabling the shortest delay (84.4 days) compared to Medicaid (100.6 days) and Medicare (97.6 days) ($p < 0.05$). Postoperative PT users had markedly higher rates of preoperative PT use when compared to patients who did not undergo postoperative PT (25.8% vs. 8.6%); notably, preoperative PT emerged as the strongest predictor of postoperative PT use (OR: 3.73) (both $p < 0.05$). Other independent predictors included inpatient surgical status (OR: 1.19), advanced education (OR: 1.28),

and comorbidities including obesity (OR: 1.35), osteoarthritis (OR: 1.43), fibromyalgia (OR: 1.49), and depression (OR: 1.29) (all $p < 0.05$). Geographic region was significant: patients in the Midwest (OR: 1.42) and Northeast (OR: 1.22) were more likely to receive PT, while those from the South (OR: 0.68) and West (OR: 0.92), or with Medicare (OR: 0.72), were less likely (all $p < 0.05$). Surgical complexity also played a role, as multi-level procedures increased PT utilization (OR: 1.07), whereas single-level surgery was associated with lower PT use (OR: 0.94). Additionally, patients experiencing medical (OR: 1.24) or surgical complications (OR: 1.32) were more likely to engage in PT (all $p < 0.05$). **Conclusion:** Postoperative PT after MD is underutilized, with only 24% of patients engaging in therapy. Utilization varies by age, comorbidities, insurance, region, levels involved, and postop complications, with preoperative PT strongly predicting postoperative use. These findings highlight disparities and the need for standardized, equitable rehabilitation guidelines to optimize recovery. This study highlights significant disparities in postoperative PT utilization following MD, influenced by demographic, socioeconomic, and clinical factors. Understanding these predictors can guide the development of standardized, equitable rehabilitation protocols to optimize patient recovery and resource allocation.

ID: AGS26/1487
P0807: The effects of postoperative activity restrictions on outcomes after spine surgery: a systematic review

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Introduction: Postoperative activity restrictions are commonly prescribed after spine surgery. However, it is unclear whether postoperative restrictions improve clinical or surgical outcomes after spine surgery. The primary aim of this study was to investigate the effects of postoperative activity restrictions in spine surgery on patient-reported outcomes. **Material and Methods:** This review included studies discussing degenerative spine surgery patients with postoperative activity restrictions, defined as limitations on specific movements such as bending or twisting, or activities such as driving or weightlifting. Electronic searches were conducted using PubMed, CENTRAL, Embase, and Web of Science databases in November 2024. The Revised Cochrane Risk-of-Bias tool for randomized trials (RoB 2) and Risk Of Bias In Non-randomized Studies - of Interventions, Version 2 (ROBINS-I V2) tools were used to evaluate included studies for risk of bias. Pain, function/disability, and data on recurrence (reherniation), adverse events and complications were collected from each study. Meta-analysis was initially planned but was deemed unfeasible due to the limited number and high heterogeneity of included studies. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach was used to determine the certainty of the body of evidence. **Results:** 3,723 studies were screened. Four studies met the inclusion criteria: 1 randomized controlled trial and 2 prospective single-arm cohort studies discussing open lumbar discectomy, and 1 prospective non-randomized two-group cohort study discussing percutaneous endoscopic lumbar discectomy (PELD). Notably, there are no studies discussing restrictions after cervical or thoracic spinal surgery. No significant differences were found between restrictive and liberal postoperative activity restrictions, and the certainty of the findings were low for all included outcome measures. **Conclusion:** Limited evidence exists regarding the effectiveness of postoperative activity restrictions on outcomes after lumbar spine surgery and there is no literature discussing postoperative activity restrictions after cervical or thoracic spine surgery. The certainty of evidence makes it difficult to provide a definitive conclusion for or against the use of postoperative activity restrictions in spine surgery. Robust randomized controlled trials are needed to determine the impact of various types of activity restriction protocols across several types of spinal surgery. Future studies could provide the basis for the creation of standardized, evidence-based postoperative activity restriction protocols to ensure optimal patient outcomes after spine surgery. Clinical recommendations for postoperative activity restrictions after spine surgery are primarily based on individual surgeon preference, and the evidence surrounding their use is extremely limited. The continued use of non-evidence-based activity restriction protocols has significant medical, legal and financial implications on practice.

ID: AGS26/1701
P0808: Spontaneous spinal subdural hematoma: a case series of an uncommon cause of paraplegia

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Introduction: Spinal subdural hematoma (SSDH) is a rare pathology with significant morbidity and mortality. It can be traumatic, iatrogenic or spontaneous and is believed to account for 4-6,5% of all spinal hematomas. The aim of this study is to showcase this rare cause of severe neurological deficit and to highlight the need of correct diagnosis. **Cases Presentation:** The first patient was 67-year-old male patient with no history coagulopathy or trauma. He presented with acute back pain during rest time and subsequent paraparesis (3/5 at all the muscle groups of the lower extremities, ASIA D) and sensory deficit below the T10 level. The thoracic spine MRI showcased a SSDH at the T8 level with mild spinal cord compression. Conservative treatment was selected. The patient underwent intensive physiotherapy with improvement of his symptoms. The second case was that of an 87-year-old woman with a history of clopidogrel intake due to coronary disease. She presented with acute back pain during swimming and subsequent paraplegia and sensory deficit below T6 level (ASIA A). The thoracic spine MRI revealed a large SSDH from T4 to T9 with spinal cord compression. Conservative treatment was selected with no improvement of the patient's clinical status. The third patient was a 74-year-old female patient that was hospitalized due to chronic obstructive pulmonary disease and was under therapeutic anticoagulant medication due to pulmonary embolism. She presented with acute lumbar pain followed by paraplegia and sensory deficit below T2 level (ASIA A). The MRI of the cervical, thoracic and lumbar spine showed a large SSDH from C7 to T7 with spinal cord compression. An acute myocardial infarction was suspected, and she was submitted in the ICU where she was intubated after 24 hours. Conservative treatment was selected for the SSDH. **Discussion:** The spontaneous SSDH can occur due to coagulating disorders or anticoagulant medications, underlying vascular malformations, neoplasms and brittle vessel walls. In many cases the initial imaging examinations were unable to identify an underlying cause. The SSDH causes spinal cord compression resulting to severe motor, sensory and autonomic dysfunctions. **Conclusion:** The SSDH can result to high morbidity and mortality, and it is of grave importance the prompt diagnosis and the selection of the correct treatment.

ID: AGS26/1712
P0809: Patterns of physical therapy utilization following anterior lumbar interbody fusion

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Introduction: Postoperative physical therapy (PT) can improve pain and functionality after lumbar fusion without increasing complication rates, however, its role following anterior lumbar fusion (ALIF) remains understudied. This study aimed to identify trends and predictors of postoperative PT utilization following ALIF and characterize the frequency, timing, and types of PT services utilized. **Materials and Methods:** In this retrospective cohort study, the PearlDiver Mariner database was used to analyze patients undergoing ALIF from 2010-2022. Patients were identified using International Classification of Disease 9th (ICD-9) and 10th (ICD-10) editions and Current Procedural Terminology (CPT) codes. Exclusion criteria included less than one year follow-up, posterior instrumentation > 5 levels, prior ALIF, revision surgery within one year, and surgical indications for neoplasm, infection, revision, or trauma. PT utilization was assessed between 7-365 days postoperatively. Patient demographics, medical comorbidities, and operative characteristics were compared between study cohorts. The secondary objectives were to characterize the frequency, timing, and types of PT services delivered. Statistical analyses included t-tests, chi-squared tests, and multivariable logistic regression to identify predictors of PT use. **Results:** Among 112,808 patients undergoing ALIF, 28,718 (25.5%) utilized PT within the first year. PT users were younger, had higher Elixhauser Comorbidity Index (ECI) scores, and higher income levels ($p < 0.001$). Multivariable analysis identified positive predictors of PT usage, including commercial insurance (OR: 1.52), orthopedic referral (OR: 1.26), higher income (OR: 1.07), previous decompressions (OR: 1.08), and postoperative medical (1.21) or surgical (1.10) 90 day-complications ($p < 0.001$ for all). Of the patients who utilized PT following ALIF, the average number of visits was 12.25. the average number of postoperative days before patients' first PT visit was 102.98 ± 84.24 days. Patients with Medicare took the longest to initiate their first PT session (113.72 ± 90.40 days, $p < 0.001$) whereas those with commercial insurance initiated postoperative PT the quickest (100.36 ± 82.86 days, $p < 0.001$). Timing of PT initiation varied: 23.6% within 6 weeks, 31.8% between 6-12 weeks, 17.9% between 12-18 weeks, and 26.6% after 18 weeks. The most frequently billed interventions also had the highest average visits per patient, the highest being CPT-97110 for therapeutic exercises (87.3% and 11.1 visits). **Conclusion:** PT utilization was low after ALIF and practice patterns after ALIF varied significantly and was influenced by insurance type, comorbidities, income level, and surgical complexity. In total, these results characterize a lack of evidence-based clinical guidelines for managing ALIF patients postoperatively, specifically recommendations outlining which patients are suitable for PT and the appropriate timing of intervention. These findings

underscore the understudied nature of PT and its contribution to postoperative outcomes following lumbar fusion procedures while cautioning providers to consider socioeconomic disparities in access to rehabilitation when developing future guidelines. The present study emphasizes the need for the development of evidence-based rehabilitation protocols to improve outcomes after ALIF. We invite these efforts in the hope that care standardization can result in reduction of existing disparities and overall improve outcomes for all patients.

ID: AGS26/1992
P0810: Extensive spinal dural arteriovenous fistula from the craniocervical junction to the lumbar region in a young adult: a rare case report

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Introduction: Spinal dural arteriovenous fistulas (SDAVFs) are rare vascular malformations, representing ~3% of all spinal cord vascular lesions. Typically seen in older males and located in the thoracolumbar region, SDAVFs result in venous congestion and progressive myelopathy. We present a rare case of extensive SDAVF, spanning from the craniocervical junction to the lumbar spine, in a young adult. This poster aims to report an exceptional case of diffuse SDAVF in a 32-year-old male with atypical symptoms and extensive radiologic involvement, but no overt myelopathy. **Material and Methods:** A 32-year-old man presented with two months of lower back and neck pain, bilateral leg numbness, and intermittent claudication. Neurological examination showed 4/5 monoparesis of the right lower limb, hyperreflexia, and bilateral Babinski signs. MRI and MRA revealed tortuous perimedullary vessels extending from the craniocervical junction to the lumbar spine, without T2 cord signal changes. Spinal angiography identified a dural fistula fed by the lateral sacral arteries, with extensive perimedullary venous drainage. The artery of Adamkiewicz showed delayed filling without venous outflow. **Results:** The diagnosis of extensive SDAVF was confirmed, with radiological findings disproportionate to the relatively mild clinical symptoms. This atypical presentation, especially in a young adult without myelopathy, underscores diagnostic challenges. Treatment options, including endovascular embolization or surgical disconnection, were discussed based on angioarchitecture and extent. **Conclusion:** SDAVF should be considered even in young patients with subtle neurological deficits. MRI plays a pivotal role in early suspicion, but spinal angiography remains diagnostic. This case is notable for the rare combination of young age, widespread venous involvement, and minimal clinical impact-highlighting the importance of early recognition and tailored management in such presentations.

ID: AGS26/2453
P0812: Postoperative physical therapy utilization for posterior cervical fusion: an analysis of practice patterns in the United States

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Introduction: Posterior cervical fusion (PCF) is a common spinal procedure used to treat conditions such as spondylosis, spinal stenosis, and cervical degenerative disc disorders involving myelopathy or radiculopathy. PCF accounted for 14.0% of all cervical spine surgeries in the United States between 2010 and 2022. However, the role of postoperative physical therapy (PT) following this procedure remains largely unexplored. The primary objective of this study was to describe postoperative PT utilization patterns and to analyze potential predictors of PT utilization after PCF. **Material and Methods:** This study identified patients who underwent PCF between January 2010 and April 2023 in the United States using the PearlDiver Mariner Database (PearlDiver Technologies, Colorado Springs, CO, USA). The database was queried for Current Procedural Terminology (CPT) codes and International Classification of Disease 9th (ICD-9) and 10th (ICD-10) editions codes that corresponded to a diagnosis of degenerative cervical radiculopathy and/or cervical myelopathy and a PCF procedure (CPT-22600 and CPT-22614). The mean time to PT was also assessed, stratified by preoperative diagnosis. Predictive factors of postop PT usage following PCF were evaluated with univariate and multivariable logistic regression analyses. **Results:** A total of 46,078 patients (21,027 female, 25,051 male) who underwent one- to five-level PCF) for cervical radiculopathy and/or myelopathy were identified. Of these, 10,130 (21.98%) received postoperative physical therapy within one year. The mean time to PT was 93.97 ± 75.36 days. On multivariable logistic regression, demographic factors associated with increased PT utilization included commercial insurance status (OR: 1.52 [1.45-1.60], $p < 0.001$), residence in the Midwest (OR: 1.37 [1.30-1.44], $p < 0.001$) or Northeast (OR: 1.21 [1.15-1.28], $p < 0.001$) , and annual income >$75,000 (OR: 1.09; [1.04-1.14], $p < 0.001$).

Medicare insurance (OR: 0.58 [0.55-0.62], p < 0.001) was linked to decreased PT utilization, as were age over 70 years (OR: 0.76 [0.72-0.80], p < 0.001), low education level (OR: 0.78 [0.74-0.83], p < 0.001), and residence in the Southeast (OR: 0.69 [0.66-0.72], p < 0.001) or West (OR: 0.88 [0.83-0.94], p < 0.001). Inpatient surgery setting (OR: 1.31 [1.20-1.43], p < 0.01), multilevel fusion (OR: 1.39 [1.31-1.48], p < 0.001), and mixed radiculopathy/myelopathy diagnosis (OR: 1.39 [1.33-1.45], p < 0.001) also increased PT utilization. **Conclusion:** PT utilization after PCF remains low. Insurance status, age, and education status were predictors for PT utilization, highlighting the importance of considering financial and socioeconomic barriers when creating postoperative treatment plans. Younger patients with commercial insurance, high income, and advanced education are the most likely to attend postoperative PT, while older patients with Medicare, low income, and basic education are least likely to attend postoperative PT.

ID: AGS26/2508
P0813: Nonoperative therapy of sacral chordomas

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Introduction: Chordomas are rare, malignant tumors arising from notochordal remnants. Roughly half of chordomas occur in the sacrum, and patients most often present with sacral pain as the primary complaint. Although surgical resection is the accepted standard treatment, some patients forgo surgery due to the high risk of surgical complications. There is an increasing need for nonoperative or palliative treatment options for patients with unresectable tumors. Currently, little is known regarding the long-term efficacy of nonoperative management of sacral chordomas, and no standard of care has been established for these cases. High-dose fractionated particle radiotherapy has emerged as a promising alternative for surgical resection in cases of unresectable sacral chordomas. **Material and Methods:** A systematic search of PubMed was conducted to identify studies published between 1998 and 2023 reporting nonoperative management of sacral chordomas. Duplicate records were removed. The search strategy included the keywords: "nonoperative treatment," "sacral chordomas," "radiotherapy," and "functional outcomes." Studies that included patients undergoing surgical intervention or hybrid therapies combining surgery and radiation were excluded. Eligible studies included case reports and case series that provided treatment details and clinical outcomes. Data from four additional case studies of nonoperatively managed sacral chordomas were collected and compared with the literature to provide a comprehensive overview of current nonoperative management strategies. **Results:** The literature review included breakdowns by age, sex, spinal segment, treatment modality, and outcome. Among 52 patients across 11 studies, we identified a mean age of 62.8 years with a clear predominance within men. Of patients who were managed nonoperatively for their sacral chordomas, the incidence in males occurred at a 2.7 times higher rate than females (73.1% vs 26.9%, respectively). The most common symptoms associated with the tumor were sacral pain, lower limb dysfunction, and bowel or bladder involvement, pointing to the proximity to critical neurovascular structures. Anatomically, the S2 region was the most commonly involved vertebral level (25%), followed by S1 and sacrococcygeal region (15.4% each). The mainstay method of diagnosis was biopsy, using MRI and CT for further corroboration. Out of 52 patients, 30 (57.7%) died of sacral chordoma, 5 (9.6%) died of secondary complications, 7 (13.5%) were alive with disease, and 30 (57.7%) were alive with no evidence of disease at an average follow-up duration of 35.7 months. CIRT was the most common treatment modality (50%), followed by cryoablation (17.3%) and proton/photon beam radiotherapy. **Conclusion:** Nonoperative management of sacral chordomas shows promising outcomes for patients who are not candidates for surgery. Our literature review and case series support nonoperative treatment of sacral chordomas as a valid alternative to surgery offering lower morbidity for some patients. Future studies should prioritize long-term follow-up and standardize data collection including associated symptoms, resolution of symptoms, and comorbidities. As the need for nonsurgical treatment modalities for sacral chordomas increases globally, prospective studies will be imperative in establishing effective treatment. Although recurrence remains a risk, nonoperative management may offer meaningful functional preservation and local disease control.

ID: AGS26/2526
P0814: 3D radiological and clinical prognostic factors for failure and improvement of bracing for adolescent idiopathic scoliosis (AIS): a comparative analysis

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Introduction: Brace treatment for Adolescent Idiopathic Scoliosis (AIS) is indicated for curves above 25° during growth. The rate of success and failure varies in the published

literature, and some factors have been highlighted as positive or negative to the treatment outcome. To date, no study compared the characteristics of failures and improvements from the same initial sample. Our objective was to separately analyze radiological and clinical prognostic factors for Cobb angle difference more than 5° in progressive (PROG) and improved (IMPR) groups of patients and detect potential associations. **Material and Methods:** Comparative Experimental Study. 113 patients (73 IMPR and 40 PROG) with progression or improvement from our prospective database, were selected for analysis. All patients that received brace treatment and practiced scoliosis specific exercises (SSE) with the following criteria were included: Cobb angle > 25°, Risser sign 0-2 with at least 12 months of treatment and one follow-up x-ray without brace. We evaluated initial Cobb angles (Cobb-IN), in-brace correction (IBC) and final Cobb angles (Cobb-FI) for thoracic (TH) and lumbar (LU) curves. The factors that we analyzed were Lenke curve type, apex location, type of progressed and improved curve, brace and SSE compliance (self-reported), supervised sessions/year, Pelvic Incidence (PI), Pelvic Tilt (PT), Sacral Slope (SS), Roussouly type, thoracic kyphosis (TK), lumbar lordosis (LL), family history, Risser sign, Triradiate Cartilage (TRC) ossification, Body Mass Index (BMI), Angle Trunk Rotation (ATR) for thoracic and lumbar curves. Chi-square, Fisher's exact and Mann-Whitney U tests were used for statistical analysis. **Results:** IBC (41% IMPR - 22.9% PROG, $p < 0.001$), Cobb-FI TH(25.7° IMPR - 50.1° PROG, $p < 0.001$), Cobb-FI LU (21.9° IMPR - 49.26° PROG, $p < 0.001$), Brace compliance (78.1% high, 19.2% moderate, 2.7% poor for IMPR - 32.5% high, 32.5% moderate, 35% poor for PROG, $p < 0.001$), SSE compliance (53.4% high, 32.9% moderate, 13.7% poor for IMPR - 15% high, 40% moderate, 45% poor for PROG, $p < 0.001$), curve type (single 35.6%, double 64.4% IMPR - single 15%, double 85% PROG, $p = 0.028$), Lenke types (1C 4.1%, 3C 2.7%, 5C 20.6% IMPR - 1C 12.5%, 3C 12.5%, 5C 0% PROG, $p = 0.008$), Roussouly types ($p = 0.038$), Risser ($p = 0.035$), TRC (open 46.5% IMPR - open 72.5% PROG, $p = 0.01$), menarche (no 56.2% IMPR - 77.5% PROG), BMI (17.7 IMPR - 19.2 PROG, $p = 0.043$) and sessions/year (26.1 IMPR - 15.4 PROG) were significantly different between groups. Cobb-IN TH (35.8° IMPR - 37.3° PROG, $p = 0.594$), PI (50.6° IMPR - 47.3° PROG, $p = 0.151$), PT (10.6° IMPR - 8.5° PROG, $p = 0.088$), SS (40° IMPR - 37.8° PROG, $p = 0.274$) and family history (57.5% IMPR - 50% PROG, $p = 0.554$) were not significantly different between groups. **Conclusion:** Higher IBC and compliance with brace and SSE (also more supervised sessions), later growth stage, single curve types and lower BMI were associated with better outcomes. Initial Cobb angles, pelvic parameters and family history did not significantly affect the result. Our study showed that many prognostic factors are associated with treatment outcome and should be carefully monitored for improving prognosis.

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P0815: Effects of GLP-1 receptor agonist medications on spinal fusion surgery outcomes: systematic review

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Introduction: Glucagon-Like Peptide-1 Receptor Agonists (GLPRAs) are a novel class of antidiabetic drugs. Such drugs help achieve adequate glycaemic control and aids in weight loss. Recent basic science literature that GLPRAs have osteoclast and immune modifying effects, which spiked interest on their effect on arthroplasty, and arthrodesis. However, its effect on spinal fusion remains unclear. To systematically review the current literature on the clinical and radiological outcomes of the safety and efficacy profile of GLPRAs on patients undergoing spinal fusion. We also aim to report these outcomes in different patient populations such as non-diabetics. **Material and Methods:** A comprehensive literature search was conducted among four databases including PubMed, Scopus, Embase, and Web of Science (WOS). Keywords that included but were not limited to "GLP-1", "arthrodesis", and "spinal fusion". **Results:** Twelve retrospective studies met our inclusion criteria. Most studies synthesized data from the global health network TriNetX. Most studies focused on lumbar fusions, where cervical vertebras were less commonly studied. Overall five out of six papers reporting pseudarthrosis rates showed favourable outcomes in GLPRAs users where only one study showed inferior results. In both obese and non-obese patients with diabetes subgroups, GLPRA therapy was linked to fewer infections, readmissions, and revision surgeries. However, among obese patients without diabetes, prolonged GLPRAs use > 9 months before and after surgery, was associated with higher rates of urinary tract infection, acute kidney injury, and additional lumbar fusion procedures. **Conclusion:** Current

evidence suggests that GLPRA use among specific patient populations may improve fusion-related outcomes during lumbar spine procedures. However, prolonged use may cause considerable side effects. Future prospective and randomised trials are needed to confirm these findings and help guide practice.

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P0816: Adolescent upper thoracic kyphosis: a 24-month prospective cohort study on the effects of antikyphotic exercises and screen-time reduction

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Introduction: Upper thoracic kyphosis (C7-T5) in adolescents has been increasingly recognized, often linked to prolonged smartphone and computer use. This study aimed to prospectively evaluate the clinical and radiographic outcomes of screen-time reduction and a standardized antikyphotic exercise program in patients stratified by sagittal balance. **Materials and Methods:** A total of 110 adolescents (10-18 years, postmenarcheal, Risser 3-5) were enrolled; 100 completed 24 months of follow-up. Inclusion required a C7-T5 angle ≥25° on standing lateral radiographs. Patients with congenital anomalies, neuromuscular disorders, kyphoscoliosis, prior spine surgery, trauma, or connective tissue disease were excluded. No neurological deficits were detected on examination. Daily screen time (phone/computer) was assessed using validated questionnaires. All participants were advised to reduce screen time by 50%, verified at one-month intervals. Sagittal balance was classified by C7-S1 sagittal vertical axis (SVA): ≤ 40 mm defined the balanced group (n = 60), while > 40 mm defined the imbalance group (n=40). The imbalance group received a standardized program of antikyphotic foam roller exercises, performed at home twice weekly for 1 hour. Families confirmed adherence with monthly checklists; mean compliance was 90%. Clinical and radiographic evaluations were performed every six months. Improvement was defined as ≥ 5° reduction in C7-T5 angle, deterioration as > 5° increase, and changes within ±4° were considered stable. **Results:** Baseline C7-T5 kyphosis averaged 31.2 ± 3.4° in the balanced group and 31.6 ± 3.1° in the imbalance group (p=0.49). Cervical lordosis (C2-C7) and thoracic kyphosis (T5-T12) were similar between groups (p > 0.40). Mean daily screen time decreased from 6.5 ± 1.0 to 3.3 ±0.9 h in the imbalance group and from 6.2±1.1 to 3.0 ± 0.8 h in the balanced group, with no significant difference in reduction (p = 0.68). In the balanced group, mild improvement or stable alignment was observed across all patients, with no deterioration. In the imbalance group, 12-month outcomes showed 70% improvement, 20% stable, and 10% deterioration. For deteriorating cases, exercise duration was doubled (2 hours, twice weekly); by 24 months, these patients achieved stability. Final distribution was 70% improved and 30% stable. VAS scores were significantly higher at baseline in the imbalance group ($p < 0.05$) but improved significantly at follow-up ($p < 0.01$), narrowing the gap with the balanced group. **Conclusion:** Reducing screen time was beneficial for all adolescents with upper thoracic kyphosis, while the addition of antikyphotic exercises provided greater benefit in patients with sagittal imbalance. Increasing exercise intensity stabilized initially worsening cases. These findings suggest that lifestyle modification combined with a structured exercise program can limit progression and potentially reduce the need for surgical intervention in skeletally mature adolescents.

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P0817: Enhancing motor function in pediatric cerebral palsy through transcutaneous spinal cord stimulation: systematic review of current evidence

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Introduction: Cerebral palsy (CP) is the most common motor disorder in childhood, leading to spasticity, muscle weakness, impaired coordination, and functional limitations. Conventional interventions including physical therapy, medications, and surgery often have limited efficacy or adverse effects. Transcutaneous spinal cord stimulation (tSCS) is a non-invasive neuromodulatory technique that may enhance sensorimotor integration and voluntary movement in pediatric CP populations. This systematic review aimed to synthesize current evidence on the effects of tSCS on motor function, spasticity, postural control, and neuromuscular coordination in children with CP. **Material and Methods:** A comprehensive search of PubMed, Scopus, and Web of Science was conducted up to July 2025. Eligible studies included observational and interventional trials assessing spinal neuromodulation in pediatric CP populations. Data extraction and methodological quality assessment were independently performed using NIH tools for observational studies and Cochrane RoB 2 for randomized trials. **Results:** Seven studies (128 participants, ages 2-16 years, GMFCS I-V) were included. tSCS was delivered via various devices, targeting thoracolumbar and cervical spinal segments, often combined with task-specific training. Across studies, tSCS consistently improved gross motor function (GMFM-88 gains exceeding minimal clinically

important differences), enhanced postural control and voluntary movement, and reduced spasticity (MAS/Tardieu scores). Functional improvements were observed across GMFCS levels, including transitions from non-ambulatory to independent walking in some participants. Neuromuscular coordination improved with decreased co-contraction indices, and interventions were well tolerated with only minor transient adverse events reported. Limitations included small sample sizes, heterogeneous protocols, and short follow-up periods. **Conclusion:** tSCS is a promising, safe, and feasible adjunct to conventional rehabilitation for children with CP, demonstrating clinically meaningful improvements in motor function, postural control, and spasticity. Future high-quality, controlled studies are needed to standardize protocols and confirm long-term efficacy.

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P0818: Intravenous acetaminophen reduces opioid use and improves outcomes in single- and multi-level lumbar fusion

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Introduction: Opioid analgesics are a common choice for the management of post-operative pain subsequent to spinal surgery. Opioid use is associated with an array of side effects, often contributing to increased morbidity and extended hospital stay. Spine surgery is the largest medical contributor to opioid abuse, followed by orthopaedics overall. Combined, spine and orthopaedics account for over one fourth of all cases of opioid abuse stemming from prescription to previously opioid-naïve patients. In pursuit of diminishing opioid consumption, alternatives such as intravenous (IV) acetaminophen have demonstrated considerable potential. An assessment of patient outcomes with the perioperative administration of IV versus oral (PO) acetaminophen may demonstrate the value of such medications in the reduction of opioid usage in lumbar spine surgery. The aim of this study is to prospectively evaluate clinical outcomes for patients undergoing lumbar fusion with the administration of either IV or oral acetaminophen perioperatively, with supplemental opioids as needed. We hypothesize that the use of IV acetaminophen will provide significant pain management, thereby reducing hospital stay, opioid consumption, and comorbidity, and that it will do so more effectively than oral acetaminophen. **Material and Methods:** Under IRB approval, consented patients were randomized prior to surgery into either IV or PO acetaminophen groups. Patients underwent lumbar circumferential fusion with anterior interbody fusion and posterior pedicle screw fixation at one or two levels. Preoperative baseline surveys including demographics, VR-12, Visual Analog Score (VAS) Pain, Oswestry Disability Index (ODI), and medication use were collected. The first dose of the assigned acetaminophen was administered within 3 hours prior to surgery. Postoperatively, 7 additional doses were given every 6 hours, with access to supplemental opioids as needed. Morphine equivalent opioid consumption was calculated daily until discharge, 6 weeks, and 6 months post-operatively. VAS scores were recorded daily until discharge, 6 weeks, and 6 months post-operatively. ODI was recorded at 6 weeks and 6 months post-operatively. Statistical analysis was performed comparing outcomes in each group. **Results:** Eighty-three patients (36 male, 47 female) were prospectively randomized and enrolled in the study. Demographics between groups were similar, however the IV group was statistically older (60 ± 8.85 IV, 55.3 ± 6.58 PO, $p = 0.024$). The length of stay was the same between groups. Daily analgesic morphine equivalent consumption was statistically significantly lower for the IV group than the PO group upon completion of the study doses (67.9 ± 53.47 IV, 94.3 ± 52.99 PO, $p < 0.04$) and remained statistically different through discharge (23.5±32.01 IV, 65.7±63.33 PO, $p < 0.0005$). VAS Back pain and VAS Leg pain scores were similar for both groups prior to discharge. ODI decreased similarly by Month 6. **Conclusion:** Although both groups (IV vs PO) reported similar clinical outcomes with regard to pain and disability, the IV acetaminophen group was able to achieve this reduction with statistically significantly less opioid usage. Although patients in the IV group were statistically older, they took significantly less MME to produce similar pain management results. Our findings suggest that IV acetaminophen is a safe and effective alternative to current opioid-based post-operative analgesic regimens and should be considered.

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P0819: A rare presentation of Bertolotti's syndrome mimicking radicular sciatica: a case report

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Introduction: Bertolotti's syndrome is an underrecognized cause of chronic low back and radicular pain, resulting from lumbosacral transitional vertebrae (LSTV). It may be misdiagnosed as discogenic sciatica due to overlapping clinical presentations. We aim to present a case of Bertolotti's syndrome mimicking L5 radiculopathy caused by a neo articulation between a hypertrophic L5 transverse process and the sacral ala. **Material and Methods:** We report the case of a 43-year-old woman with a six-year history of inflammatory left-sided L5 radiculopathy associated with hyperalgesia and radicular claudication, limiting ambulation to 300 meters. Neurological examination confirmed an L5 radicular syndrome. Initial imaging in 2017 showed a left L4-L5 disc herniation. A follow-up MRI in 2021 revealed a hypertrophic

left L5 transverse process forming a pseudo. articulation with the sacral ala and iliac wing, associated with inflammatory and degenerative changes. Additional findings included disc bulging at L3-L4 and L4-L5 without significant canal stenosis. **Results:** The patient's radiculopathy was attributed to both mechanical compression and local inflammatory changes from the neoarticulation. The atypical evolution and imaging prompted reconsideration of the initial diagnosis, leading to the identification of Bertolotti's syndrome as the primary etiology. Management options were discussed, including surgical resection of the neoarticulation, but conservative treatment was maintained due to symptom stability. **Conclusion:** Bertolotti's syndrome should be considered in chronic or atypical radicular presentations, especially when imaging reveals transitional vertebrae or neoarticulations. Early recognition allows for tailored management and avoids misdiagnosis of discogenic disease. Targeted imaging and a high index of suspicion are essential for accurate diagnosis.

ID: AGS26/2964

P0820: Safety and utilization trade-offs of spinal cord stimulation in postlaminectomy syndrome: a large matched-cohort analysis of revision surgery, systemic complications, and mortality

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Introduction: Spinal cord stimulation (SCS) is commonly used for post-laminectomy syndrome, but comparative safety and utilization outcomes beyond analgesia are unclear. We conducted a large matched evaluation of SCS versus non-SCS management, quantifying perioperative and 1-year benefits and trade-offs across surgical, systemic, and utilization endpoints, including absolute risk differences. **Material and Methods:** In a retrospective, multi-institutional matched-cohort analysis, adults with post-laminectomy syndrome were assigned to SCS or non-SCS cohorts. Propensity score matching across demographic and clinical variables yielded balanced groups of ~22,000-26,000 patients per arm (varying by outcome). Prespecified endpoints were assessed at 90 days and 1 year: revision laminectomy, device-related reoperation, infection, pneumonia, deep-vein thrombosis (DVT), stroke, ulceration, depression/anxiety, emergency department (ED) visits, intensive care admission, opioid abuse, myocardial infarction (MI), acute kidney injury (AKI), counseling, and death. Effects were reported as odds ratios (OR) with 95% confidence intervals (CI) and p-values. **Results:** At 90 days, SCS was associated with lower odds of revision laminectomy (0.26% vs 1.36%; OR 0.19, 95% CI 0.14-0.25; $p < 0.0001$), ulceration (0.08% vs 0.24%; OR 0.32, 0.19-0.53; $p < 0.0001$), death (0.19% vs 0.38%; OR 0.51, 0.36-0.72; $p < 0.0001$), pneumonia (0.46% vs 0.62%; OR 0.74, 0.58-0.95; $p = 0.018$), stroke (0.19% vs 0.34%; OR 0.57, 0.40-0.81; $p = 0.0014$), and dural tear (0.07% vs 0.13%; OR 0.56, 0.32-0.98; $p = 0.039$); higher odds occurred for device-related reoperation (2.27% vs 0.19%; OR 12.24, 9.14-16.40; $p < 0.0001$), infection (1.08% vs 0.38%; OR 2.86, 2.26-3.61; $p < 0.0001$), depression (3.18% vs 2.31%; OR 1.38, 1.21-1.56; $p < 0.0001$), and ED visits (8.18% vs 7.44%; OR 1.10, 1.04-1.17; $p = 0.0019$); AKI, MI, DVT, suicide, antidepressant use, and ICU admission were not different. At 1 year, SCS remained associated with fewer revision laminectomies (1.02% vs 2.50%; OR 0.40, 0.34-0.47; $p < 0.0001$), lower ulcer risk (0.37% vs 0.73%; OR 0.51, 0.40-0.65; $p < 0.0001$), and lower mortality (0.93% vs 1.28%; OR 0.72, 0.61-0.85; $p = 0.0001$); benefits also appeared for pneumonia (1.58% vs 2.02%; OR 0.78, 0.68-0.89; $p = 0.0003$), DVT (0.90% vs 1.10%; OR 0.81, 0.68-0.97; $p = 0.023$), counseling (0.69% vs 0.96%; OR 0.72, 0.59-0.87; $p = 0.0008$), and dural tear (22 vs 41 events; OR 0.54, 0.32-0.90; $p = 0.017$). Trade-offs included markedly higher device-related reoperation (6.66% vs 0.31%; OR 22.69, 18.14-28.38; $p < 0.0001$) and higher stroke at 1 year (2.05% vs 0.78%; OR 2.68, 2.23-3.16; $p < 0.0001$). Infection at 1 year was not significantly different (0.19% vs 0.27%; $p = 0.062$). **Conclusion:** In real-world matched cohorts of post-laminectomy syndrome, SCS is associated with fewer revision decompressions, lower ulceration, lower pneumonia and DVT, and lower mortality, balanced against substantially higher device-related reoperations and a persistent 1-year stroke signal. The novel contribution is a large, decompression-specific analysis that delineates domain-specific benefits (reduced revision surgery and select systemic complications) alongside system-level trade-offs (device revisions and late stroke), to guide shared decision-making, inform peri-implant infection bundles, psychological screening, and proactive vascular-risk management, and to motivate prospective validation of the stroke finding with granular vascular covariates.

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P0821: Deep learning-based method to predict long-term outcome of Bracing in adolescent idiopathic scoliosis

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Introduction: Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal deformity commonly managed with bracing to prevent curve progression and avoid surgery. However, individual responses to brace treatment vary markedly, influenced by factors such as skeletal maturity, initial curve magnitude, and compliance. The long-term effectiveness of bracing is crucial because the risk of progression begins to increase when the curve exceeds 30 degrees after skeletal maturity has been achieved. Existing prognostic models typically use non-AI methods or focus on short-term, binary outcomes, limiting their clinical utility for long-term, personalized decision-making. **Material and Methods:** We retrospectively collected data from 294 AIS patients treated at two tertiary centers. Standing full-spine radiographs were obtained at baseline (pre-brace) and immediately post-brace, along with clinical variables (age, sex, and Risser stage). A deep learning regression model was developed to predict Cobb angles at a minimal one-year follow-up. Through integration of spatiotemporal features and longitudinal feature fusion, it effectively captured patterns of disease progression. Rule-based post-processing informed by clinical insight further enhanced predictive accuracy. Performance was assessed via stratified three-fold cross-validation and external validation on another held-out cohort. Evaluation metrics included mean absolute error (MAE), root mean square error (RMSE), and coefficient of determination (R^2). Model interpretability was explored using SHAP and Grad-CAM. **Results:** A total of 294 patients who met the inclusion criteria were recruited from two independent centers. T Cobb angles were similar between groups (24.86 ± 8.17° in cohort 2 vs. 26.51 ± 10.01° in cohort 1; p = 0.141), while TL/L angles were significantly higher in the cohort 2 (26.48 ± 7.17° vs. 23.78 ± 7.63°; p = 0.029, Mann-Whitney U test). Three-fold cross-validation was applied. The mean absolute error (MAE) of the algorithm using V0, V1, and clinical information as inputs were 4.06 for the thoracic curve (R^2 = 0.811) and 3.75 for the thoracolumbar/lumbar curve, respectively. Such superiority was demonstrated by comparison with existing advanced DL architectures. Classic convolutional neural networks (CNNs), such as DenseNet, ResNet, and EfficientNet, achieved MAEs ranging from 5.2° to 6.1°, with corresponding R^2 values between 0.59 and 0.73. Our model got the best performance. SHAP analysis identified pre-brace Cobb angles as the top predictor, while Grad-CAM highlighted the model's focus on the application of the brace forces and the iliac crest. **Conclusion:** The deep learning-based algorithm developed in this study demonstrated strong predictive performance for thoracic and lumbar curve angles in patients with AIS undergoing bracing. By integrating radiographic and clinical data, the model offers a promising tool to support personalized treatment planning. Future research should validate its applicability across diverse populations and clinical settings and more data should be recruited.

ID: AGS26/3297
P0822: the role of acetazolamide in reducing morbidity after intraoperative CSF leaks in spine surgery: a retrospective cohort study

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Introduction: Cerebrospinal fluid (CSF) leak is a common risk of spinal surgery. Our study investigated the effectiveness of acetazolamide (ACZ) in preventing complications and changing the management of patients with intraoperative durotomies. **Material and Methods:** We retrospectively reviewed all spinal surgeries performed at our tertiary care center from 2023-2024 (N = 955). Of these, we identified patients who presented with an intraoperative durotomy (N = 94) and compared outcomes of patients who were treated postoperatively with ACZ 250 mg TID (N = 17) to those who were not (N = 77). Endpoints included wound-related complications, postoperative length of stay, readmission and reoperation rates, and flat bedrest requirements. **Results:** Wound dehiscence was observed in 0% of ACZ-treated patients vs 3.8% of non-ACZ-treated patients (p = 0.411; Figure 1). The readmission rate was 0% for ACZ-treated patients vs 2.5% for the non- ACZ-treated group (p = 0.505); the reoperation rate was 0% vs 1.3% (p = 0.625), respectively. 6% of the ACZ-treated group was placed on flat bedrest postoperatively vs 20.3% of the control group (p = 0.154). Among patients who did not undergo primary durotomy repair, those treated with ACZ spent an average of 4 fewer days in the hospital postoperatively compared to patients not treated with ACZ (8.11 vs 12.03 days, respectively; p = 0.149). **Conclusion:** Among patients presenting with intraoperative durotomy during spine surgery, those treated with ACZ experienced a lower rate of wound-related complications, flat bedrest placement, readmission, and reoperation, as well as shorter postoperative LOS. The latter was especially true for patients in which a primary durotomy repair was not achievable. Even though these findings were not statistically significant due to small sample size, our study shows that ACZ could serve as an effective adjunct in the treatment of intraoperative CSF leaks, particularly in patients with complicated durotomy not amenable to primary repair.

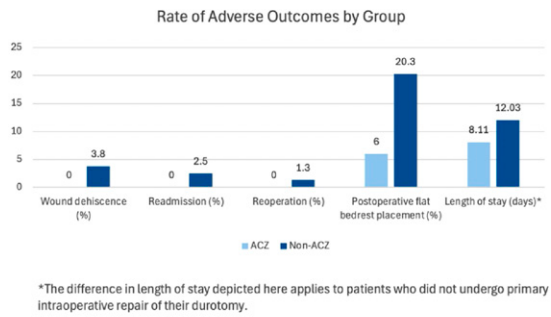


Figure 1. Comparison of adverse outcomes by group: ACZ vs. non-ACZ

ID: AGS26/3450

P0823: Novel objective-subjective pain assessment score results in decreased opioid prescription after elective spine surgery: a prospective pilot study

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Introduction: Opioid dependence after spine surgery is a major contributor to the opioid epidemic in the United States. Current pain assessment tools are largely subjective, linking patient satisfaction to reported pain and encouraging liberal opioid prescribing. Incorporating objective criteria into pain evaluation may improve prescribing practices while maintaining patient satisfaction. **Methods:** The OBSUB scale, a 10-point tool combining subjective pain scores (points 1-5) with objective signs (points 6-9: autonomic activation, avoidance behaviors, postural guarding, and distraction) plus a point for pain exaggeration, was implemented in 44 patients over 3 months. Postoperative analgesics were prescribed progressively according to the WHO analgesic ladder, with emphasis on non-opioid alternatives and staff education. Mean daily Morphine Milligram Equivalents (MME) were recorded for four intervals: 30 days preoperatively, and 0-30, 31-60, and 61-90 days postoperatively. **Results:** Compared to institutional pre-intervention averages, mean daily MME decreased by 53.2% in the first postoperative month ($p = .30$), 32.2% in the second month ($p = .0040$), and 91.8% in the third month ($p = .0085$). At 90 days, 76% of patients were no longer prescribed opioids compared to 48% prior to intervention. Despite more restrictive prescribing, patient satisfaction increased by 27% based on Hospital Consumer Assessment of Healthcare Providers and Systems (HCAPHS) scores. **Conclusions:** The OBSUB scale, integrating objective with subjective pain measures, effectively reduced postoperative opioid prescriptions without compromising patient satisfaction. This approach offers a promising strategy to mitigate opioid dependence after spine surgery and warrants validation in larger multicenter trials.

Novel technologies

ID: AGS26/126

P0824: Intra- and immediate post-operative hypotension has a cumulative impact on complications following thoracolumbar spinal fusion surgery

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Introduction: Intraoperative hypotension (IOH) with mean arterial pressure (MAP) < 65mmHg is associated with post-op complications in patients undergoing multi-level spine fusions. The impact of persistent hypotension in the immediate post-operative hypotension (iPOH) on the incidence of complications has not been evaluated. The purpose of this study is to determine if Intraoperative hypotension (IOH) and immediate postoperative hypotension (iPOH) are associated with complications in patients undergoing multilevel thoracolumbar fusion. **Material and Methods:** 539 thoracolumbar fusion cases, > 6 surgical levels and > 3 hours duration were identified. Data included OR time, fluid volume, blood loss, blood product replacement and use of vasopressors. MAP data was collected at 1 min intervals during the surgery and in the first four hours in the recovery room. Patients were stratified into those who had neither IOH or iPOH, had IOH but no iPOH, No IOH but had iPOH and had both IOH and iPOH. **Results:** There was no difference in demographic parameters such as age, sex, BMI, and ASA score. IOH and iPOH had a cumulative effect on the incidence of complications with the lowest in patients with no IOH and no iPOH (21%) and highest in those with both IOH and iPOH (44%, $p=0.006$). Post-op transfusion, colloid volume, and Norepinephrine requirements were also significantly increased in groups with either IOH or iPOH. A longer hospital stay and a greater proportion of patients who had a non-home discharge was seen in those who had iPOH. **Conclusion:** Duration of hypotension during surgery (IOH) and immediately after in the recovery room (iPOH) has a cumulative impact on the number of complications following thoracolumbar fusion. Understanding the appropriate prevention and treatment strategy can impact complications, LOS, and disposition. This

unrecognized modifiable risk extends beyond protecting the spinal cord and offers an important opportunity to increase safety and improve clinical outcomes.

ID: AGS26/160
P0825: Anterior Open Vertebroplasty as Treatment for Aggressive and Symptomatic Cervical Hemangioma

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Introduction: At present, there are very few literature on the treatment of aggressive and symptomatic cervical hemangioma (ASCH) because of its extremely low incidence. It is reported that its main surgical approach is posterior percutaneous trans-pedicular approach. However, there are a relatively high incidence of puncture-related complications as the cervical pedicle is too narrow. Thus, we proposed a new surgical approach, anterior open vertebroplasty, and assessed its effectiveness and safety. **Material and Methods:** Clinical data of patients of ASCH who underwent anterior open vertebroplasty in our hospital from January 2018 to January 2024 were retrospectively analyzed. A total of 22 patients (21 vertebrae) were included in this study, including 12 males and 10 females, with an average age of 49.2 ± 5.3 years. In all patients, anterior cervical incision was performed under general anesthesia, the target vertebra was identified by fluoroscopy, and the working channel was inserted under fluoroscopy guidance. A biopsy was taken though the working channel prior to injection of bone cement. The injection process was stopped immediately If bone cement dispersed to the posterior margin of the vertebra or bone cement leakage in the paravertebral vessels. The VAS scores and NDI index of patients were compared before and 24 hours after surgery, 3 months, 6 months, 12 months after surgery and at the last follow-up, to evaluate the therapeutic effect. And the amount of intraoperative bone cement injection, diffusion and leakage of bone cement were also recorded. **Results:** All of the 22 patients with ASCH underwent surgery successfully, including 5 cases of C3, 6 cases of C4, 7 cases of C5, 3 cases of C6 and one case of C7. All the biopsy tissues were confirmed to be the hemangioma. The average injection volume of bone cement was 2.1 ± 0.3 ml, and the average follow-up was 48.6 ± 6.8 months. The VAS scores of patients before surgery, 24 hours after surgery, 3 months, 6 months, 12 months and the last follow-up were (8.1 ± 1.2), (4.2 ± 0.5), (3.5 ± 0.6), (2.3 ± 0.4), (1.7 ± 0.3) and (1.1 ± 0.2), respectively, and the NDI index was (62.4 ± 5.7)%, (15.7 ± 2.3)%, (13.3 ± 3.2)%, (10.4 ± 2.1)% and (8.8 ± 1.9)%, respectively. The VAS score and NDI index were significantly improved after surgery and follow-up period compared with that before surgery ($p < 0.05$). Bone cement was filled into the hemangioma well in all cases, and no bone cement leakage occurred. **Conclusion:** Anterior open vertebroplasty is a safe and effective surgical method for patients with ASCH.

ID: AGS26/220
P0826: PRP use in lumbar facet syndrome - What do we know?

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Introduction: Lumbar facet joint syndrome accounts for a significant proportion of chronic low back pain, yet consensus on optimal treatment remains elusive. Conventional interventions-including corticosteroid and anesthetic injections-provide inconsistent and often short-lived relief. Platelet-rich plasma (PRP), an autologous concentrate rich in growth factors, has emerged as a promising biologic alternative. This review synthesizes current evidence supporting PRP use in facet-mediated pain. **Material and Methods:** We systematically reviewed key clinical studies comparing PRP to traditional therapies, including cohort studies, systematic reviews, and emerging prospective trials. Data on pain reduction, functional outcomes, safety, and durability were extracted and analyzed. **Results:** PRP demonstrated superior pain relief, improved disability scores, and higher patient satisfaction compared to steroids and/or local anesthetics over the follow up period. PRP applications in degenerative spine disease demonstrated its regenerative and anti inflammatory potentials. More and more studies are confirming that minimally invasive interventions, including PRP, show promise in chronic low back pain due to facet syndrome. Furthermore, PRP injections for facet mediated pain have emerged as viable alternatives to pharmacologic and radiofrequency options. Moreover, positive outcomes of CT guided PRP injections for lumbar facet syndrome have been found, demonstrating safety and early efficacy in comparison to other treatment modalities. Studies in adjacent contexts-such as cervical facet joint PRP for chronic neck pain demonstrated notable reductions in pain and disability with no adverse events. Several clinical trials are underway to assess PRP's feasibility and efficacy in lumbar facet joints. **Conclusion:** Current evidence suggests that PRP injections for facet-mediated low back pain are safe and may offer more durable relief than standard analgesic or corticosteroid therapies, with enhanced functional outcomes and high patient satisfaction. Nevertheless, most data derive from small

cohorts and non-randomized designs. The field would benefit from large-scale, randomized, controlled trials with extended follow-up to better establish PRP's long-term efficacy, cost-effectiveness, and standardized application protocols.

ID: AGS26/236
P0827: MySpine PSI vs Freehand CBT: faster operations, lower infections, and a mitigated learning curve

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Introduction: Cortical bone trajectory (CBT) screws engage dense cortical bone and can offer biomechanical advantages over traditional pedicle screws. They also spare the paraspinal muscles on the lateral aspect of the facet joint, which minimizes denervation and reduces the morbidity seen with traditional open dissection techniques. However, CBT has a steep learning curve and a narrow margin for error. These demands have driven interest in patient-specific instrumentation (PSI). PSI uses a preoperative CT to create a patient-matched 3D model and custom drill guides that seat on bony landmarks, translating a planned entry point, trajectory, and screw size into the operating room. CT-based PSI systems-such as the Medacta MySpine platform-aim to standardize screw placement, improve accuracy, reduce operative-time variability, and shorten the learning curve. **Material and Methods:** Single-surgeon retrospective cohort (2018-2025) comparing freehand CBT with CT-guided MySpine PSI (single-stage primary; two-stage for context). Operative time, estimated blood loss (EBL), length of stay (LOS), pain, and infection were analyzed using generalized linear models (Gamma, log link) adjusted for age, sex, and instrumented levels; categorical endpoints used Poisson regression with robust variance or Fisher's exact tests. A segmented interrupted time-series assessed the PSI adoption effect on the operative-time learning curve. **Results:** 247 cases (freehand n = 28; CT-PSI single-stage n = 152; CT-PSI two-stage n = 67). Baseline demographics were comparable: CT-PSI (all) median age 65.0 [60-72] vs 64.5 [56.8-71.2] years in freehand; female 68% vs 57%. The PSI cohort comprised ~1,148 CBT screws (single-stage ~730; two-stage ~418) vs ~126 in freehand. Follow-up (months): CT-PSI (all) 11.0 [5.0-20.0] (n = 216; range 1-43) vs freehand 39.5 [16.5-48.3] (n = 28; range 2.5-76). Median operative time was lower with PSI (150 [132-184] min) than freehand (183 [166-210] min; $p < 0.001$). Interrupted time-series showed a significant flattening of the learning curve: operative times improved during the freehand era (-0.86%/month) but stabilized after PSI adoption (+0.26%/month; slope-change $p = 0.017$); the immediate level change at adoption was -9.1% ($p = 0.25$). EBL, LOS, and operative complications did not differ significantly after adjustment. Pain at 3 and 6 months favored PSI ($p = 0.021$ and $p = 0.035$). All-cause infection (intra- or postoperative; SSI/UTI/pneumonia/sepsis) was lower with PSI (3.3% vs 7.1%; $p = 0.041$). **Conclusion:** Adoption of MySpine PSI reduced operative time, improved 3-6-month pain, lowered infections, and flattened the learning curve-delivering late-era performance from the outset even for an experienced CBT screw surgeon-with no increase in complications. PSI may enhance efficiency, safety, standardization, and lower barriers to CBT adoption.

ID: AGS26/240
P0828: Can pre-perfusion of bone wax and gelatin sponge further reduce bone cement leakage a retrospective case-controlled study with a 3-year follow-up

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Introduction: Although pre-perfusion with gelatin sponge (GS) in percutaneous kyphoplasty (PKP) has been proven to effectively prevent bone cement leakage (BCL), it is unknown if pre-perfusion of bone wax (BW) and GS could be more potent. We aimed to evaluate the effect of pre-perfusion of BW and GS to reduce BCL during PKP. **Material and Methods:** We retrospectively analyzed the prospectively collected data of patients with single-level painful osteoporotic vertebral compression fracture (OVCF) who underwent PKP between January 2021 and December 2023. They were divided into group A (pre-perfusion of GS only) and group B (pre-perfusion of BW and GS). Clinical outcomes in terms of visual analogue scale (VAS) scores of backpain, Oswestry Disability Index (ODI) and BCL during PKP were compared between the two groups. **Results:** A total of 426 patients were included in this study, including 106 males and 320 females, with an average age of 69.6 ± 5.6 years. Among them, 216 patients in group A and 210 patients in group B. The average follow-up time was 37.8 ± 6.9 months. All patients in both groups showed significant improvements in VAS and ODI scores compared with their preoperative values after the surgery; these improvements remained significant until the last follow-up ($p < 0.05$). However, there was no significant difference between the two groups ($p > 0.05$). The overall incidence rates of BCL and anterior leakage, respectively, were 19.5% (42/216) and 6.5% (13/216) in group A and 11.9% (25/210) and 0.5% (1/210) in group B. Thus, group B showed significantly lower rates of BCL and anterior leakage than group A

($p < 0.05$). **Conclusion:** Either pre-perfusion of BW and GS or GS alone during PKP could both achieve satisfactory clinical outcomes for patients with painful OVCF. However, pre-perfusion of BW and GS could further reduce BCL compared with pre-

ID: AGS26/307
P0829: Anterior cervical osteophyte resection for treatment of dysphagia

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Introduction: When anterior cervical osteophytes become large enough, they may cause dysphagia. Surgical osteophyte resection is taken when conservative treatment does not respond. However, few reports on its operation and postoperative follow-up. **Material and Methods:** Retrospective review identified 12 patients who underwent anterior cervical osteophyte resection for dysphagia. The mean age was 69 years and the mean follow-up was 2.2 years. The most common level operated on was C3-C4 (8, 67%). **Results:** Following anterior cervical osteophyte resection, all of the patients had improvement in dysphagia. Six patients underwent cervical fusion because of stenosis in the same segment; there were no iatrogenic instability requiring fusion in other patients. Fusion patients were older (72 vs 68 years, $p < 0.01$) and had longer operative times (148 vs 69 minutes, $p < 0.01$). No serious complications such as vascular and nerve damage occurred during the operation, and no osteophyte recurrence or internal fixation failure occurred during the follow-up period. **Conclusion:** Anterior cervical osteophyte resection could effectively improve swallowing function in all patients with symptomatic osteophytes. Spinal fusion can be added to address stenosis and other underlying cervical disease and help prevent osteophyte recurrence. Patients should undergo thorough multidisciplinary workup with swallow evaluation to confirm that anterior cervical osteophytes are the primary cause of dysphagia prior to surgery.

ID: AGS26/329
P0830: A novel two-staged technique for large soft tissue defect reconstruction following multiple dorsolumbar surgeries

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Introduction: Complex back wounds following multiple surgeries and complicated by recurrent infections require careful multidisciplinary management to achieve closure and promote healing. In the case of extensive dorsolumbar defects, the use of local and regional flaps may be limited due to insufficient reach. Moreover, repeated surgeries in such a high tension area can lead to insufficient tissue and inadequate vascularity further restricting flap coverage options. **Material and Methods:** In the first operation with the patient in a left lateral decubitus position under intercostal block by anesthesia, an infiltration was performed of the flap perimeter outlining the entire width of the right hemi-back. Three borders of incisions were autonomized : two medial paravertebral and lateral vertical incisions on the posterior axillary line as well as a distal horizontal incision at the level of the iliac crest and deep to the fascia. Antiseptic dressing and compresses were left in place. A month later, in a second procedure jointly with plastic surgery and spine neurosurgery, the patient was placed in a ventral decubitus position under general anesthesia. Surgical screw revision was performed. An alternative technique was employed for rods insertion by sliding them under the skin to preserve the flap site. Following successive compressions and bending, the rods were secured and fluoroscopy confirmed appropriate kyphosis and scoliosis correction. Bone graft harvested from the pelvis was deposited and mixed with the allograft. Antibiotic beads were left in place. For wound closure, the subfascial layer was dissected and perforators were identified. Significant volume had been acquired following autonomy. A perforator 23 cm for the distal end of the flap was dissected transmuscularly and converted into a complete vascularized island. The rest of the flap was raised in a subfascial and sub-trapezial muscle plane to the right. To cover the tissue loss in two planes, a translation and advancement on the cervico-dorsal area was performed with synthetic absorbable sterile surgical sutures and staples. The distal part of the flap was distributed to cover the distal part of the material and part of the donor site. A lateral right discharge triangle at the thoracolumbar level was left to be directed for healing by secondary intention with an incisional vacuum-assisted closure (VAC) system for tissue loss. **Results:** By the 11-month follow-up, the patient demonstrated complete wound closure, with stable soft tissue coverage and no further complications. **Conclusion:** The main purpose of this report was to document the possibility of a successful large wound closure using a two staged approach of autonomization followed by mobilization. The perforators of larger caliber are a valid propeller flap option for dorsolumbar coverage with a delayed surgical phenomenon that increases blood supply and minimizes donor site defect and functional morbidity of wound closure. The technique is a viable alternative to free flap microsurgery. Previous cases in literature for this approach covered smaller areas of interest. Our work can therefore increase therapeutic options in future large and complex wound management cases, frequently encountered in spine surgeries.

ID: AGS26/341
P0831: Safety and efficacy of robot-assisted technology in severe complex and non-severe spinal deformity correction: a retrospective comparative study

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Introduction: Surgical correction of severe complex spinal deformities (SCD) poses significant technical challenges and carries a high risk of neurological complications. In recent years, robot-assisted (RA) technology has been increasingly adopted in spinal surgery, with theoretical advantages in enhancing surgical precision and safety, particularly in anatomically complex cases. However, its clinical outcomes in the correction of SCD have not been thoroughly evaluated. **Material and Methods:** A retrospective analysis was conducted on patients who underwent RA scoliosis correction surgery between January 2021 and April 2024. Patients were classified into non-severe deformities (NSD) and SCD groups based on the criteria of Cobb angle > 80°, flexibility < 25%, or focal kyphosis > 90°. Demographic data, surgical parameters, and imaging outcomes were collected and compared between the two groups. Primary outcomes included pedicle screw placement accuracy, major curve correction rates, operative time, intraoperative blood loss, hospital stay, and postoperative complications. A p-value < 0.05 was considered statistically significant. **Results:** A total of 38 patients were included (NSD: 21, SCD: 17). No significant differences were observed between the groups in terms of age, sex distribution, BMI, or major curve region ($p > 0.05$). The SCD group exhibited significantly greater preoperative Cobb angles (93.69°± 23.20° vs. 51.05° ± 14.33°, $p < 0.0001$) and kyphosis angles (102.65° ± 36.52° vs. 37.77° ± 21.57°, $p < 0.0001$) compared to the NSD group. There were no significant differences between the groups in the number of screws placed (18.35 ± 7.00 vs. 16.86 ± 7.77, $p = 0.5414$), operative time (277.35 ± 68.81 min vs. 247.00 ± 80.40 min, $p = 0.2256$), intraoperative blood loss (379.41 ± 241.78 ml vs. 319.05 ± 197.15 ml, $p = 0.4019$), or transfusion rates (23.53% vs. 23.81%, $p = 1.0000$). However, the SCD group had significantly longer hospital stays compared to the NSD group (27.65 ± 9.64 days vs. 21.19 ± 7.24 days, $p = 0.0239$). The complication rates were similar between the two groups (5.88% vs. 4.76%, $p = 1.0000$). Although the perfect screw placement rate in the SCD group was slightly lower than in the NSD group, the difference was not statistically significant (90.60% ± 4.90% vs. 92.18% ± 6.29%, $p = 0.3997$). Major curve correction rates also showed no significant difference between the groups (66.34% ± 19.91% vs. 71.05% ± 16.08%, $p = 0.5134$). **Conclusion:** This study demonstrates that RA technology achieves comparable pedicle screw placement accuracy and major curve correction rates in SCD patients relative to NSD patients, with no significant increase in complication rates. However, SCD patients may require longer hospital stays. These findings suggest that RA technology is a safe and effective strategy for SCD management, though broader implementation requires validation through larger prospective trials. Further large-scale, prospective studies are warranted to validate these results.

ID: AGS26/351
P0832: SpineForge Planner: free and open-source software for spinal alignment analysis in surgical planning

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Introduction: Spinal balance parameters are crucial for successful spinal fusion procedures. Failure to respect these parameters often results in surgical failure, causing significant pain for patients and substantial costs to healthcare systems. While commercial software like Surgimap exists for spinal alignment analysis, new account creation has been unavailable for years, effectively blocking access for new users. Currently, there are no accessible alternatives available for comprehensive spinal alignment analysis, forcing surgeons to perform these complex measurements manually, which is time-consuming and prone to error. This limitation particularly affects new-generation surgeons and those in resource-limited settings who cannot access existing commercial platforms. **Material and Methods:** SpineForge Planner was developed using Python 3.x with PyDICOM for medical image processing and NumPy for mathematical calculations. The graphical interface utilizes Tkinter for cross-platform compatibility. DICOM pixel spacing is automatically extracted for calibrated measurements, while standard images use manual calibration with known anatomical landmarks. Spinal parameters are calculated using established geometric principles: pelvic incidence through vector analysis of the sacral endplate perpendicular and bicoxofemoral axis, sagittal vertical axis via plumb line calculations from C7 to S1, and lordotic angles using acute angle measurements between vertebral endplates. The software employs PIL for image manipulation, SciPy for spline interpolation in rod generation, and mathematical trigonometry for all angular calculations. Surgical planning algorithms simulate screw trajectories and generate patient-specific rod geometries using 3D mesh calculations. **Results:** Our software successfully provides comprehensive sagittal alignment analysis, including all standard parameters: sagittal vertical axis, pelvic incidence, pelvic tilt, sacral slope, lumbar

lordosis, C2-C7 lordosis, and T1 slope. The software enables surgical planning through interactive pedicle screw placement with customizable dimensions and trajectories, interbody/corpectomy cage positioning with various geometries, and automated generation of patient-specific rod models based on corrected spinal alignment. Additional features include osteotomy planning with correction angle estimation and visual surgical simulation. The complete software package is released as open-source under permissive licensing, ensuring free global access and encouraging collaborative development. **Conclusion:** SpineForge Planner represents the first comprehensive, free, and open-source solution for spinal alignment analysis and surgical planning as part of the broader SpineForge initiative to democratize spine surgery education worldwide. We invite the global spine surgery community to adopt this tool in clinical practice and provide feedback for continuous improvement. By eliminating financial barriers to advanced measurement tools, this initiative aims to enhance surgical planning capabilities for all spine surgeons, regardless of geographic location or resource availability. Community engagement and collaborative development will drive future enhancements to better serve global spine surgery needs.

ID: AGS26/364

P0833: "Robotics are rarely used" - A Global AO Spine survey reveals gaps in access, training, and confidence in robotic, navigation, and AR/VR techniques in spine surgery

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Introduction: Advanced technologies such as robotics, navigation, and augmented/virtual reality (AR/VR) are widely promoted in spine surgery, yet real-world adoption remains poorly understood. This international survey aimed to assess global access, use, barriers, and perceived readiness for these tools. **Material and Methods:** A structured online survey was disseminated between February 13 and March 10, 2025, through AO Spine communication channels (email, social media, and official website). The questionnaire comprised 45 items covering surgical background, access to robotics/navigation/AR-VR, comfort levels, perceived obstacles, and educational needs. **Results:** A total of 266 spine surgeons completed the survey (completion rate: 76%). Respondents were primarily from Europe and Southern Africa (36.5%), Asia Pacific (26.2%), and North America (11.0%). Most participants were younger than 45 years (n = 140; 54.6%), with 45.9% reporting fewer than 11 years of spine surgery experience. The majority were orthopedic-trained (69.2%); 57.1% had completed a spine fellowship. Nearly half (48.5%) worked in academic or university-affiliated hospitals, and 79.3% practiced in urban settings. Fluoroscopy was the most common primary surgical technique (44.0%), followed by freehand (31.6%) and navigation/robotics (9.9%). Only 2.8% reported robotic-assisted surgery as their main technique. Navigation systems were available to 67.2% of respondents, whereas only 19.2% reported access to robotics; 31.6% lacked access to any advanced surgical technology. Surgeon comfort levels varied: 47.3% reported feeling very or completely comfortable with navigation, 8.0% with robotics, and 76.4% indicated AR/VR was either unavailable or unfamiliar. Key barriers included high capital costs (83.6%), limited equipment availability (64.4%), and lack of institutional support (60.3%). Concerns related to complexity and learning curve (46.5%) and fear of skill degradation through over-reliance on technology (26.8%). Main motivators for adoption were reduced radiation exposure (63.0%), shorter operative times (63.0%), and improved patient outcomes (61.6%). Hands-on training (56.2%) and mentorship (41.1%) were considered essential enablers. **Conclusion:** There is a pronounced gap between enthusiasm for and actual use of robotics and AR/VR in spine surgery. Access and training remain key limiting factors globally, particularly in resource-limited settings. To unlock the full potential of these technologies, targeted investments in structured education and infrastructure are urgently needed.

ID: AGS26/365

P0834: Bridging the training gap: a Global AO Spine survey reveals strong demand for hands-on, hybrid, and AI-enhanced education for advanced technologies in spine surgery

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Introduction: Advanced technologies such as robotics, navigation, and augmented/virtual reality (AR/VR) are reshaping the landscape of spine surgery. Their adoption, however, depends not only on equipment availability but also on structured training and education. In parallel, artificial

intelligence (AI) is emerging as a novel adjunct for both surgical planning and educational support. This global survey aimed to assess training access, educational needs, and attitudes toward AI among spine surgeons. **Material and Methods:** A 45-question online survey was disseminated globally via AO Spine communication channels between February 13 and March 10, 2025. The questionnaire addressed demographics, training experience in robotics/navigation/AR-VR, perceived training quality, preferred educational formats, and use of AI-based tools. Descriptive statistics were applied. **Results:** A total of 266 spine surgeons completed the survey (completion rate: 76%). Respondents were primarily from Europe and Southern Africa (36.5%), Asia Pacific (26.2%), and North America (11.0%). Most were under 45 years of age (n = 140; 54.6%) and had less than 11 years of surgical experience (45.9%). The majority were orthopedic-trained (69.2%); 57.1% had completed a spine fellowship. Nearly half (48.5%) worked in academic or university-affiliated institutions, and 79.3% practiced in urban settings. Only 3.3% reported receiving weekly in-house training on advanced technologies, while 29.2% lacked structured access entirely. Despite this, 77.5% endorsed hands-on cadaver workshops as the most effective learning format. Simulation-based AR/VR training was supported by 54.9%, and 47.9% preferred hybrid models combining online modules with practical experience. Mentorship from experienced surgeons was viewed as essential by 41.1%. In the past three years, cadaver labs (62.7%) and conventional technique courses (54.1%) were most frequently attended, whereas only 34.5% received training in robotics and 22.0% in AR/VR. Over 30% rated their training in advanced technologies as inadequate. Industry-sponsored education was regarded as "very important" by 68.4% of respondents. AI was viewed positively by 86.6%, particularly for simulation and planning. Although 67.3% anticipated AI improving patient outcomes and 54.0% valued personalized feedback, only 25.7% had practical experience with AI-based tools. **Conclusion:** There is a clear mismatch between interest in and access to structured training in advanced spine technologies. Surgeons favor cadaveric, simulation-based, and hybrid educational formats but report limited exposure. AI is increasingly recognized as a promising tool for future education, yet remains underutilized in practice.

ID: AGS26/441
P0835: Automatic pedicle screw planning in lumbar spine CT images based on keypoint detection

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Introduction: In spinal fixation surgery, accurate placement of pedicle screws is crucial to ensuring patient safety and achieving optimal clinical outcomes. However, due to complex anatomical structures and variations between patients, manual positioning of these screws is prone to errors, while these errors can be partly reduced by preoperative screw planning. **Material and Methods:** This study proposes an automatic pedicle screw planning frame work based on image segmentation and key point detection techniques, applicable to 2D lumbar spine CT images. We developed and annotated a comprehensive dataset comprising lumbar spine CT scans, each image marked by ten keypoints corresponding to the endpoints of five line segments that define screw locations, screw maximum diameter constraints, and reference lines. **Results:** Using a heatmap-based keypoint detection approach, our method accurately localizes the positions and orientations of pedicle screws. The proposed method demonstrates superior performance on standard keypoint detection metrics, including object keypoint similarity (OKS) and average precision (AP). Furthermore, we introduce three specialized evaluation metrics-average angle difference (AAD), average length difference (ALD), and average distance (AD)-to provide a more detailed assessment of screw placement accuracy. The average of Dice coefficient for the lumbar CT image segmentation is 90%. The average of OKS, AP, AD, AAD and ALD are 0.95, 0.95, 3.5°, 0.05 and 0.06, respectively. These results validate the effectiveness of our method, highlighting its potential to enhance preoperative planning and improve surgical precision through reliable automatic screw localization from CT images. **Conclusion:** The experimental results revealed that the heatmap-based approach surpassed the other methods in all evaluation metrics, providing greater precision and robustness in screw placement. This advancement enhances surgical precision, minimizes complication risks, and ultimately leads to better patient outcomes.

ID: AGS26/670
P0836: B.SPINE: building a bridge between medical students and spinal research

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Introduction: Medical students and early-year medical professionals are expected to engage in research to support their careers in this increasingly competitive environment. Traditional research recruitment relies on personal networks and established mentorship, creating substantial disparities that disproportionately affect students without academic connections. Birmingham Spinal Research and Innovation Network (B.SPINE) was developed as an innovative digital solution to

address this discrepancy by creating a centralised hub where researchers post available projects and students can directly express interest obtaining necessary guidance and mentorship. **Materials and Methods:** Platform development occurred over 12 weeks through weekly meetings between one supervisor (consultant spine surgeon) and three medical students. Development focused on: (1) graphic design of the logo and online interface; (2) project database with filtering capabilities and timeline visualization; (3) comprehensive guidelines section providing step-by-step instructions for researchers and students; (4) formulating a clear registration method (5) GDPR-compliant data storage with ICO registration ensuring user rights; (6) pilot evaluation collecting quantitative and qualitative feedback via anonymous survey. **Results:** Fourteen stakeholders provided feedback: 7 medical students (50%), 5 non-medical students (36%), and 2 clinical professionals (14%). On a 10-point scale users rated visual design as 7.3 (95% CI 6.2-8.3); logo design as 8.6 (7.7-9.4); usability and ease of access as 8.2 (7.3-9.1). Qualitative feedback described the platform as "clear" and "informative" recommending mobile device optimisation and aesthetic enhancements. Platform purpose clarity scored 8.2 (6.9-9.6); perceived utility 9.0 (8.4-9.6), and recommendation likelihood 9.1 (8.1-10.0). The purpose was well understood by all students but required further logistical information for the clinical professionals. On a separate scale 1-5, six medical students reported maximum (5/5) expression of interest in using B.SPINE to join research, and six reported high levels of interest (three rating 5/5, three rating 4/5) in sharing research on B.SPINE. **Conclusion:** B.SPINE represents a scalable solution, potentially increasing research participation rates and improving career development opportunities across multiple specialities. Initial evaluation demonstrates strong stakeholder support for B.SPINE, particularly amongst the primary target demographic of medical students. The platform successfully addresses recognized gaps in research accessibility while maintaining high usability standards. User feedback will be integrated into official web design, focusing on mobile optimization. A larger validation study is planned across diverse medical education settings following the official release.

ID: AGS26/722

P0837: Sacroiliac joint fusion through the patient lens: natural language processing of a decade of reddit posts

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Introduction: Sacroiliac (SI) joint dysfunction is a leading cause of chronic lower back pain, with SI joint procedures serving as a surgical intervention for patients who fail conservative management. While clinical studies provide patient-reported outcome measures (PROMs), real-world patient experiences, satisfaction, and complications remain underreported. Social media platforms are a vast database of patient narratives. Reddit in particular offers patients an anonymous support network and advances in artificial intelligence allows us to capture and understand real time unfiltered data on the patient's experience with treatment. **Material and Methods:** We conducted a cross-sectional, mixed-methods study utilizing ~75,000 Reddit posts (2014-2024) across medical and patient-centered forums. Posts containing SI joint fusion-related keywords were identified and classified into four groups: surgery/related discussion, pain management, physical therapy and rehabilitation, and general discussion. Sentiment (positive/neutral vs negative) was assessed using natural language processing. Post characteristics such as length, date, and engagement metrics were also collected. **Results:** We isolated 1,553 relevant, unique Reddit posts from 2014-2024. General discussion comprised 41.5% of all posts, followed by pain management (21.7%), physical therapy and rehabilitation (19.1%), and surgery-related questions (17.7%). Among patient discussions online, surgery and pain management showed significantly higher negative sentiment, often reflecting frustration or unmet expectations. 81.0% were classified as positive/neutral and 19.0% as negative. Longer posts showed a significant increase in negative sentiment (36.5%) compared to shorter ones. From 2020 to 2024, post volume rose substantially, with an average annual growth rate of 129%, reaching 749 new posts in 2024. Posts referencing pain and surgical outcomes became increasingly common. **Conclusion:** Our study is the first to use social media to analyze real-world experiences of patients undergoing SI joint fusion. While clinical outcomes research shows favorable success rates, Reddit posts reveal a different picture around pain, complications, and recovery. These findings highlight a gap between published outcomes and patient-reported experiences. Social media and testimonials can influence decisions about surgery, highlighting the need to clarify expectations about recovery and pain control.

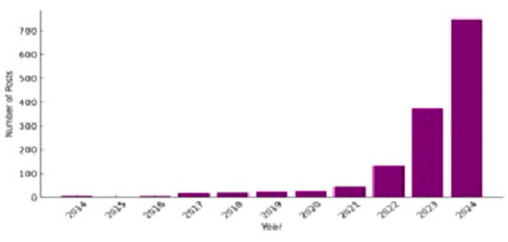


Figure 1. Total posts by year, 2014 - 2024

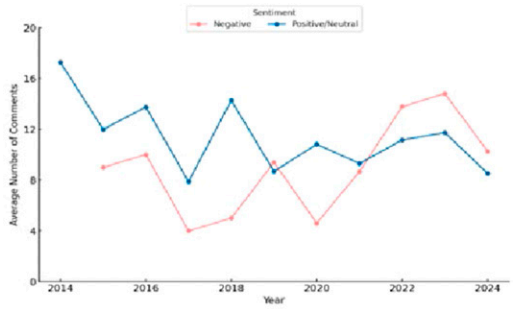


Figure 2. Average number of comments by sentiment type, 2014 - 2024



Figure 3. Percentage of sentiment type, by post type by year, 2014 - 2024

ID: AGS26/809

P0838: A non-irradiated portable 3D electronic spine measurement system for large-scale adolescent scoliosis screening: a diagnostic accuracy and implementation study

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Introduction: Early screening for adolescent idiopathic scoliosis (AIS) is essential to prevent curve progression and improve long-term outcomes. Current reliance on standing full-spine radiography exposes youths to ionizing radiation, while physical examinations like the Adams forward bend test suffer from subjectivity and variable accuracy. This study aims to validate a non-irradiated, portable 3D electronic spine measurement system for large-scale AIS screening, integrating diagnostic accuracy, implementation feasibility, and health economic evaluation. **Material and Methods:** A prospective diagnostic accuracy study embedded with an implementation science component was conducted across 20 schools and 5 community health centers in Chongqing, China. A total of 5000 adolescents aged 10-18 years were enrolled. The index test was a multi-sensor portable device measuring Cobb angle and vertebral rotation. The reference standard was standing full-spine radiography, interpreted by two blinded radiologists. All screen-positive participants and a random 10% of screen-negative participants underwent radiography. Implementation outcomes were evaluated using the RE-AIM framework. Health economic analysis included cost-effectiveness and budget impact analyses. Results: Preliminary data from a pilot study (n=2000) showed excellent agreement between the device and radiography: intraclass correlation coefficient (ICC) for Cobb angle was 0.93 (95% CI: 0.90-0.95), with a mean difference of 1.5° (95% LoA: -4.2° to +7.2°). The device-derived vertebral rotation correlated strongly with Perdriolle rotation ($r = 0.78$, $p < 0.001$). Operational feasibility was high: 100% of non-professional operators (n = 20) passed proficiency testing after 1 hour of training, with an error rate < 1.5%. Participant satisfaction reached 96%. The new screening model demonstrated a potential cost reduction of > 30% per 1000 participants compared to traditional methods. **Conclusion:** The portable 3D spine measurement system is an accurate, feasible, and cost-effective tool for large-scale AIS screening. Its non-irradiated nature and ease of use make it suitable for community and school-based settings. This study supports its integration into public health screening programs and provides a foundation for AI-driven predictive modeling using acquired 3D spine data.
Keywords: Adolescent idiopathic scoliosis, scoliosis screening, non-irradiated imaging, portable device, diagnostic accuracy, implementation science, health economics, RE-AIM framework

ID: AGS26/856

P0839: Unilateral extrapedicular approach versus traditional transpedicular approach in thoracolumbar PKP: a prospective cohort study based on a 1000-case database

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Introduction: Percutaneous kyphoplasty (PKP) is a well-established treatment for osteoporotic vertebral compression fractures (OVCFs). While the traditional transpedicular approach (TP) is widely used, the unilateral extrapedicular approach (EP) may offer superior cement distribution and reduced radiation exposure. This large-sample, prospective study aims to compare the surgical parameters, clinical efficacy, and safety profiles of these two approaches. **Material and Methods:** This study prospectively analyzed 1000 patients with single-level OVCFs treated at our institution between January 2019 and December 2023. Patients were categorized into a TP group (n=650) and an EP group (n=350) based on the surgical approach. Data on operative time, intraoperative fluoroscopy frequency, volume of cement injected, and cement leakage rate were collected and compared. Clinical outcomes were assessed by comparing visual analog

scale (VAS) scores, Oswestry Disability Index (ODI) scores, and the rate of anterior vertebral height restoration preoperatively, at 3 days postoperatively, and at the final follow-up. **Results:** The EP group demonstrated significant advantages over the TP group in both operative time (28.5 ± 5.1 vs. 32.3 ± 6.4 min, $p < 0.05$) and number of fluoroscopic shots (18.2 ± 3.1 vs. 22.5 ± 4.7, $p < 0.01$). The volume of cement injected showed no significant difference between groups (4.8 ± 0.8 vs. 4.9 ± 0.7 ml). The cement leakage rate was significantly lower in the EP group (5.7% vs. 11.2%, $p < 0.01$). Both groups exhibited marked and comparable improvement in pain relief (mean VAS improvement: EP 6.5 ± 1.2 vs. TP 6.3 ± 1.4) and functional recovery (mean ODI improvement: EP 65.4% ± 10.2% vs. TP 63.8% ± 11.5%) ($p > 0.05$). **Conclusion:** For thoracolumbar OVCFs, the unilateral extrapedicular approach for PKP represents a more efficient and safer technical option. It significantly reduces operative time, radiation exposure, and the risk of cement leakage, while achieving clinical outcomes equivalent to the traditional approach. This large-sample prospective study provides robust evidence supporting the preferential use of the EP approach in clinical practice.

ID: AGS26/887
P0840: Posterior thoracic interbody fusion: when is it useful?

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Introduction: Posterior thoracic interbody fusion (PTIF) is technically demanding because of narrow disc spaces, proximity to the spinal cord, and historically limited indications. However, when pathology is located ventral to the dura, a posterior corridor can avoid thoracotomy-related morbidity while providing direct decompression and rigid stabilization. This study evaluates the indications and outcomes of PTIF performed at a single institution. **Material and Methods:** A retrospective review identified 16 adults (mean age 66.4 years; 9 females) who underwent PTIF between T1-L2 from 2018-2023. Indications included thoracic disc herniation, proximal junctional kyphosis, infectious spondylitis, and ossification of the posterior longitudinal ligament, all with ventral dural involvement. Surgical technique consisted of bilateral total facetectomies, meticulous discectomy-endplate preparation, pedicle-screw instrumentation, and insertion of either cage + allobone or allobone alone (8 patients each). Radiographic fusion was assessed by CT ≥ 6 months post-operatively; neurological status used the ASIA scale. Mean clinical/radiological follow-up was 19.4 months**. Results:** No intraoperative spinal cord injuries, dural tears, or cerebrospinal-fluid leaks occurred. Fusion was achieved in all cases; no cage migration or pedicle-screw loosening was noted on serial CT. Patients with pre-operative neurological deficits demonstrated improvement or stabilization, and most reported meaningful back-pain relief. Post-operative ASIA grades were unchanged or improved in every patient. **Conclusion:** When ventral thoracic pathology mandates direct decompression, PTIF provides a safe and effective alternative to anterior approaches, yielding high fusion rates and consistent neurological recovery without thoracotomy-related complications. Careful patient selection and generous bilateral facetectomy are key technical factors that enable adequate exposure while minimizing neural manipulation. Further comparative studies are warranted to clarify long-term functional and cost-effectiveness profiles.

ID: AGS26/951
P0841: CATS: cerebrospinal fluid pressure analysing toolbox in spinal cord compression

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Introduction: The current mainstay for acute spinal cord injury (SCI) and decompressive cervical myelopathy (DCM) management is surgical decompression. While there is mounting evidence for the benefit of timely surgery, there is still the need for improving surgical outcomes, for example by optimizing spinal cord perfusion and reducing spinal cord swelling. To his end, the assessment of cerebrospinal fluid pressure dynamics (CSFP) and CSF drainage are emerging topics especially in SCI. With the methodology still being in research state, currently available commercial software packages have not yet incorporated algorithms for complex analysis of CSFP waveforms. To enable the spinal cord compression research community to carry out advanced CSFP assessment, we here introduce "CATS" an open-source CSFP Analysing toolbox for Spinal cord compression research. Like other biological data, CSFP signal is vulnerable to artefacts and requires a good knowledge of data processing. In addition, there is room for much more exploration from basic feature extraction to machine learning approaches that could potentially further the research where the known features fall short. **Material and Methods:** The CSFP toolbox was developed with focus on a) ease of use, b) incorporation of relevant CSFP analysis algorithms, and c) expandability for integration of future algorithms. **Results:** Following automatic or manual windowing, the toolbox extracts features from CSFP such as mean CSFP, CSFP pulsations, and respiratory modulation. It further performs feature extraction on other vital signs recorded in parallel, such as on continuously measured arterial blood pressure. The toolbox offers automatic noise reduction, pressure baseline adjustment, and multiple visualization options to obtain a quick overview of the recording. In addition,

it clusters the CSFP signal based on its morphology to detect temporal changes during intraoperative measurement. **Conclusion:** Advanced CSFP assessment could span this tool beyond research and into clinical practice. This is made possible through development of "CATS", designed with the intention of improving clinical diagnosis and gaining a better understanding of the physiology of the craniospinal compartment.

ID: AGS26/956
P0842: Cerebrospinal fluid pressure dynamics as a biomechanical marker for quantification of spinal cord compression: conceptual framework and systematic review of clinical trials

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Introduction: In patients with acute spinal cord injury (SCI) and degenerative cervical myelopathy (DCM), spinal cord compression is considered a main contributor to spinal cord damage, associated with cerebrospinal fluid (CSF) space obstruction. CSF pressure (CSFP) dynamics are studied as a potential indirect biomechanical marker for spinal cord compression, and as a proxy to estimate spinal cord perfusion pressure (SCPP). **Material and Methods:** Systematic review. This review followed PRISMA guidelines, risk of bias assessment with ROBINS-I tool, PROSPERO registration (CRD42024545629). **Results:** 11 relevant papers were identified (n = 212 patients, n = 194 intraoperative, n = 18 bedside). Risk of bias for safety reporting was low-moderate. Intraoperative CSFP assessments were commonly performed in acute SCI. CSFP was assessed to calculate SCPP (7/11), to evaluate effects from surgical decompression (5/11) and for therapeutic CSF drainage (3/11). The adverse event rate associated with the intrathecal catheter was 8% (n = 15/194). **Conclusion:** The preliminary safety and feasibility profile of CSFP assessments in spinal cord compression encourages clinical application. However, a deeper risk-benefit analysis is limited as the clinical value is not yet determined, given challenges of defining disease specific critical CSFP and SCPP thresholds. The interrelation between measures of CSFP and neuroimaging is yet to be proven. Targeted preclinical studies are essential to improve our understanding of complex CSFP-cord compression interrelations.

ID: AGS26/1014
P0843: Outcomes of robot- versus navigation-assisted minimally invasive sacroiliac joint fusion: a single-institution experience

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Introduction: Sacroiliac joint (SIJ) dysfunction is an underdiagnosed contributor to low back pain and remains relatively understudied. SIJ fusion, a surgical intervention aimed at stabilizing the SIJ, has been proposed as a treatment option for persistent SIJ dysfunction. Minimally invasive fusion techniques for SIJ fusion are increasingly favored due to their reduced surgical morbidity. This study compared clinical outcomes between patients who underwent navigation-assisted (NA) versus robot-assisted (RA) SIJ fusion at an academic tertiary spine center. **Material and Methods:** A retrospective chart review was conducted on adult patients who underwent SIJ fusion using either NA or RA techniques between November 2022 and September 2024. The primary outcome was the change in pain severity, assessed by the visual analog scale (VAS). Secondary outcomes included operative time, screw placement accuracy, 30-day unplanned readmissions, and postoperative complications. **Results:** Thirty-one patients met the inclusion criteria: 19 in the NA group and 12 in the RA group, with a mean follow-up of 24.6 ± 18.6 months. The group comprised 21 females and 10 males, with an average age of 65.5 years. Both cohorts were comparable at baseline in age ($p = 0.416$), body mass index ($p = 0.478$), and history of prior spine surgeries ($p = 0.879$). Operative time was significantly longer in the RA group (103.2 ± 51 versus 64.1 ± 14.4 minutes; $p < 0.001$). Screw placement accuracy was 100% in both groups, with no intraoperative misplacements. The NA cohort experienced a 10.3% improvement in their pain scores within 30 days postoperatively, while the RA group showed a 31% improvement ($p = 0.52$). Four patients (12.9%) experienced unplanned 30-day readmissions, two in each group (10.5% NA versus 16.7% RA; $p = 0.21$), for varying complaints: Two individuals in the NA group reported left buttock pain and difficulty ambulating, and two in the RA group experienced

blood in the feces and surgical site discharge. No postoperative complications requiring revision surgery occurred in the patient cohort. Two incidents of screw fractures were noted in the NA group without deterioration of symptoms. At the last follow-up, in the NA group, 11 out of 19 patients (57.9%) reported improvement in pain, 2 (10.5%) experienced worsening, and 6 (31.6%) remained stable. In the RA group, 7 out of 12 patients (58.3%) reported improved pain, while 5 (41.7%) remained stable; no patients in this group reported worsening symptoms. The mean VAS pain score change was 2.2 ± 3.56 in the NA group and 4.64 ± 3.51 in the RA group ($p = 0.083$). **Conclusion:** RA SIJ fusion demonstrated comparable safety and efficacy to NA technique, with similar pain relief and complication rates. Although not statistically significant, a trend toward greater reduction in postoperative pain was observed in the RA group. The longer operative times associated with RA likely reflect the early adoption phase of the technology at our institution.

ID: AGS26/1100
P0844: Scarless precision: early outcomes of interlaminar endoscopic spine surgery in a Bangladeshi cohort

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Background: Interlaminar endoscopic spine surgery (IESS) has emerged as a transformative technique in minimally invasive spine care, offering reduced tissue trauma, faster recovery, and superior cosmetic outcomes. This study presents early results from a single-surgeon experience at Bangladesh Spine and Orthopaedic Hospital, following advanced training in India, South Korea, and Thailand. **Objective:** To evaluate the clinical efficacy and safety of IESS in terms of hospital stay, blood loss, postoperative pain, functional recovery, and cosmetic satisfaction during the initial phase of practice. **Methods:** A prospective observational study was conducted from June 2024 to June 2025, involving patients undergoing IESS for lumbar disc herniation and spinal stenosis. Inclusion criteria encompassed single-level pathology with no prior spine surgery. Key outcome measures included:
• Hospital stay duration,
• Intraoperative blood loss,
• Postoperative scar assessment,
• Visual Analog Scale (VAS) for pain,
• Oswestry Disability Index (ODI). All procedures were performed using the interlaminar approach under local or general anesthesia, with real-time endoscopic visualization. **Results:** A total of 25 patients (to be filled post-study) were included.
• Mean hospital stay: < 24 hours in 85% of cases,
• Blood loss: negligible (< 20 ml) in 92% of cases,
• Scar visibility: minimal to none in 96% of patients at 3-month follow-up,
• VAS scores: improved from a mean of 7.2 preoperatively to 1.8 postoperatively,
• ODI scores: reduced from 58% to 18% at 6 months. No major complications or reoperations were reported. Patient satisfaction regarding cosmetic and functional outcomes was notably high. **Conclusion:** Interlaminar endoscopic spine surgery, even at the early stage of practice, demonstrates excellent clinical outcomes with minimal invasiveness. The technique offers a viable alternative to open surgery, especially in resource-limited settings

ID: AGS26/1142
P0845: C2 complete tetraplegia in a 10 year child: triple stimulation (epidural stimulation, diaphragmatic pacing and cardiac pacemaker) to improve outcomes

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Introduction: Epidural stimulation is a novel experimental technology for neuromodulation that is delivered via implantation of 16 electrode array to regain movement and control for persons with spinal cord injuries (SCI). Diaphragmatic stimulation, or diaphragm pacing is a technique which uses electrical impulses to activate the diaphragm muscle, primarily to assist respiration in individuals with respiratory insufficiency. It can improve respiratory function, reduce dependence on mechanical ventilation, and enhance the quality of life. There are no cases published with three stimulators in one person. This case study presents the challenges faced by a high tetraplegic and effects of advanced technologies to regain quality of life in a tetraplegic patient. **Materials and Methods:** It is a case of 11 year old child who fell from the swing and was diagnosed with traumatic fracture of odontoid along with spinal cord injury with neurological level of injury C2, AIS grade A neurology and completely ventilator dependent. For improving cardiac function cardiac pacemaker was inserted within a week of trauma. She was transferred to our institution six weeks after her injury. Her unstable fracture odontoid was fixed using anterior lag screw to retain rotation, even though the literature would recommend posterior atlantoaxial fixation after six weeks of injury. Since significant neurological recovery was not expected, after discussion with the family, epidural stimulator (ES) was implanted after 70 days of injury as part of our research trial. Every day the mapping of ES was done by activating the best possible combination of electrodes to bring the best possible movement of the upper limb at minimum tolerable intensity. Also, to decrease the ventilator dependence invasive diaphragmatic stimulation (DPS)

was done after 250 days of the injury and gradual weaning off was done by increasing the DPS settings and correspondingly decreasing the ventilator dependence. **Result:** The child has gained enough power in C5, C6 and C7 myotomes bilaterally with stimulation for activities of daily living to be initiated. Her mapping for ES continues and we are likely to tap the potential outcome in next 3 months. At baseline, Patient presented with profound motor impairment, and significant restrictions in functional independence. Following ES combined with functional training, the patient demonstrated measurable improvements: Motor Recovery: Volitional motor activation was observed during stimulation, with enhanced control in proximal upper limb movements. Functional Gains (SCIM-III): Pre-intervention: 24/100, Post-intervention (Vol+Stim): 32/100, Key improvements were seen in respiratory and sphincter management subdomains. Upper Limb Function (CUE-Q): Pre-intervention: 18, Post-intervention (Vol+Stim): 26. Notable gains were observed in push/pull tasks and fine motor performance. These results confirm that ES facilitated motor output and improved functional independence, despite medical complexities. Improvements were clinically meaningful, highlighting the synergistic effect of neuromodulation and rehabilitation. The diaphragmatic stimulation settings were gradually increased at fixed breathing rate of 18 bpm and inspiratory interval 1.2 s along with simultaneous gradual decrease in ventilator settings. The child was able to completely wean off the ventilator from BiPAP (IPAP 13 and EPAP 5) with 12 mandatory breaths at stimulation intensity of 18 ms on each channel at each diaphragm. Also, the arterial blood gas analysis reports were found to be normal throughout. Using B and M mode ultrasound normative and significant value of diaphragmatic excursion was found i.e., 11.9 mm making it more objective. **Conclusion:** Advanced technologies have the potential to improve outcomes and quality of life even in persons with high complete cervical cord injury making them more independent.

ID: AGS26/1206
P0846: Evaluating large language models for minimally invasive spine surgery decision-making across surgical triage and procedural categories

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Introduction: Generative artificial intelligence programs such as large language models (LLMs) are reshaping treatment decision-making across various neurosurgical subspecialties. Very limited literature exists on LLM applications in minimally invasive spine surgery (MISS). Treatment modalities available in MISS span across conservative therapy and interventional procedures to MISS. Our objective is to evaluate whether contemporary LLMs (GPT-5 Pro; Gemini 2.5 Pro) reproduce expert management categories from published MISS cases and to quantify agreement at both detailed procedural categories and a binary surgical triage level. **Material and Methods:** We constructed 90 de-identified clinical vignettes from MISS case reports and prompted each LLM to assign one or more of 11 predefined management categories with two-sentence rationales. Agreement with reference decisions was assessed using Jensen-Shannon divergence (JSD), Stuart-Maxwell tests, Cohen's κ, and McNemar's test for surgical vs. non-surgical triage. **Results:** Distributional heterogeneity versus reference was small (JSD 0.07, 95% CI 0.03 - 0.12), yet detailed allocations differed (Stuart-Maxwell $p < 0.01$). Case level agreement with reference was slight for GPT 5 Pro ($\kappa = 0.14$, 95% CI 0.02 - 0.27) and fair for Gemini 2.5 Pro ($\kappa = 0.24$, 95% CI 0.13 - 0.36); inter LLM agreement was moderate ($\kappa = 0.46$, 95% CI 0.33 - 0.58). For surgical vs. non-surgical triage, no paired bias was observed (all McNemar $p > 0.13$), with $\kappa = 0.38$ (GPT-5 Pro, 95% CI 0.05 - 0.66), $\kappa = 0.54$ (Gemini 2.5 Pro, 95% CI 0.15 - 0.82), and $\kappa = 0.69$ (inter-LLM, 95% CI 0.32 - 0.94). **Conclusion:** LLMs approximate expert judgments on whether to operate but diverge on the specific intervention, suggesting near-term value for high-level triage rather than granular operative planning. Future prospective studies will need to elucidate the clinical benefits of LLM in clinical decision making as these models evolve.

ID: AGS26/1231
P0847: Microscope-mediated heads-up display with augmented reality for simulated navigation in minimally invasive transforaminal lumbar interbody fusion (mTLIF)

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Introduction: Limitations of minimally invasive spine surgery (MISS) include restricted visualization of critical anatomy and reduced maneuverability within a narrow surgical corridor. These constraints can compromise a surgeon's spatial awareness, increase reliance on fluoroscopy, thereby raising radiation exposure, and elevate the risk of surgical complications. Microscope-mediated augmented reality (AR) software addresses these challenges by projecting anatomical landmarks into the microscope's field of view, enabling intraoperative navigation without external head-mounted displays (HMDs). This video demonstrates AR software (Brainlab, Munich, Germany) integrated within a surgical microscope's (Zeiss Meditec AG, Oberkochen, Germany) optical

view, on a non-cadaveric spine model (Realists Training Technologies GmbH, Leipzig, Germany) to simulate minimally invasive transforaminal lumbar interbody fusion (mTLIF). **Material and Methods:** Critical spinal landmarks were first selected in the Brainlab pre-planning environment, then uploaded via the Brainlab network to the intraoperative navigation software in the operating room. The navigation plan was saved and subsequently loaded on the Brainlab Curve platform, which provided the microscope-integrated AR overlay for real-time guidance. **Results:** The landmarks, including the inferior medial edge of the ipsilateral lamina (IMEL), ipsilateral pars interarticularis (Pars), ipsilateral superficial facet joint space (FJS), ipsilateral pedicle of the caudal vertebra (IP), intervertebral disc space, and contralateral pedicles, were digitally overlaid with selective shapes and colors. We simulated the mTLIF procedure using a tubular retractor and the microscope-mediated AR software's surgical guidance capabilities. **Conclusion:** Microscope-integrated AR software can project critical spinal landmarks into the operative field, demonstrating its potential to enhance intraoperative visualization and guidance in minimally invasive spine surgery.

ID: AGS26/1271
P0848: From numbers to change: evidence-based insights on gender equity in AO Spine compared to AO

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Data driven analysis for underrepresented groups
Introduction:
• Briefly introduce AO Access and the Mentoring Pathway's mission to foster mentorship across AO divisions and promote equitable access to leadership opportunities.
• Highlight observed gender imbalances in mentorship and leadership from the ODI report 2025.
• Purpose: Critically evaluate female participation, with a focused lens on AO Spine. **Materials and Methods:**
• Data sources: AO Access records (participant demographics, roles, divisions, regions, age/generation), and ODII data (2019 & 2025) for comparison.
• Metrics analyzed: number and proportion of female participants per division (with emphasis on Spine), roles (mentor vs mentee), age/generation distribution, and geographic region.
• Comparative lens: differences between women and men; alignment or divergence with ODI findings. **Results (expected key points based on hypothesis and available data).**
1. **Distribution across AO specialties compared to AO Spine.** o Compare the percentage of female participants in AO Spine versus other divisions, highlighting whether Spine lags or leads.
2. **Age or generational trends.** o Describe the age range of female participants (eg, early-career vs mid/late), possibly comparing to male patterns.
3. **Regional representation.** o Map participant regions (eg, NA, ESA, MENA; AP, NA, identifying areas where female representation is strong or lacking.
4. **Roles by gender.** o Analyze the split of mentor vs mentee among female participants and leadership positions and compare to male participants.
5. **Interest in mentorship roles.** o Explore any available data on expressed willingness or application rates to become mentors, comparing women vs men.
6. **Comparison with ODII surveys 2019 and 2025.** o Evaluate if current AO Access trends reflect improvement: Is female mentorship representation growing beyond the 4-8% reported in 2019 ODI? Are women mentoring women more equitably?
Discussion:
• Interpret findings: Does AO Access appear to counter prior gender disparities?,
• Emphasize the role of structured mentorship in promoting visibility and leadership potential for women in spine surgery. • Offer insight into generational and regional patterns-might early-career female surgeons benefit more? Are certain global regions lagging in female engagement? **Conclusion:**
• Summarize how the program is contributing to gender equity, leadership opportunities for women, and inclusive mentorship dynamics-especially in spine surgery.
• Reflect on the program's capacity to disrupt prior limitations tied to informal networks and systemic biases.

ID: AGS26/1340
P0849: Patient assessment of ChatGPT versus a national health chatbot for triage guidance in back pain: a prospective study at a German university emergency department

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Background: Emergency departments (EDs) in Germany are increasingly overcrowded, while back pain remains among the most common presenting complaints. Digital triage systems such as large language models (LLMs) and statutory health chatbots may support patient navigation. **Methods:** From May

to July 2025, all surgical ED patients at a tertiary center were prospectively screened (n = 568). Of these, 51 (9.0%) presented with back pain and were included in this subset analysis. While waiting, patients entered their symptoms into ChatGPT (GPT-4) and, in a subset (n = 20), the KVB Chatbot. Both systems generated recommendations, and patients rated response quality (satisfaction, usefulness, comprehensibility, empathy, length). Statistical analyses included Chi-square, McNemar, Wilcoxon, and Kruskal-Wallis tests. Recruitment occurred during daytime hours; no night cases. Ethical approval was granted. **Results:** The cohort comprised 25 women (49.0%) and 26 men (51.0%), mean age 47.5 years (SD 19.7, range 18-85). Most were treated in trauma surgery (88.2%); triage categories were orange 15.7%, yellow 23.5%, green 60.8%. Presentations occurred between 09:00-18:00, peaking at 10:00 (n = 11, 21.6%) and 11:00 (n = 8, 15.7%). ChatGPT advised ED attendance in 98.0%, GP in 41.2%, and specialist in 27.5%. The KVB Chatbot recommended ED in 50.0%, GP in 25.0%, and specialist in 5.0%. Discordance between systems was significant for ED recommendation (p=0.004). Patients rated ChatGPT highly: satisfaction mean 4.3/5, usefulness 4.2/5, comprehensibility 4.7/5; empathy was lower (3.8/5). In direct comparison, ChatGPT scored better than KVB in clarity (p = 0.017) and showed a borderline advantage in meaningfulness (p = 0.050). Overall, 31 patients (60.8%) desired an AI navigation service, and 24 (47.1%) would consult AI again. For potential future care of the same symptoms, 68.6% indicated the ED, 15.7% a GP, and 15.7% a specialist. This intention correlated with the actual triage severity (p = 0.011; linear trend p = 0.006). **Conclusion:** Patients valued ChatGPT's responses for clarity and usefulness, and many endorsed future use of such tools. While recommendations differed markedly between ChatGPT and the KVB chatbot, only the objective clinical triage category was significantly associated with patients' intended future pathway.

ID: AGS26/1347
P0850: Human vs. machine: deciding on high-stakes surgery in possible cauda equina syndrome

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Background Context: Cauda Equina Syndrome (CES) is a neurosurgical emergency requiring prompt intervention to prevent neurological deficits. Accurate identification of CES cases needing urgent surgery is essential to avoid long-term sequelae. **Purpose:** To evaluate the concordance between an AI language model (ChatGPT) and a Spinal Multidisciplinary Team (MDT) in recommending surgical intervention for suspected CES cases. **Study Design/Setting:** Retrospective concordance analysis comparing surgical recommendations between ChatGPT and a Spinal MDT. **Patient Sample:** Among 160 referrals presenting with red flags for possible CES, 10 cases were used to calibrate ChatGPT to specific clinical and diagnostic parameters, with the remaining 150 cases included in the primary analysis. The average patient age was 50.6 years (range 18-87), with a male-to-female ratio of 68:82. **Outcome Measures:** The primary outcome was the concordance rate between ChatGPT and the MDT in recommending surgery, evaluated through agreement rates and statistical analysis. **Methods:** Each of the 150 cases was presented as standardized slides including clinical history, imaging, and examination findings. Both the MDT and ChatGPT assessed the need for urgent surgery. Discordant cases (n = 17) were further reviewed by three spinal surgeons blinded to prior decisions. **Results:** ChatGPT and the MDT agreed on surgical recommendations in 133 out of 150 cases, achieving an 88.7% concordance (Cohen's Kappa = 0.764, p < 0.001). ChatGPT recommended surgery more frequently in the 17 discordant cases, but this difference was not statistically significant (McNemar's test statistic = 1.23, p = 0.46). Review by three independent surgeons reached consensus on 11 of the 17 discordant cases (64.7%), highlighting variability among experts; individual surgeons aligned with ChatGPT in 5-6 cases each (29.4-35.3%). **Conclusions:** Substantial agreement between ChatGPT and the MDT suggests ChatGPT's comparable sensitivity in detecting surgical candidates in CES cases. Variability among surgeons on discordant cases underscores subjectivity in CES triage. ChatGPT may be a valuable adjunct in high-stakes clinical decision-making, though further validation and refinement are needed.

ID: AGS26/1410
P0851: Titanium mesh lamina as a structural and neuroprotective tool in spinal deformity surgery: a case series

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Introduction: Extensive posterior osteotomies for spinal deformity correction expose the dural sac, and increase the risk of pseudoarthrosis, instrumentation failure, and dural adhesions. **Material and Methods:** This case series describes six patients who underwent complex spinal osteotomies with posterior TML placement. It details surgical technique, perioperative considerations, and postoperative outcomes. **Results:** At a minimum follow-up of 12 months, all patients demonstrated favorable clinical and radiographic outcomes, with no neurological complications or implant-related failures. **Conclusion:** We propose using titanium mesh lamina (TML) to provide posterior structural support, protect neural elements, and promote fusion in high-grade osteotomies. Titanium mesh lamina is a viable adjunct in high-grade spinal

osteotomies, offering neuroprotection and structural support. Further studies are needed to validate its long-term efficacy.

ID: AGS26/1494
P0852: Spinal cord stimulation for chronic pain secondary to post COVID large fiber neuropathy

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Introduction: Neuropathic pain is a recognized complication of COVID-19, with both small and large fiber neuropathies reported. Large fiber neuropathy can lead to significant disability, often presenting with sensory deficits and severe, treatment-resistant pain. Spinal cord stimulation (SCS) has emerged as a potential therapeutic option for refractory neuropathic pain. We report the case of a patient with post-COVID large fiber neuropathy who demonstrated significant pain relief following SCS implantation. **Material and Methods:** A 54-year-old male with a history of severe COVID-19 infection presented with persistent neuropathic pain in the upper and lower extremities. The pain, described as burning and stabbing, was refractory to multiple pharmacological interventions, including anticonvulsants, opioids, and tricyclic antidepressants. Neurological examination revealed diminished vibratory sensation and proprioception, consistent with large fiber involvement. Electromyography and nerve conduction studies confirmed a post-COVID large fiber neuropathy. The patient's pain was classified as refractory, significantly impairing his daily activities and quality of life. Given the chronic and intractable nature of his symptoms, a trial of spinal cord stimulation was proposed. Two electrodes were implanted: a 5x6x5 lead at the thoracic T9-T10 level and a 2x8 lead at cervical C5-C7 level. **Results:** Post-COVID neuropathies, though increasingly recognized, remain a challenging entity with limited treatment options. Large fiber neuropathy, in particular, lacks established guidelines for intervention. Spinal cord stimulation has been successfully used in other neuropathic pain syndromes, such as diabetic neuropathy and post-surgical pain syndromes, and appears to be a promising option in post-COVID cases. The mechanism of SCS in neuropathic pain relief includes modulation of dorsal column pathways, inhibition of central sensitization, and restoration of normal pain processing. In this case, the dual-lead approach targeting both cervical and thoracic regions provided comprehensive pain relief, highlighting the importance of tailored neuromodulation strategies. Following the permanent implantation, the patient reported a substantial reduction in pain scores, improved functional status, and decreased reliance on analgesic medications. **Conclusion:** This case demonstrates the potential of spinal cord stimulation as an effective treatment for chronic pain secondary to post-COVID large fiber neuropathy. Further studies are needed to establish the role of neuromodulation in this emerging patient population.

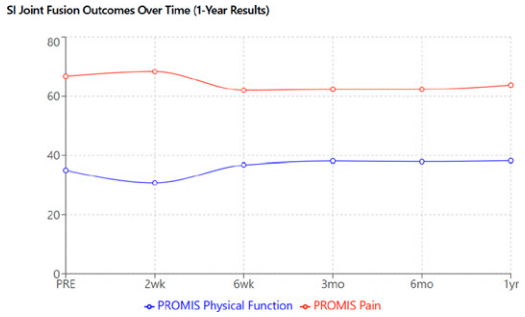
ID: AGS26/1717
P0853: Longitudinal analysis of PROMIS physical function and pain scores following SI joint fusion: a two-year follow-up study

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Introduction: The demand for sacroiliac (SI) joint surgery has increased due to accumulating evidence supporting its efficacy. However, the outcomes following SI joint fusion are not yet fully understood. The Patient-Reported Outcomes Measurement Information System (PROMIS) offers standardized assessments of physical function (PF) and pain, making it a valuable tool for evaluating recovery trajectories after SI joint fusion. **Material and Methods:** This study retrospectively analyzed data from 140 consecutive patients undergoing SI joint fusion surgery at a tertiary care center. PROMIS PF and Pain scores (T-scores, mean = 50, SD = 10) were collected preoperatively and at designated postoperative intervals: 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and 2 years. Higher PF scores represent better physical function, while higher pain scores indicate greater pain severity. Patient satisfaction at the final follow-up and demographic data (age, sex, BMI, and comorbidities) were also evaluated. Follow-up beyond one year was limited as patients typically concluded care after recovery. **Results:** The study cohort consisted of 75 females (53.6%) and 65 males (46.4%), with a mean age of 55.8 years (range 27-83). Most patients were White (92.1%). PROMIS PF improved from baseline (35.0) to 1 year (38.2), with initial decline at 2 weeks (30.8) followed by steady improvement. PROMIS Pain showed improvement from baseline (66.7) to 6 months (62.3) and 1 year (63.7). Prior lumbar fusion predicted worse outcomes at 1 year (PF: 36.6 vs 39.6, $p = 0.052$; Pain: 61.3 vs 65.3, $p = 0.049$). Higher preoperative PF predicted better outcomes at 6 months (PF: 43.3 vs 33.3, $p = 0.046$) and 1 year (PF: 41.9 vs 34.8, $p = 0.046$). Lower preoperative pain predicted improved function at 6 weeks (PF: 38.9 vs 34.6, $p = 0.051$) and 6 months (PF: 47.3 vs 34.5, $p = 0.048$). The overall satisfaction rate was 79.1%, with no significant differences across demographic or comorbidity subgroups, though osteoporosis showed a trend toward lower satisfaction (65.6% vs 83.2%, $p = 0.100$). **Conclusion:** SI joint fusion demonstrates meaningful improvements in PROMIS Physical Function and Pain scores through 1 year. Recovery was evident and maintained as early

as 6 weeks out from surgery. Prior lumbar fusion and preoperative functional status are significant predictors of outcomes. While overall satisfaction is high, the presence of osteoporosis may influence satisfaction rates. These findings may help inform patient selection and set appropriate expectations for postoperative recovery trajectories.



ID: AGS26/1736
P0854: Reimagining surgical consent in the AI era: a quality assessment of informed consent generator for spine surgery

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Introduction: Traditional informed consent forms in spine surgery often utilize standardized, generic language that fails to address individual patient characteristics and educational backgrounds. This practice can lead to inadequate patient comprehension and ncreases medico-legal risks for surgeons by potentially invalidating the consent itself. The advent of Large Language Models (LLMs) presents an opportunity to address these challenges. Context-engineering, is a methodology of structuring an LLM's operational environment with a specific role, workflow, and a curated knowledge base to ensure reliable and contextually appropriate outputs. This study aimed to develop and evaluate a context-engineered LLM for creating personalized, evidence-based consent forms and to quantitatively compare their quality against standard national templates. **Material and Methods:** We employed Google's NotebookLM, a state-of-the-art LLM with built-in Retrieval-Augmented Generation (RAG) capabilities, which allow dynamic retrieval of high-quality literature. The model was supplied with a curated knowledge base including AO Spine and NASS clinical practice guidelines, and systematic reviews and meta-analyses published within the last five years relevant to the selected pathologies. A detailed meta-prompt was engineered to instruct the model on its role, workflow, and the principles of generating high-quality consent forms. Five common spine surgery procedures were selected: unilateral biportal endoscopic lumbar discectomy, open cervical microdiscectomy, posterior instrumented fusion for lumbar spinal stenosis, posterior fossa decompression for Chiari malformation, and excision of foramen magnum meningioma. For each procedure, AI-generated consents were created for three educational levels (elementary, high school, university) and varying age groups, resulting in 45 personalized consent documents These were compared against corresponding National Neurosurgical Society standard consent forms using three evaluation metrics: readability assessment (Flesch Reading Ease and Flesch-Kincaid Grade Level), informed consent quality criteria developed by Spatz et al., and a novel personalization scoring system assessing patient-specific and procedure-specific content integration. **Results:** AI-generated forms demonstrated significantly superior performance across all metrics ($p < 0.001$). Regarding readability, AI forms had substantially higher Flesch Reading Ease scores (mean 75.3 vs. 45.2) and dynamically aligned Flesch-Kincaid Grade Levels to each persona. In contrast, standard forms consistently required a college-level education (mean grade 14.8). On the Spatz et al. quality checklist (max score: 20), AI forms achieved near-perfect scores (mean 19.2), while standard forms scored significantly lower (mean 14.5). The most significant disparity was observed in the Personalization Score (max score: 20). AI forms effectively integrated patient-specific data, achieving a mean score of 19.5, whereas standard forms scored poorly in comparison (mean 11.5). **Conclusion:** Context-engineered LLM systems can produce highly personalized, readable, and comprehensive informed consent documents that significantly outperform traditional standardized forms across multiple quality metrics. The integration of evidence-based medical knowledge through RAG architecture ensures clinical accuracy while maintaining patient-specific relevance. By enhancing patient comprehension and creating a more robust, personalized document, this approach offers a powerful tool to foster shared decision-making and strengthen the medicolegal integrity of the informed consent process in spine surgery.

ID: AGS26/1755
P0855: Cervical spine diagnostics with generative AI: a comparison of OpenEvidence 2.0 and ChatGPT-4o

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Introduction: Generative artificial intelligence (AI) is increasingly applied in spine care, but concerns remain regarding accuracy, sourcing, and hallucinated references. ChatGPT has shown limitations in citation validity and guideline alignment, whereas OpenEvidence (OE) is designed to prioritize verified, evidence-based content. This study

represents the first comparison of OE and ChatGPT using cervical spine clinical guidelines (CSCGs). **Material and Methods:** A cross-sectional comparative analysis was performed using 110 evidence-based clinical questions derived from 10 CSCGs authored by six academic societies. Responses were generated by OE (v2.0) and ChatGPT-4o, with a subset repeated using standardized prompts to assess prompt-engineering effects. Primary outcomes were guideline alignment score and citation validity. Secondary outcomes included source distribution, publication year, susceptibility to hallucinations, and additional prompting. **Results:** OE produced 999 citations, all verified as accurate, compared with 393 from ChatGPT, of which only 184 (46.8%) met accuracy criteria ($p < 0.001$). In analyses limited to a subset of CSCGs, OE achieved a significantly higher mean guideline alignment score compared with ChatGPT (4.6 ± 0.8 vs 4.1 ± 0.7; $p = 0.03$). ChatGPT generated 88 partially hallucinated citations (22.4%), most commonly due to incorrect hyperlinks (34.3%), author names (27%), or publication years (24%). Compared with ChatGPT, OE cited a greater proportion of peer-reviewed articles (79.8% vs 60.1%) and fewer non-journal sources ($p < 0.001$), with citations that were, on average, more recent (2018 ± 5.6 vs 2012 ± 7.4; $p < .001$). In the prompt-engineering analysis ($n = 824$ citations), OE contributed a larger proportion of citations (63.7% vs 36.3%; $p < 0.001$), maintained higher validity (89.5% vs 71.4%; $p < 0.001$), and demonstrated lower rates of partial (4.0% vs 18.6%) and full hallucinations (6.5% vs 10.0%). OE's initial 100% accuracy declined to 89.5% when outputs were reformatted through ChatGPT-4o, suggesting cross-model contextual contamination. **Conclusion:** OE demonstrated superior CSCG concordance, citation validity, and sourcing quality compared with ChatGPT, with substantially lower susceptibility to hallucinations. As AI platforms evolve, physician oversight remains essential to ensure AI outputs are applied accurately, safely, and in alignment with evidence-based standards, reinforcing their role as stewards in integrating AI into patient care.

ID: AGS26/1790
P0856: Comparative analysis of vertebral augmentation in osteoporotic compression fractures: vertebroplasty versus kyphoplasty versus stenting: our experience

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Introduction: Osteoporosis is a most common metabolic bone disease commonly associated with aging. Fractures in spine is complication of the on going metabolic pathology. It's management includes two aspects i.e. treatment of Ongoing osteoporosis and treatment of fracture. Fracture management in osteoporosis is dubious, it ranges from conservative to Percutaneous vertebral augmentation to Instrumented Stabilisation. Augmentation Procedures are now popular option for management of Osteoporotic Compression fractures, but dilemma lies in choosing the most appropriate procedure. **Aim:** To analysis the factor affecting the selection of Augmentation procedure for Osteoporotic compression fractures. **Materials and Method:** Study type retrospective analysis. Duration of study August 2022 to May 2024. Place of Study: Sri Ramachandra Institute Of Higher Education and Research, Porur, Chennai. Inclusion criteria: Symptomatic Osteoporotic Compression Fractures after at least 2 weeks of Conservative treatment. Exclusion criteria: Non Symptomatic fractures, Fractures with Neurological deficit. Functional Parameters observed: VAS and ODI. Radiological parameters observed: segmental kyphosis, Focal kyphosis, Anterior Vertebral Body Height and Posterior Vertebral Body Height. **Results:** 120 patients (73 females and 47 male) under vertebral augmentation procedures out of which 57 had Vertebroplasty, 23 had Kyphoplasty and 40 had implantable device (vertebral body stent). None of the patients had revisions. All had equal functional improvement in immediate post op i.e. VAS Score of 4. Implantable device had excellent radiology improvements i.e. mean Height restoration of 31.7%, mean fracture kyphosis improved by 40.9%, mean segmental kyphosis angle improved by 62.69%. followed by Kyphoplasty with mean height restoration of 15.6%, mean fracture kyphosis improved by 22.4%, mean segmental kyphosis angle improved by 38.3%. Vertebroplasty group mean height restoration of 2%, mean fracture kyphosis improved by 5%, mean segmental kyphosis angle improved by 6%. At 6 months follow implantable device group had mean improvement in ODI by 90% while Kyphoplasty group had 76% Vertebroplasty group had 74%. Radiological implant device group had similar radiological parameters, where as loss of correction was observed in the Kyphoplasty group mean height restoration reduced by 91%, fractures kyphosis decrease by mean of 93%, segmental kyphosis decrease by mean of 94%. Vertebroplasty group had lost all the correction gain. At 12 months follow implantable device group had mean improvement in ODI by 92% while Kyphoplasty group had 81% Vertebroplasty group had 80%. Radiologically implant device group had 5% loss of fracture kyphosis and 7% loss of segmental kyphosis. where as at 12 months follow up both Kyphoplasty group and Vertebroplasty at similar radiology parameters as compare to their preoperative measurements. **Discussion:** Vertebral body augmentation procedure are effective for OVCF type 2,3 and some times in type 4. Most of the procedures in short term gives similar pain relief and are comparable. But radiological parameters varies from procedure to procedures which in turns impact the complication rate as well as long term functional and radiological outcomes. Factors to consider before choosing most appropriate procedures depend upon patient (BMD, Risk factors for Embolism, Other comorbidities, functional demands) and fracture specific like duration of

fracture , type of fracture, Kummell lesion , angular motion, end plate defect. MRI findings also plays a crucial role in prognostic the outcome of the procedures. In our series we found Implantable device type augmentation appropriate choice in patients with additional comorbidities and additional fractures features in X-rays and MRI. Where as Vertebroplasty and Kyphoplasty had similar outcome,

ID: AGS26/1848
P0857: Artificial intelligence and machine learning based predictive analytics in cervical myelopathy

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Introduction: Recent advancements in Artificial Intelligence (AI) and Machine Learning (ML) offer transformative potential in the field of predictive analytics for neurological disorders, including cervical myelopathy. We aim to evaluate the current landscape of AI and ML applications in predictive analytics for cervical myelopathy, focusing on diagnostic accuracy, patient stratification, surgical decision-making, and outcome prediction. **Materials & Methods:** A systematic search was conducted across PubMed, Embase, Scopus, and Web of Science using keywords related to cervical myelopathy and AI/ML. Studies were selected based on relevance to AI-driven predictive models in diagnosis, prognosis, and management of cervical myelopathy. Data extraction included algorithm types, validation methods, clinical applicability, and performance metrics. Qualitative synthesis was performed to identify thematic trends and methodological gaps. **Results:** Out of 169 records, 41 studies met inclusion criteria. AI/ML models demonstrated high accuracy in gait analysis, hand motion tracking, and image-based diagnostics, with some achieving >90% sensitivity and specificity. ML algorithms effectively stratified patients into phenotypic clusters and predicted surgical outcomes, including postoperative complications and opioid use. Radiomics and deep learning enhanced imaging interpretation, while ensemble models improved prognostic reliability. Despite promising results, limitations included data heterogeneity, retrospective design, and lack of standardised validation protocols. **Conclusions:** AI and ML are reshaping cervical myelopathy management by enabling precise diagnostics, personalised treatment planning, and predictive modelling. Integration of multimodal data and explainable AI frameworks is essential for clinical adoption. Future research should prioritise prospective validation, ethical safeguards, and interdisciplinary collaboration to bridge the gap between technological innovation and patient-centred care.

ID: AGS26/1861
P0858: Artificial intelligence and cervical sagittal balance

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Introduction: Cervical Sagittal Balance (CSB) is a fundamental cornerstone of spinal biomechanics and surgical outcomes. Artificial intelligence (AI) has recently emerged as a promising tool to enhance the assessment of spine alignment, clinical decision-making with personalized treatment and support outcome prediction. This systematic review aims to provide a comprehensive evaluation of AI's impact on CSB. **Material and Methods:** A systematic review with thorough literature search was conducted on PubMed, covering publications from January 2020 to December 2025. evaluating the application of AI in cervical sagittal balance. Eligible studies included those reporting image measurement, predictive analytics for surgical outcomes or integration of AI into clinical decision-making and prognostic factors. Data were synthesized regarding methodological approaches, supervised and self-supervised learning, large language models, accuracy, reproducibility, clinical applicability and limitations. **Results:** AI-based image recognition demonstrated high accuracy and consistency for the evaluation of sagittal parameters such as T1 slope, cervical lordosis and C2-C7 Sagittal Vertical Axis (cSVA). Machine learning models showed potential in predicting Patient-reported Outcomes, postoperative alignment restoration and risk predicting models. Deep learning algorithms applied to three-dimensional and dynamic imaging provided novel insights into cervical kinematics. However, heterogeneity in datasets and lack of external validation may restrict a broader generalization. There is an increasing trend towards sustainable growth strategies for AI-health care solutions. **Conclusion:** AI applications in cervical sagittal balance represent a rapidly advancing field with significant potential to improve personalized surgical spine care. Future research should focus on improving dataset diversity, Person-Generated Health Data and integration into decision-support workflows before widespread application in clinical practice.

ID: AGS26/1864
P0859: Awake spine surgery - Our experience

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Introduction: Awake spine surgery is an emerging technique that offers several advantages over traditional methods, such as reduced anesthesia risks, shorter recovery times, and improved postoperative outcomes. **Materials and Methods:** Type of study : Observational. Place of study : Tertiary care Hospital in South India. Duration of Study : 2 yrs. Inclusion criteria :

• Surgery involving single level,
• Surgery involving minimal invasive approach, Exclusion criteria :
• Surgery involving more than one level,
• Surgery with unpredictable duration,
• Surgery involving expandable cages and osteobiologics,
• Patient with high risk of respiratory compromise, Obstructive sleep apnea , Pre existing anxiety or depression, Intracranial Hypertension. **Results:** In our series, 50 patients (23 male, 27 female) were included. Twenty seven patients underwent Transforaminal endoscopic discectomy under local anesthesia, with one requiring conversion to general anesthesia. The average surgery duration was 45 minutes, with minimal blood loss and patients were mobilized six hours post-surgery. Significant improvements were observed in the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) in 2 yrs of follow up. Twenty patients underwent Microlumbar discectomy under erector spinae block, with an average surgery duration of 30 minutes and minimal blood loss and were mobilized after six hours. These patients also showed significant improvements in ODI and VAS scores. Three patients underwent minimally invasive Transforaminal lumbar interbody fusion (MIS TLIF) under regional anesthesia, with an average surgery duration of 115 minutes, 100 ml blood loss and were mobilized after six hours. Significant improvements in VAS and ODI scores were observed. No neurological complications or procedure related complications were observed. No patient in our series required revision surgery. **Conclusion:** Awake spine surgery, encompassing transforaminal endoscopic discectomy, microlumbar discectomy, and MIS TLIF, demonstrates promising results in terms of surgical efficiency, minimal blood loss, and rapid postoperative recovery. Our experience with 50 patients suggests that this approach is a viable alternative to traditional spine surgery methods, offering significant benefits in terms of patient outcomes and overall satisfaction. Further studies with larger patient populations and longer follow-up periods are warranted to validate these findings and establish awake spine surgery as a standard practice in spinal surgery.

ID: AGS26/1867
P0860: Degenerative cervical myelopathy progression monitoring: empowering patients through the use of mobile applications

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Introduction: Degenerative Cervical Myelopathy (DCM) is a chronic condition caused by compression of the cervical spinal cord, resulting in variable loss of motor and sensory function. Identifying the point when decompressive surgery is indicated is time sensitive. Therefore, monitoring disease progression within the community becomes crucial. Mobile applications (apps) are powerful tools to fulfil this role, as they are convenient, cost-effective, and objective. This also makes them suited to collect clinical data for research. We designed and developed MyMyeloPath to address these aspects. **Material and Methods:** Our app was designed to collect data stored locally and securely on the patient's phone. Development used the .NET MAUI platform so that the app is available for both Android and iOS operating systems. The interface displays three main pages: (i) a Questionnaire page, allowing measurement of disease progression via the patient-derived Modified Japanese Orthopaedic Association (p-mJOA) scale; (ii) a built-in Pedometer to reflect gait, and (iii) a Minigame, a real-time task for assessing dexterity. **Results:** The app provides an all-in-one platform for DCM patients to self-assess their disease progression. It also serves as an educational resource- either directly, or through sign-posting to relevant literature via a built-in PDF viewer. The simplicity of the interface aims to maximise user retention and consistency. A notification-based reminder system, and an implementation of a daily to-do list also serve this purpose. Graphical representations provide an effective way for patients to visualise their data. **Conclusion:** Here we developed an app that aims to

monitor DCM disease progression. This user-friendly tool will empower patients to take an active role in monitoring their condition. The next step is its imminent release within a representative cohort of DCM patients, in order to assess its utility and gather relevant clinical data.

ID: AGS26/2267
P0861: Effects of glucagon-like peptide-1 agonists on clinical outcomes following lumbar fusion surgery

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Introduction: Glucagon-like peptide-1 (GLP-1) receptor agonists are increasingly prescribed for type 2 diabetes and obesity, providing glycemic control, weight loss, and potential anti-inflammatory effects. The impact of preoperative GLP-1 use on spine surgery recovery and long-term clinical outcomes remain unclear. Given the rising prevalence of GLP-1 prescriptions, understanding their effect on surgical outcomes has become increasingly relevant. The goal of this study is to evaluate the relationship between preoperative GLP-1 use, recovery trajectory, and long-term clinical outcomes following lumbar fusion surgery. **Material and Methods:** A single-center retrospective cohort study was performed of 298 adults who underwent elective lumbar fusion for degenerative pathology between 2019 and 2024. GLP-1 exposure was defined as an active prescription within 3 months preoperatively. Group differences in age and sex were assessed using independent t-tests and chi-square analyses. Functional outcomes were assessed using PROMIS and Oswestry Disability Index (ODI) scores at baseline, 6 months, and 12 months. Group differences in improvement were evaluated with independent samples t-tests. Descriptive and inferential statistics were performed. **Results:** Thirty-five patients (11.7%) were prescribed GLP-1 therapy within 3 months of surgery. GLP-1 and non-GLP-1 groups were similar in age (56.5 vs 57.4 years, $p = 0.714$) and sex distribution (77.1% vs 58.2% female, $p = 0.077$). A more rapid ODI improvement was observed in GLP-1 users (ΔODI: -18.9) at 6 months post-operatively than non-users (ΔODI: -8.5) [$p = 0.002$]. Both cohorts demonstrated similar long-term improvement at 1 year post-operatively (ΔODI -17.14 vs -19.80, $p = 0.526$). PROMIS improvement at 12 months was greater in GLP-1 users (ΔPROMIS: 8.34) than non-users (ΔPROMIS: 4.71, $p = 0.025$). No significant differences were observed at 6 months (ΔPROMIS: 3.95 vs 4.85, $p = 0.549$). **Conclusion:** Preoperative GLP-1 use within 3 months of elective lumbar fusion was associated with a more rapid ODI improvement at 6 months and improved patient-reported quality of life at 12 months postoperatively. These preliminary findings suggest a beneficial role of GLP-1 therapy in perioperative spinal recovery, potentially mediated by metabolic and anti-inflammatory effects.

ID: AGS26/2392
P0862: Evaluation of receiporcal changes after prone positioning: systematic review and metanalysis

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Introduction: Lateral lumbar interbody fusion (LLIF) has emerged as an effective technique for treating degenerative spinal conditions, scoliosis, and other deformities. It offers several advantages over posterior approaches, including muscle preservation and direct access to the disc space. Surgical technique innovations-particularly patient positioning-have aimed to optimize clinical and radiographic outcomes. However, a comprehensive analysis comparing traditional lateral decubitus LLIF and the more recent prone transpsoas technique (PTP) is still lacking. This systematic review and meta-analysis aims to bridge this gap, analyzing morphological, neurological, and functional outcomes associated with prone positioning in LLIF. The findings may influence global spine surgery practice by providing evidence-based insights into whether prone positioning offers superior clinical efficacy and safety. **Material and Methods:** Following PRISMA-2020, we systematically searched MEDLINE, Embase, Scopus and CENTRAL from inception to 10 September 2025 for English-language cadaveric or volunteer studies that imaged the lumbar spine in both prone and lateral decubitus positions. Two reviewers independently screened titles/abstracts, examined full texts and extracted mean segmental lordosis, psoas and plexus coordinates, retropsoas corridor width, and visceral or vascular displacement; conflicts were resolved by consensus. Owing to heterogeneous measurement techniques, results were synthesised narratively given the discrepancy between adopted methodologies for similar measurements between articles. **Results:** Seven positional-imaging studies (169 volunteer or cadaveric specimens) compared lumbar anatomy in prone versus lateral decubitus. As for the lumbar plexus position, three investigations ($n = 72$) showed that prone positioning moves the femoral nerve ~ 8-10 % further posterior along the vertebral-body width at L4-L5, enlarging the safe transpsoas window; no shift was observed at other levels. As for changes in the

Psoas muscle morphology, Four MRI cohorts (n = 91) reported a consistent posterior migration of the psoas, with the most detailed series quantifying a 4.1 ± 3.4 mm shift ($p < 0.01$). Furthermore, when analyzing the working corridor, one study documented a 16.2 mm increase in skin-to-disc distance when prone (134.9 ± 21.4 mm vs 118.7 ± 19.3 mm; $p < 0.001$); another found corridor dimensions equal or wider than lateral at L4-L5. Viscera and vessels, one study showed prone shifted the colon 20.8 mm posteriorly and one that prone translated the kidney 7.0 ± 5.8 mm anteriorly; vascular displacement was minimal (≤ 2.3 mm). Finally, two studies demonstrated that the prone positioning technique led to significantly increase in lumbar lordosis, and one further showed significant increase in L4S1 and L4L1 lordosis. **Conclusion:** Prone positioning consistently posteriorises the psoas-plexus complex, possibly enlarging the psoas working corridor, and provide moderate to higher increase in global and regional lordosis while causing only minor, clinically negligible shifts in major vessels and abdominal viscera. These anatomical advantages support the safety and technical feasibility of single-position prone lateral interbody fusion. Larger, standardised imaging studies are needed to confirm level-specific effects and determine whether the spatial gains observed translate into improved surgical outcomes.

ID: AGS26/2393

P0863: Comparison of surgical and radiological outcomes between prone transpsoas and lateral LLIF - Systematic review and metanalysis

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Introduction: Prone transpsoas / prone lateral lumbar interbody fusion (PTP-LLIF) has gained popularity because it allows single-position surgery, yet its peri-operative benefits over traditional lateral-decubitus LLIF remain debated. **Material and Methods:** We updated a systematic review and meta-analysis, removing the Hiyama 2019 comparison study. Eleven prone-only cohorts (n = 245) and three direct comparative studies (n_prone = 84; n_lateral = 132) were pooled. Single-arm proportions were synthesized with a logistic-normal random-effects model; mean differences (MD) for continuous outcomes used inverse-variance random-effects weighting. **Results:** Complications. The pooled proportion of patients experiencing ≥ 1 complication after prone LLIF was 18 % (95 % CI 9 %-33 %). Across three comparative studies, prone positioning showed a non-significant 45 % reduction in odds of complications versus lateral (OR = 0.55, 95 % CI 0.28-1.07). Of the complications transient psoas-related symptoms dominated, hip-flexor pain/weakness or thigh dysesthesia accounted for 268 events (84 % of all complications; 39 % of patients). However, serious events were infrequent: vascular injuries = 6 (0.9 %), cage subsidence/failure = 5 (0.7 %), and persistent neurologic deficits = 5 (0.7 %). "Other" medical or wound issues totaled 33 episodes (4.9 %). As for the surgical time. Prone cohorts averaged 212 min (95 % CI 162-262). In head-to-head studies, prone surgery was 49 min faster than lateral (MD = -49.6 min, 95 % CI -84.0 to -15.2; $I^2 \approx 0$ %). As for the mean estimated blood loss (EBL), the single-arm mean for the prone cases cohort was 159 mL (95 % CI 122-195). While the pooled MD against Lateral decubitus (+30 mL, 95 % CI -26 to 86) did not differ significantly favored any position. **Conclusion:** This systematic review with early evidence studies about prone transpsoas surgery, suggest that the technique is capable of providing faster surgeries with similar blood loss and complications rates compared to traditional LLIF approaches. Although early evidence favours the single-position prone approach for operative efficiency, heterogeneity in reporting and limited comparative data warrant further high-quality, prospective studies capturing standardized safety and radiographic outcomes.

ID: AGS26/2421

P0864: Use of AI for implant identification, feature detection, and classification in spine surgery: a scoping review

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Introduction: Traditional clinician-based identification of spinal implants on radiographs and CT scans can be time-consuming and erroneous, which poses risks during critical periods such as postoperative surveillance and planning of revision procedures. Artificial intelligence (AI) technology has demonstrated significant potential in automating this process to enhance implant detection accuracy, but the exact extent and performance of such applications in spine surgery are not clear. This review aims to map the current literature on the use of AI for spinal implant identification, feature detection, and classification tasks. **Material and Methods:** A

systematic search of PubMed, EMBASE, and MEDLINE was conducted from inception to March 13, 2025 to identify studies pertaining to application of AI models to spinal implant identification and detection tasks. Data pertaining to implant and imaging type, model details, and performance metrics were abstracted. Results were tabulated and presented in a descriptive summary format. **Results:** A total of 12 studies published between 2019 and 2025 were included in this review. The imaging modality consisted of radiographs in 9 studies and CT scans in 3. Detected implants include pedicle screws (n = 5), anterior cervical discectomy and fusion plates (n = 2), growing rods (n = 1), and unspecified implants (n = 4). Six studies focused primarily on implant detection while the other six focused on manufacturer identification. Convolutional neural networks (n=9) were the predominant architectures used, with support-vector machines (n = 2) and simple computer-vision (n = 1) also being used. Commonly reported performance metrics included accuracy, sensitivity/specificity, precision, F1 scores, and AUC, although reporting was quite heterogeneous across studies. Reported implant and manufacturer detection accuracies ranged from 86.6%-99.8% and 61.0%-100%, respectively. Compared to clinicians, deep learning (DL) models were also more accurate (79%-100% vs 44%-82%) and faster in detection/labelling tasks. **Conclusion:** AI models are highly accurate and efficient in implant identification and classification tasks. Studies are currently limited by heterogeneous methods and small datasets, necessitating future research to fully elucidate the role this technology can play in spine surgery.

ID: AGS26/2469
P0865: A decade of novel technological innovations in spine surgery: bibliometric and literature review

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Introduction: In the last decade, spine surgery has been strongly influenced by new technologies such as robotics, navigation, endoscopy, artificial intelligence, extended reality, and three-dimensional printing. Research in these fields has grown quickly, but a clear picture of overall trends and clinical impact is still limited. **Material and Methods:** We carried out a bibliometric analysis of studies indexed in Scopus between January 2015 and August 2025. Publication growth, citation patterns, and the contributions of leading countries, institutions, and authors were examined. Co-authorship and keyword networks were mapped with VOSviewer, and collaboration indices and thematic trends were analyzed in R Studio. We also reviewed the most frequently cited papers to highlight clinical use, reported benefits, and existing limitations of these technologies. **Results:** A total of 856 publications from 179 journals were identified, showing an average annual growth rate of 23.2%. The field is highly collaborative, with 3,593 contributing authors and almost six co-authors per paper, though only about 22% of studies involved international partners. The United States, China, and South Korea produced the largest share of work. Robotics accounted for about 30% of the literature, followed by minimally invasive and endoscopic techniques (25%) and navigation systems (20%). These approaches were consistently linked with improvements in accuracy, safety, and recovery. Artificial intelligence, 3D printing, and extended reality appeared less often but have shown steady growth in recent years. Persistent challenges include cost, technical demands, and unequal global access. **Conclusion:** Technological innovation has become central to the progress of spine surgery. Robotics, navigation, and minimally invasive techniques dominate the literature, while newer areas such as artificial intelligence and 3D printing are beginning to gain momentum. Making these advances more affordable, practical, and widely accessible will depend on stronger collaboration, broader training, and attention to cost-effectiveness.

Keywords: spine surgery, technological innovations, robotics, endoscopy, navigation, artificial intelligence, 3D printing, extended reality

ID: AGS26/2470
P0866: Interlaminar full endoscopy for exiting root compression and lateral recess stenosis: surgical technique and clinical outcomes

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Introduction: Lumbar exiting nerve root compression and lateral recess stenosis are frequent causes of radiculopathy and disability. Conventional open decompressive surgery may lead to significant soft tissue injury and prolonged recovery. Full endoscopic interlaminar decompression has emerged as a minimally invasive alternative, but comprehensive outcome data in targeted patient groups remain limited. **Material and Methods:** This prospective study enrolled 45 patients (mean age 53 ± 12 years) with MRI-confirmed lumbar exiting root compression or lateral recess stenosis unresponsive to ≥ 8 weeks of conservative treatment. All patients underwent full endoscopic interlaminar decompression via a standardized surgical technique. Preoperative and postoperative outcomes were assessed using Visual Analog Scale (VAS) for leg pain and Oswestry Disability Index (ODI), as well as complication rates and patient satisfaction (Modified Macnab). Data were analyzed with paired t-tests and effect sizes (Cohen's d). **Results:** Postoperative VAS significantly improved from 7.8 ±

1.2 to 2.1 ± 1.0 ($p < 0.001$, d=1.8), and ODI from 52 ± 10 to 18 ± 9 ($p < 0.001$, d = 1.6). Mean operative time was 45 ± 10 minutes; hospital stay averaged 1.5 ± 0.7 days. One patient (2.2%) experienced a dural tear without persistent neurological deficit. No postoperative motor deficits were observed. Patient satisfaction was rated excellent or good in 87% of cases. **Conclusion:** Full endoscopic interlaminar decompression is a safe and efficacious minimally invasive option for lumbar exiting root compression and lateral recess stenosis. This technique achieves robust symptom relief, low complication rates, and rapid patient recovery, supporting its role in modern spine surgery.

ID: AGS26/2518
P0868: Modified pedicle subtraction osteotomy for osteoporotic vertebral compression fractures (OVCF): a retrospective study of 104 patients

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Introduction: Osteoporotic vertebral compression fractures (OVCF) caused by osteoporosis is a common clinical fracture type. There are many surgical treatment options for OVCF, but there is a lack of comparison among different options. Therefore, we counted a total of 104 cases of OVCF operations with different surgical plans, followed up the patients, and compared the surgical outcome indications before, after and during the follow-up. **Material and Methods:** 104 patients who underwent posterior osteotomy (Modified PSO, SPO, PSO, VCR) and kyphosis correction surgery at our hospital between April 2006 and August 2021 with a minimum follow-up period of 24 months were included. All cases were injuries induced by a fall incurred while standing or lifting heavy objects without high-energy trauma. The mean CT value was 71 HU, which was below 110 HU, indicating severe osteoporosis. The indications for surgery included gait disturbance due to severe pain with pseudarthrosis, increased kyphotic angle, and progressive neurological symptoms. Pre- and postoperative CL, TLK, TK, PrTK, TKmax, GK, LL, PI, SS, PT, SVA, TPA, were investigated radiologically. Additionally, We evaluated estimated blood loss, surgical time and perioperative symptom. **Results:** The results show, after operation, TLK (37.32 ± 10.61° vs. 11.01 ± 8.06°, $p < 0.001$), TK (35.42 ± 17.64° vs. 25.62 ± 12.24°, $p < 0.001$), TKmax (49.71 ± 16.32° vs. 24.12 ± 13.34°, $p < 0.001$), SVA (44.91 ± 48.67 vs. 23.52 ± 30.21, $p = 0.013$), CL (20.23 ± 13.21° vs. 11.45 ± 9.85°, $p = 0.024$) and TPA (27.44 ± 12.76° vs. 13.91 ± 9.24°, $p = 0.009$) were improved significantly in modified pedicle subtraction osteotomy (mPSO) after operation. During follow-up, TLK (37.32 ± 10.61° vs. 13.88 ± 10.02°, $p < 0.001$) and TKmax (49.71 ± 16.32° vs. 24.1 2± 13.34°, $p < 0.001$) were improved significantly in modified PSO group. In addition, estimated blood loss (790.0 ± 552.2 ml vs. 987.0 ± 638.5 ml, $p = 0.038$), time of operation (244.1 ± 63.0 min vs. 292.4 ± 87.6 min, $p = 0.025$) were favorable in Modified PSO group compared to control group. **Conclusion:** To conclude, mPSO could acquire a favorable degree of kyphosis correction as well as fewer follow-up complications. Compared with other surgical methods, it also has the advantages of less surgical trauma and shorter operation time. It can be an effective solution for the treatment of OVCF.

ID: AGS26/2608
P0869: A proof-of-concept study with NVDX3, an osteogenic implant of human allogenic origin, in the treatment of low grade degenerative lumbar spondylolisthesis by interbody fusion in adults

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Introduction: Advances in biomaterials offer new opportunities to improve outcomes in spinal fusion procedures by enhancing bone healing and stability. This proof-of-concept study investigates the application of **NVDX3**, a bioactive, osteoconductive stem cells material, in Transforaminal Lumbar Interbody Fusion (TLIF) to promote faster and more robust fusion. TLIF is a widely used technique for treating degenerative lumbar disc disease, but achieving consistent and timely fusion remains a clinical challenge, particularly in patients with risk factors such as osteoporosis, smoking, or diabetes. **Methods:** Five patients, all presenting with symptomatic lumbar disc degeneration and varying degrees of spinal instability, underwent TLIF procedures augmented with **NVDX3**. The material was applied during the interbody fusion process to the surgical site between the vertebral endplates, with the goal of enhancing osteogenesis and promoting faster fusion. Clinical outcomes will be assessed at regular intervals over 24 months using a combination of physical examinations,

Oswestry Disability Index (ODI) scores, and Visual Analog Scale (VAS) for pain. Radiographic fusion will be evaluated using X-rays and CT scans at 3, 6, and 12 months postoperatively to monitor the progression of bone growth and stability of the implants. **Results:** showed that all five patients demonstrated early signs of bone formation at the 3-month follow-up. The radiographic evidence confirmed continuous bone growth across the interbody space, with no signs of pseudoarthrosis or hardware loosening. Clinical outcomes were also favorable, with significant improvements in pain relief and functional recovery.

ID: AGS26/2615
P0870: Robot or basic navigation? Operative and clinical outcomes of pedicle screws (ROBOCOP): a prospective observational study in posterior thoraco-lumbar fixation

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Introduction: Pedicle screw fixation remains a cornerstone of spinal stabilization, with accuracy directly impacting safety and outcomes. Traditional freehand techniques have been largely supplemented by navigation and, more recently, robotic systems. While recent literature has predominantly compared robot-assisted navigation (RAN) with fluoroscopy or freehand techniques, no robust prospective comparison with standard navigation (NAV) has yet been published. The ROBOCOP study represents the first project from French-speaking Switzerland to systematically compare RAN and NAV in pedicle screw placement, aiming to generate new evidence in a high-volume academic spine surgery center. **Material and Methods:** ROBOCOP is a single-center, prospective observational study at Geneva University Hospitals. All patients undergoing elective or emergent posterior spinal fixation with either RAN (ExcelsiusGPS, Globus) or NAV (BrainLab/O-ARM, Medtronic) are being consecutively enrolled. The primary outcome assessed is screw accuracy, by Gertzbein-Robbins classification for position within the pedicle and Shah classification for facet joint violation. The secondary outcome assessed is time, sub-quantified as absolute time-per-screw, technical planning time as well as overall operative time. Tertiary outcomes include intraoperative radiation exposure, blood loss, length of stay, complications, and patient-reported outcomes (VAS, ODI, EQ-5D-3L, McCormick, McNab). Sample size calculations indicate a minimum of 217 patients (868 screws) to detect a 5% difference in malposition rates with 80% power. However, we plan to exceed this substantially, targeting over 1000 screws to enhance subgroup and multivariate analyses. **Results:** Patient enrollment and data collection began in February 2025, and are actively underway. An interim analysis at 12 months will be ready for presentation before the Global Spine Congress 2026. These data will provide early comparative insights into accuracy, safety, and patient-centered outcomes of RAN versus NAV pedicle screw placement. **Conclusion:** ROBOCOP will deliver high-quality prospective evidence on navigated versus robotic spinal instrumentation, with the potential to refine surgical strategy and improve patient-centered outcomes.

ID: AGS26/2633
P0871: Reliability of surgical planning in Surgimap®: comparison between planned and used screws in the lumbar spine

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Introduction: Preoperative planning in spinal surgery is a key element for optimizing clinical outcomes, reducing surgical variability, and anticipating patient-specific anatomical challenges. In recent years, this process has advanced notably thanks to the incorporation of technologies such as artificial intelligence, robotic surgery, and computer-assisted navigation systems. Within this context, Surgimap® has established itself as a reference digital tool for radiographic analysis, surgical simulation, and implant planning. Being accessible and non-invasive, it represents a valuable option, especially in settings without access to navigation or robotics. Surgimap®, developed by Nemaris Inc. in 2008, is a free software that enables visualization and planning of surgical cases, including standardized parameter measurements, simulation of osteotomies, and implant placement, thus allowing estimation of postoperative results. Several studies have validated the utility of Surgimap® in predicting postoperative sagittal alignment. Langella et al. (2017) demonstrated that this software can accurately predict sagittal correction when planned with a target PT (Pelvic Tilt) of 20°. Despite its increasing use, concordance between digitally planned implants and those actually used in surgery has not been thoroughly evaluated.

Therefore, this study aims to contribute to that analysis by evaluating the real reliability of surgical planning performed with Surgimap®. **Material and Methods:**
• Study type: Observational, ambispective.
• Population: Patients undergoing thoracolumbar spine surgery with preoperative planning in Surgimap®.
• Inclusion criteria: Patients with complete planning in Surgimap® (including measurements of transpedicular screws and interbody spacers).
• Exclusion criteria: Patients in whom transpedicular screws were not simulated, or measurements were unavailable.
• Measurement: Linear measurement in Surgimap® vs. implant placed intraoperatively. Screw placement was performed under neuronavigation or fluoroscopy. If the preoperative planned screw was considered too long or too short, intraoperative adjustment was made. **Results:** A total of 5 cases were included: 3 (60%) with Adult Spinal Deformity (ASD) and 2 (40%) with Lumbar Degenerative Disease (DLD), with 41 instrumented levels. In preoperative planning, one screw per side was considered without distinction between left and right. Differences between planned and placed screws were calculated. Changes in screw measurements occurred in 3 patients: in the first case, 8 screws were replaced with shorter ones; in the second, 18 screws were replaced with longer and wider ones; and in the last case, 2 screws were replaced with shorter and thinner ones. In 22 out of 41 levels (53.66%), the screw length matched exactly. In 17 levels (41.46%), shorter screws were used. In only 2 levels (4.88%), longer screws were used. The mean difference between planned and placed screws was -2.56 mm. These findings suggest a tendency to intraoperatively shorten screws, influenced by visual perception with navigation or fluoroscopy images. Comparison between ASD (n = 33) vs. DLD (n=8) showed greater fidelity in DLD patients, with 75% exact matches vs. 48% in ASD patients. **Conclusion:** Surgimap® is an effective and accessible preoperative planning tool that accurately simulates transpedicular screw placement. This study shows discrepancies between planned and placed screws may have clinical consequences, including complications such as PJK. Greater reliance on digital planning should be promoted to optimize outcomes and reduce complications.

ID: AGS26/2712
P0872: AP-DADNet: an anatomical prior-driven framework for 3D spinal cord segmentation and shape quantification in CT with metal artifacts

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Introduction: Spinal deformity, including scoliosis and kyphosis, is a common disease that may seriously affect the quality of life of patients. Surgical treatment is the key method to improve the symptoms of these diseases, and the evaluation of the effect of surgical treatment of spinal deformity urgently requires an accurate spinal cord morphology quantification method. This study proposes an anatomical prior-driven spinal cord segmentation and quantification framework to break through the bottleneck of segmentation and fracture in the postoperative metal artifact area of traditional methods, and provide a reliable three-dimensional morphological basis for surgical parameter calculation. **Material and Methods:** This study proposes an anatomical prior-driven deformable attention dynamic convolution network AP-DADNet (Anatomical Prior-Driven Deformable Attention and Dynamic Convolution Network). First, based on the prior segmentation results of the vertebrae, direction-sensitive spinal cord candidate regions are generated. Anatomically conditioned dynamic convolution is introduced in the UNet encoder, and the convolution kernel parameters are dynamically adjusted using the vertebral position to enhance the feature discrimination of the metal artifact area. A deformable attention module is added

at the jump connection to adaptively align multi-scale features guided by vertebral coordinates. Finally, BiConvLSTM is used to model the long-range continuity of the segmentation results along the spinal axis to reduce the fracture phenomenon. After extracting the spinal cord of patients before and after surgery, the center line was fitted using B-spline, and the curvature-torsion quantification was used to evaluate the surgical correction effect. **Results:** The validation on a dataset of 240 preoperative and postoperative CT images of 120 patients with spinal deformity showed that the Dice coefficient of the evaluation index of AP-DADNet on the test set reached 0.88, which was 12.7% higher than that of the baseline U-Net, significantly improving the fracture and false positive phenomenon of spinal cord segmentation. The changes in curvature and torsion calculated based on the spinal cord center line fitted by B-spline can accurately reflect the differences in spinal morphology before and after surgery, proving the effectiveness of surgical treatment of spinal deformity. **Conclusion:** This study achieved high-precision three-dimensional reconstruction of the spinal cord in CT images with metal artifacts in patients with spinal deformity for the first time, and its anatomically driven dynamic fusion mechanism provides a new paradigm for medical image segmentation. The spinal morphological changes caused by surgery were quantified by differential geometry parameters, providing explainable decision support for the formulation of personalized surgical plans. In the future, biomechanical simulation will be integrated to build a surgical effect prediction system.

ID: AGS26/2777
P0873: AI-Assisted Cervical Correction Predictability Index in Ankylosing Spondylitis with Severe Global Kyphosis

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Introduction: Severe global kyphosis (SGK) is a characteristic deformity in ankylosing spondylitis (AS). The hunched posture often prevents acquisition of whole-spine radiographs on a single film, whereas medical photography allows only the chin-brow vertical angle (CBVA). The need for additional cervical osteotomy following thoracolumbar correction remains difficult to predict. This study introduces a novel AI-assisted parameter, the Cervical Correction Predictability Index (CCPI), to assess the necessity for cervical osteotomy in AS patients with SGK. **Methods:** A prospective study was conducted on 25 patients (18 males, 7 females) with SGK.
• Data acquisition: AP and lateral photographs and whole-spine radiographs were obtained with patients standing and knees fully extended.
• AI-assisted processing: Lateral photographs and radiographs were digitally extracted (iPhone software) and montaged in 1: 1 ratio using MacBook software.
• Measurements: o Kyphotic Tilt Angle (KTA): angle between the vertical axis and a line drawn from T1 to the most inferior kyphotic vertebra. o CBVA: standard chin-brow vertical angle. o CCPI: calculated as. All patients underwent thoracolumbar kyphosis correction. **Results:**
• 22 patients (88%) with CCPI < 20° were satisfied postoperatively and did not require cervical osteotomy.
• 1 patient with CCPI = 32° required cervicothoracic osteotomy.
• 2 patients with CCPI = 25° and 28° accepted their residual head position without additional surgery. **Conclusion:** The Cervical Correction Predictability Index (CCPI) is a simple, reliable, and reproducible AI-assisted parameter. It allows prediction of the need for cervical osteotomy in AS patients with severe global kyphosis and may help refine surgical planning.

ID: AGS26/2970
P0874: The orthomate application in spine surgery: evaluation of knowledge and preparation among residents and instrumentalists

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Introduction: Effective preparation for spine surgery requires mastery of complex procedures and instrumentation. The Orthomate application provides digital access to structured surgical information prior to interventions. This study evaluates its impact on knowledge acquisition and readiness among residents and surgical instrumentalists in spine procedures. **Materials and Methods:** A prospective observational study was conducted involving 30 participants (12 residents, 18 instrumentalists) in spine surgeries. Questionnaires were completed 30 minutes before each procedure. Usability was assessed using the System Usability Scale (SUS), while perceived usefulness and preparation adequacy were evaluated using descriptive and comparative statistical analyses. **Results:** Orthomate significantly enhanced participants' preparation for spine surgery. SUS scores averaged 77 for residents and 68 for instrumentalists. A majority of

residents (66%) and instrumentalists (46%) rated the application as "very useful." Most participants (70%) considered the 30-minute preoperative access sufficient, though 35% suggested earlier access could be beneficial. A significant positive correlation was found between usability and perceived usefulness ($p < 0.001$). The perception of preparation adequacy varied significantly between residents and instrumentalists. **Discussion:** The application facilitates rapid assimilation of procedural steps and instrumentation details, enhancing confidence and readiness in spine surgery. Participants suggested the addition of multimedia content and extended preoperative access to further improve effectiveness. **Conclusion:** Orthomate is a valuable tool for spine surgery education, improving both knowledge and operative preparation. This study supports the integration of digital applications in surgical training programs for spine procedures.

ID: AGS26/3006
P0875: Intrabody cage implantation via lateral approach for Kummell disease

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Introduction: Kummell disease can be managed with various treatment options. Recently, intrabody cage implantation has emerged as a novel approach. In this study, we introduce a technique of implanting an interbody cage into the vertebral body via an anterolateral approach. **Material and Methods:** Between 2022 and May 2025, six patients with Kummell disease underwent anterolateral intrabody cage implantation. The mean age was 75.8 years, and the cohort included three men and three women. The affected vertebral levels were L1 in four cases, L2 in one case, and L3 in one case. A 3D-printed OLIF cage was used in four patients. In one patient, a single TLIF PEEK cage was implanted, and in another patient, two TLIF PEEK cages were implanted. **Surgical Technique:** With the patient in the lateral decubitus position, the vertebral body was exposed using an approach similar to the OLIF technique. Under C-arm fluoroscopic guidance, a chisel or electric burr was used to create an entry window at the lateral wall of the vertebral body. The intravertebral cavity was then prepared using a shaver or burr. After confirming the space with a cage trial, the definitive cage was inserted. **Results:** The mean preoperative VAS score was 8.3, which improved to 2.8 at the final follow-up (mean follow-up, 22.2 months). Radiologically, no additional vertebral body collapse was observed during the follow-up period. Cage position was satisfactory in all cases. **Conclusion:** Lateral intrabody cage implantation represents a novel and effective surgical option for Kummell disease. This technique provided marked pain relief and durable radiological stability at mid-term follow-up, suggesting its potential as an alternative to conventional treatments. However, the small number of cases limits generalization, and further studies with larger cohorts are warranted.

ID: AGS26/3120
P0876: Three-dimensional radiological predictors of brace treatment outcomes in adolescent idiopathic scoliosis

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Introduction: Adolescent idiopathic scoliosis (AIS) affects 2-3% of adolescents and represents the most common spinal deformity in this age group. Bracing remains the gold standard nonoperative treatment for moderate progressive curves, with randomized trials demonstrating a success rate of approximately 70%. However, treatment outcomes are highly variable, and a substantial proportion of patients continue to experience curve progression requiring surgery. Current prognostic factors including initial Cobb angle, skeletal maturity, growth velocity, curve flexibility, and in-brace correction provide only partial predictive value. Moreover, these factors rely predominantly on two-dimensional measures and do not fully capture the three-dimensional (3D) nature of the deformity. Recent developments in low-dose EOS stereoradiography and 3D reconstruction techniques have enabled detailed morphologic assessment of spinal and pelvic parameters. Despite increasing recognition of the 3D complexity of AIS, validated models predicting brace treatment success are still lacking. This study aimed to identify baseline 3D radiological parameters associated with a favorable brace response in AIS patients. **Material and Methods:** We retrospectively analyzed 112 AIS patients treated with a rigid brace at CHU Sainte-Justine between 2013 and 2021, followed from skeletal immaturity to maturity. Over 300 radiological parameters derived from EOS 3D reconstructions were extracted. Principal component analysis and clinical relevance screening reduced this number to 70 variables. After eliminating multicollinearity, candidate predictors were entered into a multivariate logistic regression with backward selection. Treatment success was defined as absence of surgery and curve progression < 5°. Data were standardized and internally validated with bootstrapping and penalized methods (LASSO/elastic net). Predictive performance was assessed by AUC ROC, Nagelkerke R^2, Brier score, and calibration. **Results:** The final model retained five independent predictors:

thoracolumbar Cobb angle (3D frontal plane), spinal length, coronal imbalance, pelvic obliquity, and T8-T9 disc wedging. Apparent AUC was 0.77, with a Nagelkerke R^2 of 0.28 and a Brier score of 0.20. Bootstrap validation confirmed satisfactory internal robustness. Penalized regression approaches supported the stability of the first four predictors, while disc wedging appeared less consistent. **Conclusion:** Five 3D radiological parameters were associated with successful brace treatment in AIS. These results highlight the prognostic value of 3D spinal and pelvic morphology. However, key clinical determinants such as brace adherence, treatment duration, age, and skeletal maturity remain to be integrated into the models. Future work will focus on combining radiological and clinical predictors to refine risk stratification and develop more powerful predictive tools, potentially enhanced by machine learning approaches.

ID: AGS26/3168
P0877: Using ultrasonic osteotomes to reduce post-operative complications in lumbar stenosis surgery: a retrospective study about 74 patients

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Introduction: Lumbar canal stenosis is a common surgical condition with potentially serious complications. Ultrasonic micro-vibration osteotomy saws are innovative new tools for performing laminectomies and lumbar canal recalibrations, but have been little studied to date, although the results so far are promising, particularly when compared to drilling techniques.

The aim of this study was to analyse whether these new tools reduced post-operative complications compared to the techniques commonly used by surgeons. **Material and Methods:** We conducted a retrospective before-and-after study on 74 consecutive patients who underwent surgery for lumbar canal stenosis following the acquisition of an ultrasonic micro-vibration osteotomy device (Piezosurgery, Mectron SPA, Carasco, Italy). Twenty-eight patients operated on in 2022 were included in the 'Piezo' group and 46 patients operated on in 2023 were included in the control group. The two groups of patients were comparable preoperatively in terms of age, gender, ASA score and number of levels operated on. Patients in the Piezo group underwent laminectomy performed exclusively with the ultrasonic osteotome; patients in the control group underwent laminectomy performed with Gouge forceps, Kerrisson-Smith forceps and/or bone scissors, depending on the surgeon's preference. The primary endpoints were the overall rate of post-operative complications, including dural tears, haemorrhagic complications (including post-operative anaemia) and neurological complications, infections and the reoperation rate. The secondary endpoints were operating time, the rate of return home and length of stay. **Results:** Our results showed that the use of an ultrasonic osteotome was associated with a significant reduction in the overall complication rate (21% vs. 76%, $p = 0.009$), particularly the rate of post-operative anaemia (3.6% vs. 8.7%, $p = 0.02$). There were no differences between the two groups in terms of other complications, including the rate of dural tears. In the Piezo group, the length of stay was shorter (1.6 days vs. 2.1 days, $p = 0.02$), as was the duration of surgery (51.3 min vs. 70.5 min, $p = 0.004$). **Conclusion:** Our results show a significant association between the use of an ultrasonic micro-vibration osteotomy micro saw and a reduction in post-operative complications, particularly anaemia, as well as a reduction in operating time and length of stay for patients. Randomised controlled trials are therefore necessary and justified to confirm these results.

ID: AGS26/3350
P0878: Trends and insights in prone lateral approach for spine surgery: a bibliometric analysis

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Introduction: The prone lateral approach, also known as prone transpsoas (PTP), represents an important advancement in minimally invasive spine surgery. It enables simultaneous access to anterior and posterior spinal elements from a single patient position. Although the technique has gained considerable traction within the spine surgery community, the literature remains dispersed across multiple subspecialty journals without comprehensive synthesis. This study aims to analyze publication trends on this emerging technique, providing an overview of current research and identifying gaps in the literature. **Material and Methods:** We conducted a systematic search using relevant keywords across multiple databases from inception to September 2025. We included all peer-reviewed publications on the PTP approach in spine surgery. Articles were then extracted from Scopus database for bibliometric data. The data were analyzed using the bibliometrics package in R and Publish or Perish (POP) software. Key metrics included annual publications, citation trends, countries and institutions of origin, and publishing journals. **Results:** A total of 104 peer-reviewed articles were published between 2014 and 2025, accumulating 1,008 citations with an h-index of 19. Publication volume demonstrated strong

growth, with 23 articles published in 2025 alone (through August). The United States accounted for the majority of research output (93 articles, 89.4%). *World Neurosurgery* and *Operative Neurosurgery* were the most productive journals (13 articles each, 12.5%). **Conclusion:** This bibliometric analysis demonstrates the rapid growth and increasing recognition of the prone lateral approach in spine surgery. The research landscape is characterized by strong U.S. leadership, diverse journal representation, and evolving clinical applications. These findings highlight the successful transition of this approach from an experimental technique to an established clinical practice with significant impact on minimally invasive spine surgery.



Figure 1: Annual scientific production in PTP-related articles.

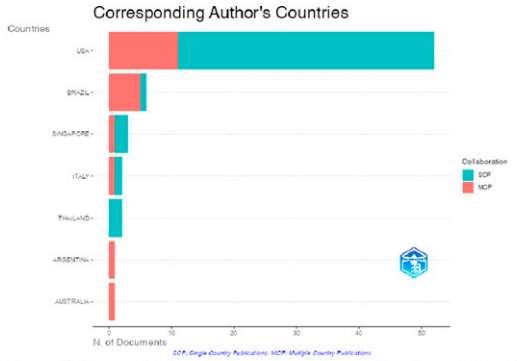


Figure 2: Bar graph showing corresponding authors' countries, divided by single-country and multiple-country publications.

ID: AGS26/3447
P0879: Robot assisted spinal surgery: a systematic review

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Introduction: Although robotic-assisted spinal surgery has demonstrated improved accuracy in the placement of implants, there remains debate regarding its impact on functional outcomes and complication rates. This study sought to comprehensively evaluate the advantages of robotic-assisted spinal surgery compared with conventional techniques. **Material and Methods:** Observational, analytical and descriptive study based on a systematic review of the literature indexed in PubMed. Inclusion criteria: English-language articles published within the last 10 years. **Objective:** To evaluate the clinical, functional, and technical impact of robot-assisted surgery in spinal instrumentation procedures. **Results:** Robot-assisted spinal surgery is an evolving field aiming to improve precision and safety. The technique has shown value but also presents specific challenges and limitations. Systems and pedicle screw placement accuracy (reported): - Mazor X and Mazor SpineAssist/Renaissance: accuracy reported up to 100% (Gertzbein-Robbins Grade A). - ExcelsiusGPS: accuracy ≈ 99% (Grade A or B). - TiRobot: accuracy 98.9% with deviation < 2 mm. Reported benefits: - Reduced operative time (in selected series). - Lower intraoperative blood loss. - Reduced exposure to intraoperative radiation. - Fewer postoperative complications in some reports. - Reduced postoperative pain. - Shorter length of hospital stay. Limitations and challenges: - Cost-effectiveness concerns. - Steep learning curve and system adoption issues. - Reported complications (observed in some series): - Postoperative anemia. - Need for revision surgery. - Surgical-site infection. - Increased postoperative opioid consumption in certain cohorts. Applications / Indications (reported uses): - Pedicle screw placement. - Burst fractures. - Spinal deformity correction. - Vertebral metastases. **Conclusion:** Robotic assistance in spinal surgery has improved accuracy and safety-especially for pedicle screw placement-and is associated in multiple series with reductions in intraoperative blood loss and radiation exposure. Challenges remain regarding cost, learning curve, and certain complications. Continued technological development and integration with tools such as artificial intelligence are likely to broaden the clinical impact of robotic systems in spine surgery.

ID: AGS26/3457
P0880: Comparing objective surgical outcome measures versus patient reported outcomes with the use of wearable technology in lumbar spine surgery: a systematic review and meta-analysis

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Introduction: Patient-reported outcome measures (PROMs) are the gold standard for evaluating recovery after lumbar spine surgery, but they remain subjective and may incompletely capture functional change. Wearable technologies, such as accelerometers and activity monitors, provide objective, continuous measures of mobility that may complement PROMs. However, their validity and correlation with traditional outcomes remain uncertain. This study systematically reviews the use of wearable technology for measuring

postoperative outcomes in lumbar spine surgery and quantifies correlations between wearable-derived metrics and PROMs. **Material and Methods:** A systematic review was conducted according to PRISMA guidelines. PubMed/MEDLINE, Embase/Elsevier, and CINAHL were searched through August 2025, yielding 10,831 records. Eligible studies included patients undergoing lumbar surgery for degenerative conditions, reported PROMs and wearable-derived gait data, and provided correlation coefficients. For quantitative synthesis, studies were included if they reported Pearson correlations of change in wearable-derived mobility metrics (e.g., step count, gait velocity) with change in PROMs from baseline to postoperative timepoints. One effect per study per domain (disability, pain, health-related quality of life [HRQL]) was extracted at the first postoperative timepoint ≥6 weeks. Correlations were Fisher z-transformed, pooled under random-effects models, and back-transformed for presentation. Heterogeneity was summarized with I^2, and significance tested on the Fisher-z scale. **Results:** Fifteen studies met inclusion criteria, of which eight contributed to the meta-analysis. Pooled change-change correlations demonstrated strong association with disability ($r = 0.646$, 95% CI 0.475-0.770, $I^2 = 51\%$, $p < 0.0001$), moderate association with pain ($r = 0.459$, 95% CI 0.235-0.637, $I^2 = 0\%$, $p = 0.0002$), and weaker association with HRQL ($r = 0.357$, 95% CI 0.066-0.592, $I^2 = 29.4\%$, $p = 0.0174$). Gait velocity and composite indices showed stronger correlations with PROM changes than daily step counts, which were less consistent. **Conclusion:** Wearable-derived mobility metrics significantly correlate with PROM changes after lumbar spine surgery, with strongest associations for disability. These findings support wearables as complementary tools for outcome assessment. Standardization of metrics, timing, and reporting is needed to enable clinical integration and define clinically meaningful thresholds.

ID: AGS26/3466
P0881: The role of XLIF in removing failed interbody implants: a systematic review of the literature

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Introduction: This review examines the novel application of the Extreme Lateral Interbody Fusion (XLIF) approach for the removal of foreign bodies in the spine, including subsided cages, failed hardware, and other implants. It aims to evaluate the efficacy, safety, and technical considerations of XLIF in this context and compare it to traditional anterior and posterior surgical approaches. **Methods:** A comprehensive literature search in accordance with PRISMA was conducted using Google Scholar, PubMed/MEDLINE, and the Cochrane Library. Search terms included "extreme lateral interbody fusion," "lateral lumbar interbody fusion," "cage retrieval," "revision surgery," and "foreign body removal." Articles were selected based on relevance to XLIF use in foreign body removal and included case reports, clinical trials, and observational studies published in English before April 7, 2025. **Results:** Seven documented cases met inclusion criteria. The XLIF approach demonstrated advantages such as reduced operative time, blood loss, and shorter hospital stays. It allowed safe access around scar tissue and critical neurovascular structures. The technique was successfully used to remove migrated or failed implants in the lumbar spine with minimal complications, most of which were transient. The approach also enabled the insertion of larger interbody cages, contributing to improved spinal stability and fusion outcomes. **Conclusion:** The XLIF approach is a promising alternative for foreign body removal in complex spinal revision surgeries. However, potential complications, such as transient nerve injury, underscore the need for careful patient selection and surgical expertise. Further studies are needed to validate its broader clinical application.

Spine biologics

ID: AGS26/1502
P0882: Hirayama disease: treated with cervical epidural PRP injection - A case report of muscle wasting reversal and functional improvement

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Introduction: Hirayama disease is a rare, self-limiting cervical myelopathy affecting mostly young individuals; characterized by progressive and asymmetric wasting of distal upper limb muscles. Conventional management is usually conservative. Surgical intervention might be needed in progressive cases. No medication has shown proven efficacy in reversing muscle wasting so far. **Materials and Methods:** We report the case of a 19-year-old female presenting with progressive weakness and atrophy of her right hand and forearm over one year. Neurological examination and cervical spine MRI with flexion confirmed the diagnosis of Hirayama disease. After failure to improve with standard conservative

therapy, the patient was treated with autologous platelet-rich plasma (PRP) injection in cervical spine. The patient demonstrated significant functional improvement and visible reversal of muscle wasting. **Results:** To our knowledge, this is the first reported case of cervical epidural PRP injection showing regenerative potential in Hirayama disease. PRP contains growth factors which might promote neuron and microvasculature repair and regeneration. **Conclusion:** Autologous PRP injection may represent a novel and promising treatment for selected cases of Hirayama disease, especially where muscle wasting persists or progresses. Larger studies are needed to validate its safety, efficacy, and mechanism of action.

ID: AGS26/2685
P0883: Bioactive glass plus demineralized bone matrix in single-level standalone ACDF: a retrospective comparative study

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Introduction: Demineralized bone matrix is commonly used as a graft material in anterior cervical discectomy and fusion, especially with standalone polyetheretherketone interbody cages. Its clinical performance can vary because of donor variability and limited intrinsic osteogenic cells. Bioactive glass releases ions that stimulate osteogenesis and may improve early graft integration. Clinical evidence comparing bioactive glass combined with demineralized bone matrix to demineralized bone matrix alone in standalone constructs is limited. This study evaluated whether adding bioactive glass is associated with earlier radiographic fusion and faster improvement in pain and disability after single-level fusion. **Materials and Methods:** We performed a retrospective comparative study of consecutive adults who underwent single-level fusion with a standalone polyetheretherketone interbody cage at a single ambulatory center. Patients received either bioactive glass plus demineralized bone matrix as the interbody graft or demineralized bone matrix alone. Minimum follow up was two years. Primary outcome was radiographic fusion at prespecified intervals, assessed on dynamic radiographs by two fellowship trained spine surgeons with discrepancies resolved by consensus. Secondary outcomes were Visual Analogue Scale scores for neck and arm pain and Neck Disability Index. Baseline demographics, perioperative variables, complications, and reoperations were recorded. Group comparisons were descriptive; no imputation was used. **Results:** Eighty one patients (n = 81) met inclusion criteria: forty four received bioactive glass plus demineralized bone matrix and thirty seven received demineralized bone matrix alone. Baseline characteristics were comparable between groups. Radiographic review suggested earlier fusion in the bioactive glass plus demineralized bone matrix group, with most patients showing arthrodesis by six months, whereas fusion in the demineralized bone matrix only group was more often observed at or after one year. By final follow up, complete fusion was observed in all patients without pseudarthrosis. Patients who received bioactive glass plus demineralized bone matrix reported faster improvement in neck pain at six and twelve months, with parallel gains in disability. At two years, both groups demonstrated substantial and sustained improvement. There were no graft related complications, device failures, or index level revisions in either group. One patient in the bioactive glass plus demineralized bone matrix cohort underwent adjacent level surgery during follow up. All procedures were performed in an ambulatory setting without unplanned admissions. **Conclusion:** In this retrospective cohort, adding bioactive glass to demineralized bone matrix in single-level standalone fusion was associated with earlier radiographic fusion and faster symptom relief compared with demineralized bone matrix alone. Both strategies achieved complete fusion by final follow up with low complication rates. Bioactive glass combined with demineralized bone matrix may be a useful adjunct when autograft is not used. Prospective studies with standardized imaging and randomized allocation are needed to confirm these observations and to define cost effectiveness.

ID: AGS26/3405
P0884: Systematic review of predictive patient risk factors in SCS explantation

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Introduction: Spinal cord stimulation (SCS) is a widely used intervention for chronic neuropathic pain, but a significant proportion of patients undergo device explantation due to complications or suboptimal outcomes. Identifying preoperative predictors of explantation, both modifiable and non-modifiable, is crucial for improving patient selection and long-term therapy success. This systematic review evaluates the association between preoperative risk factors and the rates of SCS explantation. **Material and Methods:** This review was conducted in accordance with PRISMA guidelines. A comprehensive search of PubMed and Google Scholar in June 2025. Eligible studies included comparative cohorts of adult SCS recipients that reported explantation outcomes in relation to diagnosis, lead type, preoperative opioid use, smoking history, age, or sex. Two independent reviewers screened and extracted data, resolving disagreements by consensus. Results were synthesized descriptively. **Results:** 15 retrospective cohort studies comprising 86,071 patients who underwent SCS implantation met inclusion criteria. Among these, 5,932 patients (6.9%) underwent device explantation during follow-up periods ranging from 6 months to 9 years. Study sizes varied from small single-center cohorts to large database studies exceeding 55,000 patients, with most (n = 11) reporting intermediate follow-up durations of 12-24 months. 6 studies found a higher proportion of paddle leads in the explant group. Of the 6 studies that reported explant indications for both neuritis and back pain, 4 found a higher proportion of explants due to neuritis. Preoperative opioid use was reported in 7 studies, with 5 demonstrating higher opioid use among patients who underwent explantation. 7 out of 11 studies that reported sex-specific data found a higher proportion of females in the explant group. Age-related findings were mixed across 14 studies, with 7 reporting older age and 6 reporting younger age in explanted patients. Smoking was reported in 5 studies, with 3 showing higher use among those who underwent explantation. **Conclusion:** This review identifies several potential predictors associated with SCS explantation, including paddle lead use, neuritis diagnosis, preoperative opioid use, female sex, and smoking. Age-related trends remain inconclusive. These findings may inform patient selection and perioperative counseling to optimize long-term outcomes following SCS implantation.

Surgical complications

ID: AGS26/68
P0885: Surgical safety in degenerative spine disease under aspirin therapy: a retrospective study

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Introduction: Managing patients on antiplatelet therapy during spinal surgery is controversial due to bleeding concerns. This study aimed to assess the safety of continuing low-dose aspirin in patients undergoing spine surgery for degenerative conditions. **Material and Methods:** A retrospective analysis was performed on 43 patients undergoing lumbar spine surgery (disc herniation or stenosis) between 2015 and 2022. All patients remained on 100 mg aspirin daily. Surgical outcomes, intraoperative blood loss, and postoperative complications were reviewed. **Results:** No major bleeding events or reoperations occurred. Median blood loss was 50 mL, with no transfusions required. No thromboembolic complications were observed. These findings support the safety of continuing low-dose aspirin during spine surgery in patients with cardiovascular risk. **Conclusion:** Low-dose aspirin can be safely continued in degenerative spine surgery without increased bleeding risk, offering dual benefit by preserving cardiovascular protection.
Approved by the Ethics Committee of Westfalen-Lippe, reference number 2025-025-f-S

ID: AGS26/81
P0886: Pneumoencefalus: rare complication after lumbar spine surgery

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Introduction: Surgery. It is a rare complication after epidural anesthesia and we have not found any bibliographic reference to the presence of pneumoencephalus after lumbar surgery. The following clinical case of pneumocephalus after lumbar spine surgery is presented. **Material and Methods:** 46-year-old woman with symptoms of low back pain and left L4 radiculopathy with a diagnosis of left foraminal disc herniation L4-L5 and degenerative disc disease at that level. L4-L5 transforaminal circumferential arthrodesis, pedicle instrumentation with interbody implant were performed. On the third post-operative day, the patient began inflammatory pain in the lumbar region and in the iliac crest, with suppuration through the drainage hole corresponding to the crest; surgical debridement were performed. Firstly, after taking intraoperative culture samples, the iliac crest is debrided, and subsequently the lumbar area is instrumented, the bilateral posterolateral and right interlaminar graft is partially removed, and cleaning is carried out with a mechanical pulsatile irrigation device. In the immediate post-operative period, the patient reported severe pain in the posterior region of the cervical spine. After 12 hours of evolution, the patient reported photophobia and severe frontal pain. A cranial CT scan was performed, which showed the presence of a large pneumoencephalus in the frontal area. **Results**: The patient's evolution is favorable with a good appearance of the surgical wound, no germ was isolated, so it was decided to extend oral antibiotic treatment for 3 months (Ciprofloxacin 750 mg/12 hours and Rifampicin 600 mg/12 hours). The pneumocephalus after successive control CT scans is completely reabsorbed after 3 weeks. After 6 weeks, a lumbar MRI was performed in

which a small pseudomeningocele was observed, most likely an unnoticed dura mater lesion and the excessive pressure of the pulsatile irrigation that caused the introduction of air into the intradural space. After one year of evolution, the patient did not report lumbar or radicular pain, radiologically no postero-lateral bone mass was observed, although there was at the interbody level. CT, with sagittal and 3D reconstruction one year later, shows images of interbody fusion mass, without signs of lysis in pedicle screws Figs. 12; Radiologically there are no signs of osteolysis in the pedicle screws, all of this, together with the disappearance of the lumbar pain, suggests the existence of a solid interbody arthrodesis. **Conclusion:** We do not recommend the use of pulsatile irrigation in spinal debridements, given the possible existence of unnoticed dural lesions through which air driven by the excessive pressure of pulsatile irrigation can penetrate.

ID: AGS26/119
P0887: Relationship between the postoperative variations of paraspinal muscles and adjacent-segment degeneration in patients with degenerative lumbar spinal stenosis after posterior instrumented lumbar fusion

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Introduction: This study aimed to quantify pre- and postoperative paraspinal muscular variation following posterior lumbar interbody fusion (PLIF) in patients with degenerative lumbar spinal stenosis (DLSS) and measure the association of this variation with adjacent-segment degeneration (ASD). **Material and Methods:** Data from 149 patients who underwent L4-S1 PLIF for DLSS were collected. Patients were divided into radiologically confirmed ASD and control groups according to follow-up radiological findings. MRI was performed before surgery and at the last follow-up. Muscular parameters including the relative cross-sectional area (rCSA), relative functional cross-sectional area (rFCSA), relative total cross-sectional area (rTCSA), and fatty infiltration (FI) of the multifidus (MF), erector spinae (ES), and psoas major (PM) muscles were measured on preoperative and follow-up L2-S1 MR images. Logistic regression was used to investigate risk factors for ASD. **Results:** The rate of radiological ASD was 42.3% at the final follow-up (mean 25.71 ± 8.35 months). At surgical levels, the rFCSA and rTCSA of the MF and ES muscles decreased. The FI of the MF from L2-3 to L5-S1 and ES muscles at L5-S1 significantly increased after surgery, while the rFCSA and rTCSA of the PM muscle increased and its FI decreased. At adjacent levels, the rFCSA and rTCSA of the MF muscle and rTCSA of the ES muscle decreased and the FI of the MF muscle increased postoperatively ($p < 0.05$), but the rFCSA and rTCSA of the PM muscle increased and its FI decreased ($p < 0.05$). The FIs of the MF, ES, and PM muscles at adjacent levels significantly differed between the ASD and control groups. Logistic regression analysis indicated that higher BMI ($p = 0.002$) and FI of the PM muscle at adjacent levels ($p = 0.025$) were significant risk factors for ASD. **Conclusion:** The functional area decreased in the MF and ES muscles and increased in the PM muscle after L4-S1 PLIF. A compensatory postoperative decrease in FI of the PM muscle at the adjacent level was a protective factor for ASD in DLSS patients after PLIF.

ID: AGS26/120
P0888: Correlation between lordosis tilt and lordosis distribution index and occurrence of proximal junctional kyphosis following surgery for adult degenerative scoliosis

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Introduction: This study was aimed to evaluate the effect of postoperative reciprocal progression of lordosis tilt (LT) and lordosis distribution index (LDI) and occurrence of proximal junctional kyphosis (PJK) following surgery for adult degenerative scoliosis (ADS). **Material and Methods:** 122 consecutive patients with ADS treated with correction of deformity followed-up for a minimum of 2 years. Spinopelvic parameters were measured at pre-operation post-operation and the latest follow-up. Japanese Orthopaedic Association score (JOA), Oswestry Disability Index (ODI), visual analog scale (VAS), were measured at the latest follow-up. Associations between LT, LDI and PJK were analyzed using receiver operating characteristic (ROC) analyses. **Results:** The prevalence of PJK in the present study was 24.6%. Outcomes of patients with PJK were significantly worse than that in patients without PJK. Postoperative reciprocal progression in LT and LDI with lumbar lordosis (LL) restorative surgery was found. Preoperative risk factors of PJK were older age, larger LT and larger Cobb angle of the curves. Postoperative risk factors for PJK included postoperative LT and postoperative Cobb angle of the curves, which were smaller than that in preoperative time. We found a strong correlation between postoperative LT and Cobb angle of the curves resulting in PJK. And the patients with LT larger than 8° were at higher risk of getting PJK. **Conclusion:** LT was a spinopelvic parameter of analyzing the relationship between the relative positions of spine and pelvis, which indicates the inclines of the total lordosis. LT could be used to predict the occurrence of PJK in patients undergoing surgery for ADS. Appropriate postoperative LT is crucial to prevent progression of PJK.

ID: AGS26/272

P0889: Fatty infiltration in the multifidus predicts screw-loosening following short-segment decompression and fusion: proof of why we should protect and rehabilitate the paraspinal muscles

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Introduction: Screw-loosening is a common instrumentation-related complication following fusion. Patients who present with pain and neurological symptoms due to screw-loosening require revision. It has been reported that fat-infiltrated and/or atrophied paraspinal muscles were associated with low back pain, disability, radiculopathy, and instrumentation-related failures. However, there is limited and conflicting knowledge regarding the association of paraspinal muscles with screw-loosening. In the present study, we aimed to identify whether fatty infiltration in the paraspinal muscles was associated with screw-loosening. **Material and Methods:** A retrospective analysis of the clinical and radiological data of the patients who underwent short-segment decompression and fusion for lumbar spinal stenosis (LSS) at a tertiary spine clinic between 2013 and 2023. Goutallier's classification system was used for grading fatty infiltration in the paraspinal muscles. **Results:** Patients with screw-loosening had fattier multifidus at the upper lumbar spine (particularly L2-L3, cephalad to the upper instrumented level of L3-L4) compared to those without screw-loosening. In univariate analysis fatty multifidus at L2-L3 level, elder age, and male sex had ORs of 1.509 (p = 0.008), 1.116 (p = 0.001) and 4.702 (p = 0.004), respectively. In multivariate analysis fatty multifidus at L2-L3 level, elder age and male sex had ORs 1.428 (p = 0.043), 1.109 (p = 0.003), and 5.911 (p = 0.004), respectively. **Conclusion:** Fatty infiltration in the multifidus muscle (particularly in the one at the cranial end of the fusion mass) is predictive for screw-loosening following short-segment lumbar decompression and fusion for LSS. Preserving multifidus in subjects is essential to prevent future long-term complications of spine surgery.

ID: AGS26/273

P0890: Higher Charlson Comorbidity Index Score correlates with higher rate of pseudoarthrosis following short-segment lumbar fusion surgery

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Introduction: In the present study, we aimed to analyze whether the Charlson Comorbidity Index (CCI) score was predictive for pseudoarthrosis in patients who underwent with short-segment lumbar decompression and fusion for degenerative lumbar spine disorders (DSD). **Material and Methods:** Consecutive patients who underwent short-segment lumbar decompression and fusion for DSD between 2013 and 2023 in a tertiary spine clinic were included into the study. Patients' charts were reviewed for patients' comorbidities, smoking status, and the CCI score was calculated accordingly. Subcutaneous fat index (SFI) was used for the anthropometric evaluation of the participants. **Results:** Comorbidities/smoking had no significant effect on the pseudoarthrosis rate, when analyzed separately. However, subjects with pseudoarthrosis at their final follow-up visits had significantly higher CCI scores at the pre-operative era compared to the subjects without pseudoarthrosis (**p = 0.022**). Besides, in patients with pseudoarthrosis and those without pseudoarthrosis 48.1% and 75.3% were overweight according to SFI, respectively (**p = 0.003**). Multivariable regression analysis depicted ORs of 1.256 (**p = 0.018**) for the CCI score and 0.269 (**p = 0.003**) for overweight. The ROC analysis revealed a cut-off value of **2.5 points** for the CCI score. **Conclusion:** A combined effect of comorbidities might yield higher pseudoarthrosis rates following short-segment decompression and fusion for DSD. Each one-point increment in CCI score and SFI score yielded a 26% increment and a 73% decrement in risk for pseudoarthrosis in those subjects. A cut-off value of 2.5 points for the CCI score could distinguish the subjects who might have pseudoarthrosis following short-segment surgery for DSD.

ID: AGS26/289
P0891: Preoperative anemia severity predicts complications following anterior cervical spine surgery

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Introduction: Preoperative anemia is a well-established risk factor for adverse surgical outcomes, with several studies in arthroplasty demonstrating a strong exposure-response relationship between anemia of increasing severity and risk of complications. These findings have led to the integration of anemia screening and optimization protocols into perioperative pathways for total hip and knee arthroplasty. However, despite similar concerns around blood loss, transfusion, and recovery in spine surgery, anemia severity has not been systematically studied in this population. In particular, anterior cervical spine procedures pose unique physiologic demands and may be especially sensitive to hematologic compromise. Understanding how the degree of preoperative anemia influences both short-term complications and longer-term structural outcomes is essential for tailoring perioperative care and implementing patient counseling. This study evaluates the relationship between anemia severity and postoperative outcomes in a large cohort of patients undergoing cervical spine surgery, with 90-day and 1-year follow-up. **Material and Methods:** Using the TriNetX Research Network, adult patients who underwent anterior cervical spine procedures were identified and stratified into four groups based on preoperative anemia severity: severe (< 8 g/dL), moderate (8-9.9 g/dL), and mild (10-11.9 g/dL), and no anemia. Propensity score matching (1:1) was performed using the Charlson Comorbidity Index to control for baseline medical complexity across cohorts. Postoperative outcomes were assessed at two time points: 90-day complications (surgical site infection, transfusion, pneumonia, postoperative anemia, and venous thromboembolism (DVT/PE)) and 1-year outcomes (pseudoarthrosis and reoperation). Risk ratios (RR), 95% confidence intervals (CI), and p-values were calculated for each comparison. **Results:** A total of 34,391 patients were included in the analysis. Anemia of any severity was associated with significantly elevated rates of 90-day complications compared to non-anemia patients. Patients with severe anemia had the highest relative risk for transfusion (RR: 7.11, $p < 0.0001$), DVT/PE (RR: 3.70, $p < 0.00001$), and pneumonia (RR: 2.74, $p < 0.0001$). Moderate and mild anemia also demonstrated consistent and significant associations with adverse events, including elevated risk for infection, transfusion, and postoperative anemia. At 1 year, patients with severe and moderate anemia had markedly higher rates of reoperation (RR: 1.54 and 1.93, respectively). Pseudoarthrosis rates were not significantly different across groups. **Conclusion:** Preoperative anemia, particularly hemoglobin < 10 g/dL, is an independent predictor of both early postoperative complications and 1-year reoperation. The stepwise increase in risk with worsening anemia underscores the need for anemia stratification in preoperative risk models. While anemia is not always modifiable, especially in the setting of chronic disease or malignancy, its presence should prompt heightened perioperative vigilance and transparent discussion with patients regarding surgical risk. Future prospective studies are warranted to determine whether preoperative correction of anemia can reduce complication rates and improve long-term outcomes in cervical spine patients.

ID: AGS26/313
P0892: Late implant removal of steffe plate system without the original instrumentation set in the pedicle screw era: a note on the technical nuances and workarounds

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Introduction: Steffee plate system, introduced in 1982, was once a standard instrumentation method for spinal fixation and was widely used till modern pedicle screws were introduced. Occasionally, older patients present back for revision surgeries or with late infection of the existing Steffee implants and in many parts of the world, the original instrumentation sets and implants are no longer available. Younger generation of spine surgeons, who are trained in the pedicle screw era are often not exposed to the system ,and may face difficulties with the removal of the same. **Material and Methods:** We discuss the case reports of 2 diabetic patients with history of Steffee plate fixation for trauma spine about 15 years ago, presented to us with delayed infection of implants necessitating implant exit. Due to the unavailability of original instrumentation, implant exit was done with difficulty using general orthopaedic set and limb reconstruction system (LRS) instrumentation, keeping a metal cutting burr as backup. The parts of the system were reviewed, with emphasis to the relation between top-nuts and the screw. **Results:** The notable findings intra op were the presence of fibrous discoloured scar around the plates, and the cold welding of top-nuts to the conical tapered screw or plate. Even though infected screws were loose and were expected to be removed easily, the top-nuts and the whole screw were rotating as a single system around the plate, preventing unscrewing. In one case, the screw was found cut flush with the top nut, providing no place to hold a counter-torque. The hexagonal T wrench was not engaging in the top-nut due to the

blunting of nut corners, and a polygonal ring wrench from the orthopaedic LRS set had to be used. A pointed nose plier/vise-grip was inevitable to loosen the nuts where standard vise-grip failed to grab tightly. Counter torque during nut removal was given with a spanner, or by holding the plate with another pointed plier. Since none of the tricks worked in 2 screws in one case, the entire plate-screw construct was levered up as a whole using an osteotome, which was possible due to the infected loose screws, risking pedicle breakage. As both of our cases had documented spine fusion in pre op CT scan and no instability, revision of instrumentation was not done, with no pedicle fracture noted intra op clinically and patients showed no worsening of deformity in follow ups. **Conclusion:** Late removal of implants are sought with difficulty when the original instrumentation is no longer available, and may result in an unsuccessful surgery. The general orthopaedic set with 2 or more pointed nose pliers, hexagonal T wrench, spanners of all sizes, wide osteotome, pointed vise-grips and a polygonal ring wrench in LRS set were the minimum requirements used in our cases; with a metal cutting burr and hollow mills arranged as backup. Special care must be taken to avoid iatrogenic fractures and pedicle breakages in cases where a re-instrumentation is planned. These cases should be well planned ;possible difficult scenarios described should be kept in mind and may require a backup plan when being done in a resource limited setting.

ID: AGS26/366
P0893: Preventive measures against postoperative nausea and vomiting (PONV) in spine surgery

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Introduction: Postoperative nausea and vomiting (PONV) following spinal surgery is reported to occur in approximately 30% of cases. Like postoperative pain, PONV is unpleasant, contributes to reduced patient satisfaction, and can also hinder rehabilitation. This study evaluated the effectiveness of PONV prevention measures implemented during spinal surgery. **Material and Methods:** A total of 335 spinal surgeries performed between January 2020 and August 2022 were retrospectively reviewed. Male: 187, Female: 148, mean age: 66.3 years. Surgical sites: Cervical spine: 30 cases, Thoracic spine: 25 cases, Lumbar spine: 280 cases. PONV risk assessment (Apfel score: female, non-smoker, motion sickness/history of PONV, postoperative opioid use) was used to guide preventive measures. Preventive measures included: ① Droperidol bolus within IV-PCA, ② Intravenous Dexamethazone during surgery, ③ Female patients: Intravenous Metoclopramide immediately postoperatively. PONV occurrence was evaluated in these cases. **Results:** PONV: 19 cases (5.7%). Nausea only: 12 cases; vomiting present: 7 cases. Gender: Male 5 cases, Female 15 cases; PONV occurrence was significantly higher in females. No significant differences were observed by surgical site. Additionally, only one female patient required supplemental antiemetic medication. **Discussion:** In our previous report, PONV occurred in 31.4% of spinal surgery patients. This time, using the Apfel score as a reference, we focused prevention on postoperative opioid use and female patients. As a result, PONV incidence decreased significantly. Furthermore, among PONV cases, only one patient actually required additional antiemetic medication. Therefore, we consider this prevention method also reduces the severity of PONV. Since PONV itself occurs only within the first few postoperative days, it has not been actively prevented in Japan. However, given the trend toward shorter hospital stays, once PONV occurs, it contributes to delayed rehabilitation and reduced patient satisfaction, making proactive measures essential. Because PONV onset involves multiple factors, prevention with a single agent is difficult. Therefore, multifaceted preventive strategies are necessary, requiring collaboration not only within the orthopedic department but also with anesthesiology and other departments. **Conclusion:** As a result of implementing targeted PONV prevention measures, particularly for postoperative opioid users and female patients, PONV was observed in only 5.7% of cases.

ID: AGS26/406
P0894: Preoperative anemia severity predicts complications following lumbar decompression

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Introduction: Preoperative anemia is a well-established risk factor for adverse surgical outcomes, with several studies in joint arthroplasty demonstrating a stepwise increase in complication risk as anemia severity worsens. These findings have led to the integration of anemia screening and optimization protocols into perioperative pathways for total hip and knee arthroplasty. However, despite similar concerns around blood loss, transfusion, and recovery in spine surgery, anemia severity has not been systematically studied in this population. In particular, lumbar decompression procedures have unique

physiologic demands and may be especially sensitive to hematologic compromise. Understanding how the degree of postoperative anemia influences both short-term complications and longer-term structural outcomes is essential for tailoring perioperative care and implementing patient counseling. This study evaluates the relationship between anemia severity and postoperative outcomes in a large cohort of patients undergoing lumbar decompression, with 90-day and 1-year follow-up. **Material and Methods:** Using the TriNetX Research Network, adult patients who underwent lumbar decompression procedures were identified and stratified into four groups based on preoperative anemia severity: severe (< 8g/dL), moderate (8-9.9g/dL), and mild (10-11.9g/dL), and no anemia. Propensity score matching (1:1) was performed using the Charlson Comorbidity Index to control for baseline medical complexity across cohorts. Postoperative outcomes were assessed at two time points: 90-day complications (surgical site infection, transfusion, pneumonia, postoperative anemia, and venous thromboembolism (DVT/PE)) and 1-year outcomes (pseudoarthrosis and reoperation). Risk ratios (RR), 95% confidence intervals (CI), and p-values were calculated for each comparison. **Results:** Among over 109,000 patients undergoing lumbar decompression, anemia severity was associated with significantly elevated rates of 90-day complications and 1-year outcomes. Patients with severe anemia had the highest relative risks across nearly all metrics, including transfusion (RR: 6.91, $p < 0.0001$), postoperative anemia (RR: 3.72, $p < 0.0001$), lumbar fracture (RR: 3.22, $p < 0.0001$). Pseudoarthrosis (RR: 1.94, $p < 0.0001$), and reoperation (RR: 1.73, $p < 0.0001$) were also significantly more common. Patients with moderate anemia demonstrated similar trends, with increased risk of transfusion (RR: 5.22), postoperative anemia (RR: 2.78), lumbar fracture (RR: 2.59), pseudoarthrosis (RR: 1.76), and reoperation (RR: 1.50), all $p < 0.0001$. Even mild anemia was associated with higher complications rates. These findings demonstrate a clear stepwise relationship between anemia severity and adverse postoperative outcomes following lumbar decompression. **Conclusion:** Preoperative anemia, particularly when moderate to severe, is an independent predictor of both early postoperative complications and 1-year reoperation. The stepwise increase in risk with worsening anemia underscores the need for anemia stratification in preoperative risk models. While anemia is not always modifiable, especially in the setting of chronic disease or malignancy, its presence should prompt heightened perioperative vigilance and transparent discussion with patients regarding surgical risk. Future prospective studies are warranted to determine whether preoperative correction of anemia can reduce complication rates and improve long-term outcomes in patients undergoing lumbar decompression.

ID: AGS26/424

P0895: Extended oral antibiotic prophylaxis after anterior cervical spinal fusion is associated with increased infection and sepsis rates

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Introduction: Extended oral antibiotic prophylaxis, commonly employed in hip and knee arthroplasty beyond the standard 24-hour perioperative period[1], has gained popularity as a preventive measure[2]. However, recent large-scale matched cohort studies have reported no reduction in prosthetic joint infection rates and, in some cases, an increase in complications. Despite limited evidence, the practice remains widespread, particularly among high-risk patients[3,4]. In spine surgery, the efficacy of extended oral antibiotics in reducing postoperative infection, sepsis, or revision rates has not been evaluated in large, multi-institutional studies. Given the rising concerns over antibiotic resistance and microbiome disruption, this study investigates the clinical utility of extended prophylaxis following posterior cervical spinal surgery. **Material and Methods:** A retrospective cohort study was performed using data from the TriNetX United States Collaborative Network. Adult patients ($\geq$ 18 years) who underwent posterior cervical spinal surgery were identified via CPT codes. All patients were assumed to have received standard intravenous antibiotic prophylaxis within 24 hours postoperatively. Cohorts were defined by the presence or absence of extended oral antibiotic prescriptions administered between 24 hours and 7 days following surgery. Propensity score matching (1:1) was used to control for age, sex, BMI, smoking status, and relevant comorbidities (e.g., renal failure, diabetes mellitus). The primary outcome was 90-day postoperative spinal surgical site infection. Secondary outcomes included reoperation and sepsis. Outcomes were analyzed using Kaplan-Meier survival estimates, hazard ratios, and cumulative incidence statistics. **Results:** A total of 9,472 patients who received extended oral antibiotics following posterior cervical spinal fusion were propensity score matched 1:1 to 9,472 patients who did not. The 90-day incidence of surgical site infection was statistically higher in the extended antibiotic cohort compared to controls (20.612% vs. 18.232%; RR: 1.131, $p \leq 0.0001$). Reoperation rates

were also elevated in the antibiotic group (3.324% vs. 2.832%, RR: 1.174, p = 0.0424). Sepsis occurred in 3.206% of patients receiving extended antibiotics versus 2.449% of controls (RR 1.309, p < 0.0011). Wound infections were significantly more frequent in the extended antibiotic cohort (4.307% vs. 2.97%; RR 1.471, p < 0.0001). **Conclusion:** Extended oral antibiotic prophylaxis following posterior spinal fusion was associated with significantly higher rates of surgical site infection, sepsis, wound infection, and reoperation compared to standard perioperative prophylaxis alone. These findings, while accounting for potential selection bias, challenge the presumed protective benefit of extended antibiotic use in this context. In light of the increased complication rates and the broader implications for antimicrobial resistance and microbiome disruption, the routine use of extended prophylaxis warrants critical reevaluation.

ID: AGS26/472
P0896: Cervical spinal cord injury elevates risk of psychiatric morbidity in matched cohort analysis

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Introduction: Spinal cord injury (SCI) is a life-altering condition associated with disproportionately high rates of depression and anxiety, with prevalence estimated to be two to three times greater than in the general population. These psychiatric comorbidities negatively affect rehabilitation engagement and functional outcomes. However, few studies have isolated the psychological impact of SCI from that of trauma more broadly. This study aimed to compare the incidence of new-onset mood and anxiety disorders in patients with cervical SCI versus matched trauma-exposed controls with long bone or pelvic fractures. **Material and Methods:** A retrospective cohort study was conducted using the TriNetX United States Collaborative Network. Adult patients (≥1 8 years) with a new diagnosis of cervical SCI were identified and matched 1:1 to patients with pelvic or long bone fractures. Patients with prior diagnoses of mood or anxiety disorders or prior psychiatric medication use were excluded. The primary outcomes were new diagnoses of mood or anxiety disorders and new prescriptions for antidepressants or anxiolytics between 14 and 90 days post-injury. Propensity score matching controlled for age, sex, race, comorbidities (e.g., diabetes, obesity), and substance use. Psychiatric outcomes were assessed using Kaplan-Meier analysis, hazard ratios, risk ratios, and odds ratios. **Results:** A total of 36,492 patients with cervical SCI were matched to 36,492 orthopedic trauma controls. New-onset mood or anxiety disorders occurred more frequently in the SCI cohort (0.85%) compared to controls (0.29%; RR 2.90, 95% CI: 2.33-3.61, p < 0.0001). Cervical SCI was also associated with significantly increased initiation of psychiatric medications, including SSRIs (RR 5.11), SNRIs (RR 4.17), atypical antidepressants (RR 4.51), tricyclic antidepressants (RR 7.38), and anxiolytics (RR 4.62; all p < 0.0001). SCI patients were over eight times more likely to be referred for psychiatric services (RR 8.07, 95% CI: 4.63-14.06). **Conclusion:** Cervical SCI is associated with a markedly increased risk of new-onset mood and anxiety disorders, psychiatric medication initiation, and mental health service utilization compared to matched high-energy orthopedic trauma patients. These findings highlight a distinct psychiatric burden following SCI and underscore the need for early mental health screening and integrated psychiatric care in this population.

ID: AGS26/482
P0897: Identifying predictors of postoperative hemoglobin recovery patterns following TLIF

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Introduction: Hemoglobin (Hgb) trends following transforaminal lumbar interbody fusion (TLIF) are commonly used to estimate blood loss, guide transfusion protocols, and monitor recovery. Prior studies have largely focused on identifying the nadir - the absolute lowest postoperative Hgb value - as a proxy for blood loss or clinical concern. However, this single time point may not accurately represent the full clinical trajectory. The concept of postoperative Hgb "plateau" has not been well defined or systematically analyzed in the TLIF population. In this study, we propose a novel framework to classify patients based on Hgb stabilization patterns and use regression-based approaches, including LASSO, to identify clinical predictors of cohort membership. **Material and Methods:** We retrospectively reviewed adult patients undergoing TLIF with postoperative Hgb measurements through postoperative day (POD) 3-5. Patients were assigned to one of four cohorts based on daily Hgb changes: Constant (minimal variation, daily change < 0.5 g/dL). Decline (ongoing decrease without stabilization), Late (nadir on or after POD4 without plateau), or Plateau (initial drop followed by stabilization, defined as < 0.5 g/dL change over ≥ 2 consecutive days). Transfused patients were excluded from hemoglobin visualization trends. Clinical and perioperative variables -including age, sex, BMI, estimated blood loss (EBL), drain output, number of TLIF levels, preoperative Hgb, platelet count, and

transfusion status- were analyzed using multinomial logistic regression. To reduce model complexity and validator predictor robustness, LASSO-penalized regression was performed on a subset with complete data. **Results:** A total of 57 patients met inclusion criteria. Hemoglobin nadirs occurred most commonly on POD3 (n = 17, 30%), followed by POD4 (n = 16, 28%), POD2 (n = 11, 19%), POD5 (n = 9, 16%). POD1 (n = 4, 7%). Based on daily hemoglobin patterns, patients were classified into four cohorts reflecting distinct postoperative trends: Constant (n =7), Decline (n = 10), Late (n = 20), Plateau (n = 20). Of the 57 patients, 30 (53%) experienced a > 0.5g/dL hemoglobin decline between POD1 and POD2. Fewer patients showed continued decline on subsequent days: 12 (21%) from POD2 to POD3, 11 (19%) from POD3 to POD4, and 5 (9%) from POD4 to POD5. Average Hgb change interval was -0.72 g/dL (POD1-2), -0.11 (POD2-3), -0.12 (POD3-4), and +0.04 (POD4-5). Traditional multinomial regression revealed that the Decline cohort was biologically distinct. Compared to the Late cohort, Decline patients were more likely to be male (p = 0.048) and have lower preoperative platelet counts (p = 0.017). In the LASSO model, five variables were retained: gender, EBL, preoperative Hgb, platelet count, and TLIF levels. Within this model, Decline patients showed significantly higher intraoperative blood loss (p = 0.031), lower platelet counts (p = 0.006), were more likely to be male (p = 0.049), and showed a trend toward lower preoperative Hgb (p = 0.063). Despite the smaller sample size, the Lasso model achieved a 58.3% classification accuracy supporting the robustness of selected predictors. **Conclusion:** Hemoglobin commonly continues to decline after POD1 in TLIF patients, with over half of the cohort experiencing a > 0.5 g/dL drop between POD1 and POD2. This trajectory is often misinterpreted as ongoing blood loss, prompting unnecessary diagnostic workups. Recognizing this expected pattern may reduce unwarranted interventions during routine postoperative care.

ID: AGS26/483

P0898: Postoperative NSAID use and lumbar fusion outcomes: timing-dependent risks by surgical approach

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Introduction: Postoperative pain control is essential after lumbar fusion, but reliance on opioids raises concerns about prolonged use and dependency. In response, alternative, opioid-sparing strategies increasingly incorporate NSAIDs for their analgesic and anti-inflammatory benefits. However, NSAID use in spine surgery remains controversial due to potential inhibition of bone healing and increased risk of nonunion. While prior studies have linked NSAIDs to pseudoarthrosis, most have evaluated NSAID exposure as a binary variable, without accounting for timing - a factor that may significantly affect outcomes. As NSAIDs become more common in postoperative protocols, clarifying how timing influences risk is critical. This study investigates the association between NSAID use at three postoperative intervals (0-30, 30-60, and 60-90 days) and complication risk following TLIF/PLIF and ALIF procedures, to better understand the temporal impact of analgesic timing on surgical outcomes. **Material and Methods:** Using the TriNetX Research Network, adult patients undergoing TLIF/PLIF or ALIF were identified and stratified based on NSAID use during one of three isolate postoperative intervals: 0-30 days, 30-60 days, or 60-90 days. NSAID users were compared to matched non-users within each time frame. Outcomes included 90-day complications (postoperative anemia, transfusion, surgical site infection [SSI], pneumonia, venous thromboembolism [DVT/PE]) and 1-year complications (reoperation, pseudoarthrosis, and lumbar fracture). Risk ratios (RR), 95% confidence intervals (CI), and p-values were calculated for each outcome. **Results:** Of 11,022 TLIF/PLIF patients, NSAID use within 0-30 days was associated with significantly lower rates of postoperative anemia (RR: 0.774, p < 0.0001), transfusion (RR: 0.85, p = 0.0022), and DVT/PE (RR: 0.797, p = 0.0057),however it conferred a significant increase in pseudoarthrosis (RR: 1.11, p < 0.0001). In contrast, delayed NSAID use (30-90 days) was associated with a significant increase in reoperation risk (RR: 1.8, p = 0.0147) and lumbar fracture (RR:1.667, p = 0.0416) in the 60-90 day group, despite continued reduction in transfusion and anemia. Of 9,048 ALIF patients, NSAID use in the early postoperative period (0-30 days) was associated with a significantly lower risk of pseudoarthrosis (RR: 0.906, p = 0.0138) and reduced reoperation rates (RR: 0.785, p < 0.0001). In contrast, NSAID use between 30-90 days was linked to decreased transfusion and reoperation, but showed a trend toward increased pseudoarthrosis. **Conclusion:** NSAID use demonstrates a complex, timing-dependent pattern of risk. In TLIF/PLIF, early NSAID use (0-30 days) was linked to reduced rates of anemia, transfusion, and thromboembolic events, but at the cost of a modest

increase in pseudoarthrosis risk. Delayed use (30-90 days) further lowered hematologic complications but was associated with increased rates of reoperation and lumbar fracture, In contrast, early NSAID use after ALIF was associated with lower rates of pseudoarthrosis and reoperation, while delayed use was linked to reduced transfusion and reoperation without a clear impact on fusion outcomes. These findings underscore the importance of both surgical approach and NSAID timing in postoperative management. Prospective studies are warranted to clarify causality and guide the development of procedure-specific, time-targeted NSAID guidelines.

ID: AGS26/560
P0899: Epidural hematoma following thoracic vertebroplasty in multiple myeloma patients: two case reports and literature review

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Introduction: Epidural hematoma (EH) after vertebroplasty is a rare but potentially serious complication (0.2-1.2%), usually related to vascular injury during pedicular puncture. Early recognition via MRI or CT is critical when neurological deterioration occurs. We report two cases in multiple myeloma (MM) patients. **Material and Methods: Case 1**: A 67-year-old female with newly diagnosed MM presented with T4-T8 vertebral fractures and renal insufficiency, without neurological deficit. Conservative treatment failed, and T5, T7, and T8 vertebroplasties were performed. Persistent thoracic pain prompted MRI, revealing an T4-T7 epidural hematoma without cord compression. **Case 2:** A 71-year-old female with MM relapse, renal failure, thrombocytopenia, and multiple dorsal fractures underwent T1-T3 cemented arthrodesis and T8 and T12 vertebroplasty. Postoperatively, she developed acute ASIA C deficit. MRI showed T7-L5 extensive epidural hematoma with intramedullary signal changes. **Results: Case 1:** Surgery was not indicated. One month later, she developed ASIA C deficit; follow-up MRI showed resolution of the hematoma but spinal cord signal changes. She did not regain mobility and died two months later due to MM progression. **Case 2:** Urgent decompression at D8 and D12 provided local relief but no clinical improvement. She died two weeks later due to pulmonary and renal complications. **Conclusion:** Vertebroplasty is generally safe and effective for MM-related fracture pain, even in immunocompromised patients. Hematoma risk is elevated due to coagulation abnormalities in MM. Literature shows most thoracic spine vertebroplasty EHs recover neurologically after decompressive laminectomy; key predictors are hematoma size, motor impairment severity, and rapid decompression. In our cases, advanced MM and poor general condition likely contributed to unfavorable outcomes. These reports highlight the importance of vigilant post-vertebroplasty monitoring in MM patients.

ID: AGS26/564
P0900: Evaluating the role of C2PA in predicting proximal junctional failure

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Introduction: C2 Pelvic Angle (PA) has been proposed as a predictor of proximal junctional failure (PJF), with prior work suggesting a C2PA > 20° may be linked to worse outcomes. This study assesses whether immediate postoperative C2PA - alone or alongside other alignment measures such as L1PA, T4PA, and Proximal Junctional Angle (PJA) - is associated with PJF development following adult spinal deformity (ASD) surgery. **Material and Methods:** 730 ASD patients who underwent fusion of ≥7 levels with pelvic instrumentation were included. Patients were then divided into two groups based on the presence or absence of PJF, defined as symptomatic proximal junctional kyphosis requiring revision. Immediate postoperative radiographic parameters-C2PA, PJA, L1PA, and T4PA - were recorded. The L1PA formula (L1PA = 0.5*(Pelvic Incidence) - 19 ±2) was used to assess alignment. Various C2PA thresholds (≥ 10°, ≥ 15°, ≥ 20°, ≥ 25°, ≥ 30°, ≥ 35°, ≥ 40°) were tested for association with PJF. The immediate postop radiographic parameters were also assessed for a relationship with the development of PJF. **Results:** The mean age was 49.1 years, with a follow-up of 20.5 months. PJF developed in 5.75% of patients. Immediate postoperative C2PA, including values >20° and in combination with L1PA alignment, was not significantly associated with PJF ($p = 0.71$, $p = 0.95$). Likewise, no C2PA threshold was linked to increased PJF risk (all $p > 0.1$). However, immediate postoperative PJA was significantly higher in patients who developed PJF (mean 11.17°) compared to those who did not (mean 6.13°, $p < 0.001$). **Conclusion:** Immediate postoperative C2PA did not correlate with PJF in this cohort, even when evaluated across multiple cutoff points or combined with alignment metrics like L1PA or T4PA. In contrast, elevated immediate postoperative PJA was significantly associated

with PJF development. These findings suggest PJA may provide more relevant predictive insights than C2PA in evaluating PJF risk.

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P0901: Management of subarachnoid-pleural fistula after spinal deformity surgery using non-invasive positive pressure ventilation: a case report

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Introduction: Subarachnoid-pleural fistula (SPF), an abnormal communication between the subarachnoid and pleural spaces, is an uncommon complication after spinal surgery, with an incidence of 1.4%. It predominantly presents as pleural effusion (≈74%), since the pressure gradient between the pleural cavity and the subarachnoid space favors the accumulation of cerebrospinal fluid (CSF) in the pleural space. Detection of β2-transferrin in the fluid provides a highly sensitive diagnostic tool (≈85.7%). This study reports an illustrative clinical case highlighting the importance of accurate diagnosis and effective management of this complication, focusing on the role of non-invasive positive pressure ventilation (NIPPV). **Material and Methods:** A 14-year-old adolescent with neuromuscular kyphoscoliosis (global hyperkyphosis and scoliosis of 73°) underwent surgical correction of the deformity with instrumented fusion from T2 to the ilium, without intraoperative complications. On postoperative day 6, the patient developed a right pleural effusion without evident signs of infection. Thoracentesis confirmed a transudate; a chest tube was placed, β2-transferrin testing of the pleural fluid was positive, and spinal CT revealed minimal intracanal invasion of a T8 pedicle screw, establishing the diagnosis of SPF. **Results:** The initial course was unsatisfactory, with continuous chest tube drainage averaging 300 ml/day and persistence of a 2-3 cm effusion on radiological follow-up. In the absence of improvement, acetazolamide and NIPPV were initiated. This strategic approach led to progressive reduction of the effusion, reaching minimal values of 3 mm after 4 days and complete resolution after 9 days. NIPPV was discontinued on day 10 without recurrence of the effusion. **Conclusion:** SPF should be considered in the differential diagnosis of pleural effusion after spinal surgery. Continuous application of NIPPV for 10 days proved to be an effective strategy, achieving fistula closure without the need for surgical reintervention. This case underscores the importance of comprehensive postoperative management in spinal surgery and highlights the relevance of NIPPV as a valuable tool in the treatment of this complication.

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P0902: Meat mincer effect during cemented spondylodesis that leads to cement leakage migration to the inferior vena cava

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Introduction: Cement leakages during percutaneous cementoplasty are well-known complications. Accounting for 10 to 30% of cases, they may be treated conservatively most of the time. Only some posterior leakages may require emergency decompression to free from neural structure compression. Vascular leakages are frequent, but usually their extension is limited by the control of cement pressure. The aim of this study was to describe a rare case of cement leakage migration to the inferior vena cava. **Material and Methods:** An 82-year-old woman, with osteoporosis and previous L3/4/5 decompression and mild left L5 paresis, was followed by lumbar MRI because of a new onset of lumbar pain after carrying a mild weighted device at home. MRI found an osteoporotic fracture OF4 of L3 with 25% of vertebral height loss, as well as recurrence of severe L4/5 stenosis by a disc herniation. Dynamic lumbar X-rays showed unstable spondylolisthesis at L4-5 level. A L3 kyphoplasty was scheduled with redo of decompression and cemented L4/5 spondylodesis. At the end of the spondylodesis, an image compatible with cement was observed at the L1-2 level under fluoroscopy. L3 kyphoplasty was performed and posterior decompression with dural suture for dural tear. A postoperative CT-scan confirmed cement migration within the inferior vena cava. The patient was transferred to the university hospital center at the vascular surgery department to remove the cement by anterior spra-umbilical laparotomy and vena cava approach. **Results:** Fragment of cement was removed in one piece without the need for vascular plasty. Intraoperative findings showed a structure looking like minced meat, with pieces stuck together. Postoperatively, the patient was treated with analgesics and curative heparin. After 2 days at the middle care unit, she was able to come back to the vascular surgery department. The follow-up was uneventful. Mechanism of cement leakage and its migration was considered as a high pressure on cement during L5 pedicle screw insertion, leading to cement leakage through the vertebral venous system and lumbar veins, with connection to the iliac veins and thus the

inferior vena cava. **Conclusion:** This rare complication illustrated the need to carefully manage cemented lumbar spondylodesis and to avoid putting pedicle screws after cement injection. Further studies are needed to assess the behavior of the cement in vivo and the pressure around the pedicle screws during insertion.

ID: AGS26/659
P0903: White cord syndrome: systematic review and case series of 22 cases

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Background: White Cord Syndrome (WCS) is a rare but serious complication that can occur after spinal decompression surgery. This review looks at 22 cases-20 from the published literature and 2 from Sultan Qaboos Hospital in Oman-to better understand patient characteristics, imaging findings, surgical practices, and outcomes. Our findings suggest that early detection and intervention may lead to better neurological recovery. Most patients had partial recovery, and common comorbidities included hypertension and diabetes. **Methods:** Fifty reported cases of WCS were initially identified through online databases. After excluding duplicates and unrelated cases, 20 published reports were analyzed alongside two additional local cases. We collected data on demographics, comorbidities, MRI results, surgical methods, use of intraoperative monitoring, timing of neurological deficits, and recovery outcomes. The data were summarized using descriptive statistics and trend analysis. **Results:** The average patient age was 55.3 years, and most were male. Hypertension, diabetes, and atrial fibrillation were the most frequent comorbidities. Most patients had severe cervical stenosis or disc herniation, often with T2 hyperintense signals on preoperative MRI. Posterior decompression and fusion were the most common surgical techniques, and intraoperative neuromonitoring (IONM) was used in over 90% of cases. Despite surgery, many patients developed new neurological deficits-typically tetraplegia or quadriparesis-within 48 hours. Outcomes showed: 60% had partial recovery, 20% had full recovery and 20% had no recovery. Longer recovery periods were associated with more severe initial injuries. Although the use of IONM correlated with somewhat better outcomes, the small sample size limited statistical certainty. **Conclusion:** White Cord Syndrome is a rare but critical complication that can dramatically affect postoperative recovery. Close attention to preoperative imaging, comorbidity management, and early postoperative care may help improve outcomes.

ID: AGS26/667
P0904: Propensity-matched analysis of anticoagulation in lumbar spine surgery: increased complications without VTE benefit in decompressions, equivocal in fusions

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Introduction: The use of anticoagulation in spine surgery remains debated due to competing risks of thromboembolic events versus surgical complications. Anatomical location and need for instrumentation introduce distinct risk profiles often overlooked when spine surgery is considered as a whole. Prior studies have been limited by small sample sizes, retrospective designs, and unclear anticoagulation indications. Prescribing differences between orthopedic and neurosurgery services at our institution, combined with prospectively collected outcomes, created a natural experiment to address this question. **Material and Methods:** A multicenter prospectively collected database was queried for all patients treated at a tertiary care institution from 2013–2023. Chart review confirmed adherence to service-specific prescribing patterns. Patients with prior DVT or hypercoagulable conditions were excluded. Propensity score matching balanced baseline characteristics. Composite outcomes for overall and neurologic complications were created. T-tests and Chi-square tests were used for continuous and categorical variables, respectively. Binary logistic regression with Firth correction was employed for rare events. **Results:** The matched cohort included 1,722 patients (861 per group), with a mean age of 63 years, 89% White, and 58% male. Overall complication rates were similar between anticoagulated (AC) and non-anticoagulated (NAC) patients (33.4% vs. 30.4%, $p = 0.18$). DVT (1.2% vs. 0.7%, $p = 0.315$), PE (0% vs. 0.3%, $p = 0.083$), and hematoma requiring reoperation (0.2% vs. 0.9%, $p = 0.057$) were low and nonsignificant. However, AC patients had higher rates of wound dehiscence (2.1% vs. 0.6%, $p = 0.006$), CSF leaks (4.8% vs. 1.9%, $p = 0.001$), neurogenic bowel/bladder dysfunction (1.0% vs. 0.2%, $p = 0.034$), urinary retention (6.9% vs. 3.6%, $p = 0.002$), and longer hospital stays (3.90 vs. 1.94 days, $p < 0.001$). Discharge to skilled nursing facilities was more frequent in AC patients (12.1% vs. 6.6%, $p < 0.001$). Return to OR within 90 days was higher in the NAC group (5.5% vs. 3.5%, $p = 0.047$). In the lumbar decompression subgroup ($n = 883$), AC patients had significantly higher rates of any

complication (32.7% vs. 22.3%, $p < 0.001$), neurologic complications (9.9% vs. 4.1%, $p < 0.001$) and new weakness (9.3% vs. 3.6%, $p < 0.001$), Lumbar fusion patients showed no significant differences in complication rates, though return to OR remained higher in NAC ($p = 0.039$). Logistic regression identified time to discharge (OR = 1.22, $p < 0.001$) and prior spine surgery (OR = 1.73, $p < 0.001$) as consistent predictors of overall and neurologic complications. Coronary artery disease (OR = 1.59, $p = 0.013$) increased risk; Asian race was protective (OR = 0.113, $p = 0.039$). Within the decompression subgroup, anticoagulant use independently predicted neurologic complications (OR = 2.57, $p = 0.026$. **Conclusion:** Anticoagulation in lumbar spine surgery was associated with increased complications across multiple domains without reducing thromboembolic events. Risk was concentrated in lumbar decompression patients, while fusion patients showed no significant differences. These findings underscore the need to tailor anticoagulation strategies to individual patients and procedural factors, and raise questions about routine anticoagulation use in elective lumbar procedures.

ID: AGS26/711
P0905: Management of wound necrosis and dehiscence after spinal surgery: Collaboration between orthopaedic and plastic surgery

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Introduction: Wound complications after spinal surgery can have serious consequences, therefore early and aggressive management is necessary. However, it is difficult to construct a surgical plan due to the wide range of wound problems. We undertook a retrospective chart review of patients who underwent reconstruction of the back after spinal surgery. The goals of the study were to determine the patients managed with primary repair versus those who required flap reconstruction, and based on these results to develop an algorithm for the management of wound necrosis and dehiscence after spinal operations. **Material and Methods:** We collected information on patient demographics, the index spine operation, location and size of the necrosis or skin defect, comorbidities, types of wound problems, reconstructive methods, complications after repair, and follow up time. A reconstructive algorithm, based on a two layer (deep and superficial) repair was constructed. **Results:** Thirty two patients with mean age 38 (4-80) were reconstructed. Most of the wounds (n = 18) were located in the thoracic area, followed by the lumbar (12), and cervical (n = 2). The index spinal operations were performed for scoliosis or other spinal deformities (n = 9), disc disease (n= 6), spinal stenosis (n = 10), vertebral fracture (n = 5), metastasis of prostate cancer (n = 1), and neural tube defect (n = 1). Necrosis or defect sizes ranged between 2x5 cm and 30x8 cm. The wounds were closed in a single operation in all patients. Overall there were 8 muscle flaps (five paraspinous muscular, two latissimus dorsi muscular, and one trapezius musculocutaneous), 5 fasciocutaneous flaps, and 20 skin only primary closures. One patient underwent implant removal 6 months later due to exposure of the prosthesis at another site. **Conclusion:** An algorithmic approach is useful to address the different requirements in post spinal surgery wound complications. Patients with an intact muscular layer and relatively minor skin losses can be salvaged with primary skin only repair, which is simple and aesthetically the most advantageous. Larger defects confined to the skin layer can be closed with local or regional skin flaps. Patients with exposed implants, active CSF leak, and history of radiotherapy require reconstruction of both the muscle and skin layers.

ID: AGS26/763
P0906: A postoperative variant of Bow-Hunter syndrome: dynamic subaxial vertebral artery compression following posterior cervical surgery

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Introduction: Bow-Hunter syndrome (BHS) is a rare form of vertebrobasilar insufficiency (VBI) caused by mechanical compression of the vertebral artery, most often triggered by head rotation [1-4]. While the majority of cases occur at the craniovertebral junction, postoperative subaxial variants are exceedingly uncommon [5]. We present a patient who developed a novel BHS-like syndrome characterized by cervical deformity and vertical vascular compression following posterior cervical surgery involving facet cage placement and decompression**. Case Description:** A 50-year-old male with ankylosing spondylitis underwent posterior cervical decompression with bilateral facet cage placement at C4-6 in another hospital for cervical stenosis and spondylolisthesis. Due to persistent symptoms, a revision procedure was performed, during which the right-sided cages were removed (Figure 1). Two weeks later, the patient began experiencing recurrent vertigo and syncopal episodes exclusively when transitioning to a sitting position**.** On admission, neurological examination revealed tetraparesis (upper extremities 2/5, lower extremities 3/5). CT angiography demonstrated coronal imbalance and listhesis with a dominant right vertebral artery loop at C4-5 (Figure 2-3). Symptom relief was observed with the application of a large Philadelphia cervical collar providing partial traction, further supporting the diagnosis of posture-dependent vertebrobasilar insufficiency. **Results:** The patient subsequently underwent anterior cervical discectomy and fusion (ACDF) from C4 to C7**,** with PEEK cages restoring alignment

and decompressing the vertebral artery. Postoperatively, all syncopal and vertigo episodes resolved completely**.** Follow-up CT angiography demonstrated correction of the coronal deformity and elimination of vertebral artery loop compression, while MRI confirmed resolution of foraminal narrowing (Figure 4-5-6). **Conclusion:** This case illustrates a rare postoperative variant of Bow-Hunter syndrome in which vertebral artery compression was induced by cervical deformity following posterior cervical surgery. Unlike classical BHS, symptoms were triggered not by head rotation but by vertical loading during postural change (sitting)**.** Recognition of this unusual mechanism is critical, as timely anterior decompression and fusion achieved both radiographic correction and complete clinical recovery. Surgeons should maintain a high index of suspicion for vertebrobasilar insufficiency in patients-particularly those with underlying rheumatologic disease-who present with unexplained vertigo or syncope after posterior cervical procedures.

References

1. Spetzler RF, Hadley MN, Martin NA, Hopkins LN, Carter LP, Budny J. Vertebrobasilar insufficiency. Part 1: Microsurgical treatment of extracranial vertebrobasilar disease. J Neurosurg. May 1987;66(5):648-61. doi:10.3171/jns.1987.66.5.0648

2. Sorensen BF. Bow hunter's stroke. Neurosurgery. May-Jun 1978;2(3):259-61. doi:10.1227/00006123-197805000-00013

3. Nagashima C. Surgical treatment of vertebral artery insufficiency caused by cervical spondylosis. J Neurosurg. May 1970;32(5):512-21. doi:10.3171/jns.1970.32.5.0512

4. Bakay L, Leslie EV. Surgical treatment of vertebral artery insufficiency caused by cervical spondylosis. J Neurosurg. Dec 1965;23(6):596-602. doi:10.3171/jns.1965.23.6.0596

5. Shimizu T, Waga S, Kojima T, Niwa S. Decompression of the vertebral artery for bow-hunter's stroke. Case report. J Neurosurg. Jul 1988;69(1):127-31. doi:10.3171/jns.1988.69.1.0127

ID: AGS26/778

P0907: Increased risk of venous thromboembolism following posterior versus anterior cervical spine fusion: a propensity-matched cohort study

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Introduction: Venous thromboembolism (VTE) remains a potentially dangerous postoperative complication in spine surgery, with limited data comparing procedure-specific risk across surgical approaches. This study aimed to compare VTE incidence following anterior cervical discectomy and fusion (ACDF) versus posterior cervical decompression and fusion (PCDF), using a large, multicenter database. **Materials and Methods:** A retrospective, multicenter cohort study was conducted using the TriNetX database. Adult patients undergoing single- or multi-level ACDF or PCDF between 2004 and 2024 were identified using Current Procedural Terminology (CPT) codes. Patients with prior VTE, thrombophilia, or prior cervical spine surgery were excluded. Propensity score matching (1:1) was performed based on demographics, comorbidities, and anticoagulation use. Primary outcomes included 30- and 90-day incidence of VTE events (pulmonary embolism, upper and lower extremity deep venous thrombosis [DVT]) and postoperative bleeding complications. Differences between PCDF and ACDF were reported as odds ratios (ORs) with 95% confidence intervals (CIs). **Results:** A total of 4,381 patients were included in each single-level cohort, and 15,577 patients in each multi-level cohort. Compared to single-level anterior cervical discectomy and fusion (ACDF), single-level posterior cervical decompression and fusion (PCDF) was associated with significantly increased odds of venous thromboembolism (VTE) at both 30 days (OR: 1.96, 95% CI: 1.28-2.94; $p = 0.001$) and 90 days (OR: 2.05, 95% CI: 1.43-2.94; $p < 0.001$). Similarly, multi-level PCDF was associated with higher odds of VTE compared to multi-level ACDF at 30 days (OR: 3.83, 95% CI: 3.13-4.76; $p < 0.001$) and 90 days (OR: 3.97, 95% CI: 2.94-4.76; $p < 0.001$). No significant differences in postoperative bleeding complications were observed between groups. **Conclusion:** PCDF was associated with increased VTE complications with no differences in postoperative bleeding events when compared to ACDF. These findings underscore the need to reconsider existing VTE prophylaxis strategies for posterior cervical surgery. Incorporating surgical approach into risk stratification algorithms may help optimize outcomes by balancing thrombotic and bleeding risks. Further research is needed to refine chemoprophylaxis protocols and assess the clinical impact of VTE events in this patient population.

ID: AGS26/801

P0908: Bedside sarcopenia screening in resource-limited settings: a pragmatic tool for reducing spinal surgery complications

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Introduction: Sarcopenia screening in low-resource settings remains unvalidated. This study demonstrates that bedside functional measures achieve accuracy comparable to MRI. To validate a low-cost sarcopenia screening tool and quantify its prognostic value for postoperative complications. **Material and Methods:** Retrospective cohort study of 650 patients undergoing spinal surgery (2022.1-2023.12) at a county

Chinese hospital. Interventions: Bedside screening (grip strength + gait speed) vs MRI-based assessment. **Results:** Sarcopenia increased risks of adjacent fractures (16.7% vs 5.2%; adjusted odds ratio (aOR) = 3.21), implant failure (11.4% vs 3.1%; aOR = 2.89), and deep infection (5.3% vs 1.0%; aOR = 4.12). Bedside screening (grip strength + gait speed) achieved AUC = 0.79, comparable to MRI. **Conclusions:** This first surgical cohort validation demonstrates that bedside screening reduces costs by 60% while matching MRI accuracy, providing a cost-effective and equitable strategy for LMICs.

ID: AGS26/832
P0909: Incidence of pseudarthrosis in osteoporotic patients after posterior lumbar arthrodesis from 2014-2024 at the centers for diagnosis and advanced medicine and medical conferences and telemedicine (CEDIMAT), Dominican Republic

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Introduction: Pseudarthrosis is a significant complication following posterior lumbar arthrodesis, with a reported incidence of approximately 9.8%. Osteoporosis is a known risk factor for mechanical complications after spinal fusion, yet its impact and the predictive utility of diagnostic tools like Hounsfield Units (HU) from computed tomography (CT) scans remain understudied in the Dominican Republic. This study aims to determine the incidence of pseudarthrosis in osteoporotic patients after lumbar arthrodesis at a single center and to identify predominant risk factors, including the predictive value of Hounsfield Units compared to DEXA T-scores. **Material and Methods:** A retrospective, analytical cohort study will be conducted. Medical records of patients who underwent posterior lumbar arthrodesis at CEDIMAT between 2014 and 2024 will be reviewed. Inclusion criteria comprised patients with pre-surgical CT scans and bone densitometry (DEXA), while those with tumors, previous fractures, trauma, or prior lumbar surgery were excluded. Variables analyzed included demographic data, comorbidities (smoking, diabetes, hypertension), Surgical techniques, osteoporosis diagnosis including Treatment and its duration, and radiological parameters (HU values and DEXA T-scores). Data collection was performed using a standardized form. Statistical analysis included descriptive statistics, Chi-square tests, ANOVA, Pearson's correlation, and binary logistic regression to identify predictors of pseudarthrosis. **Results:** Data collection is ongoing and the results will be available for presentation at the congress. **Conclusion:** This study is poised to significantly improve medical practice by translating its findings into direct, actionable clinical protocols, particularly within the Dominican Republic and similar healthcare settings. Primarily, it addresses a critical local gap by providing the first high-quality evidence on the incidence and specific risk factors for pseudarthrosis following lumbar fusion in an osteoporotic population, thereby empowering surgeons at CEDIMAT and nationally to develop standardized guidelines mandating pre-operative bone health assessment for at-risk patients. A key anticipated outcome is the validation of Hounsfield Units (HU) from routine CT scans as a superior, cost-effective predictor of pseudarthrosis compared to formal DEXA scans; this would offer an accessible diagnostic tool that requires no additional cost or radiation, greatly enhancing risk stratification, especially in resource-conscious environments. By enabling the identification of high-risk patients beforehand, the study directly supports pre-operative optimization through osteoporosis treatment, allows for better-informed surgical planning and patient counseling, and ultimately aims to reduce the need for costly and complex revision surgeries. Consequently, this research promises to elevate the standard of care, improve surgical outcomes, reduce healthcare costs, and improve patient safety and quality of life by moving from a reactive to a proactive, preventive model in spinal surgery.

Keywords: Pseudarthrosis, Osteoporosis, Spinal Fusion, Lumbar Vertebrae, Hounsfield Units, Risk Factors, Dominican Republic.

ID: AGS26/854
P0910: Risk factor analysis for cement leakage during PKP and validation of a comprehensive prevention strategy in a county hospital setting: a real-world study of 1000 procedures

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Introduction: Cement leakage is the most frequent complication of PKP, potentially leading to serious consequences such as neurological deficits or pulmonary embolism. Most existing risk models are derived from tertiary care centers, and their applicability in resource-conscious county hospitals remains unverified. This study aims to identify independent risk factors relevant to our setting and validate the effectiveness of a comprehensive prevention protocol. **Material and Methods:** We retrospectively analyzed our database of

1000 PKP procedures performed between 2018 and 2023. Patients were stratified into leakage and non-leakage groups based on intraoperative imaging. Potential risk factors were evaluated, including patient demographics (age, sex, BMI), fracture characteristics (level, posterior wall integrity, chronicity), and surgical factors (approach, cement viscosity, injection timing). Multivariate logistic regression identified independent risk factors. Based on these findings, a comprehensive prevention strategy-emphasizing **refined preoperative assessment, precise intraoperative control of cement viscosity and timing, and a standardized real-time fluoroscopy monitoring protocol**-was implemented in mid-2022. Leakage rates were prospectively compared before and after implementation. **Results:** The overall cement leakage rate was 8.5% (85/1000). Multivariate analysis identified breach of the posterior vertebral wall (OR = 4.21, $p < 0.001$), fracture level (thoracolumbar junction vs. lumbar, OR = 2.15, $p < 0.05$), and low-viscosity cement usage (OR = 3.78, $p < 0.001$) as independent risk factors. Following the implementation of the strategy, the leakage rate significantly decreased from 10.8% to 5.1% ($p < 0.01$). **Conclusion:** Breach of the posterior wall, thoracolumbar junction fractures, and use of low-viscosity cement are independent risk factors for cement leakage during PKP. A tailored, comprehensive prevention strategy based on these factors can significantly mitigate leakage risk in a county hospital setting. This protocol demonstrates high clinical practicality and transferability.

ID: AGS26/961
P0911: Minimally invasive tubular decompression versus traditional open surgery for lumbar spinal stenosis: a systematic review and meta-analysis

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Introduction: Lumbar spinal stenosis (LSS) is often treated with surgical decompression to relieve symptoms and improve quality of life. While open laminectomy is effective, it requires soft-tissue disruption and prolongs recovery. Minimally invasive (MI) tubular decompression aims to reduce tissue trauma, shorten hospital stay, and lower complications. Our objective is to compare clinical outcomes, perioperative characteristics, and complication rates of MI tubular decompression and open laminectomy for symptomatic LSS. **Material and Methods:** Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, we conducted a systematic review and meta-analysis by searching PubMed, Embase, and Cochrane Central Register of Controlled Trials (CENTRAL) for studies from 2015 to April 2025 comparing MI tubular-assisted and open decompression for LSS. Primary outcomes included complications, perioperative parameters, and patient-reported outcome measures (PROMs). **Results:** From 2,853 screened articles, nine studies comprising ten cohorts were included. MI tubular surgery significantly reduced overall complications (odds ratio [OR] 0.42, 95% confidence interval [CI] [0.21; 0.86], $p = 0.0165$), surgical site infections (OR 0.28, 95% CI [0.11; 0.69], $p = 0.0055$), estimated blood loss (EBL; mean difference [MD] -46.65 mL, 95% CI [-80.89; -12.41], $p = 0.0076$), and hospital length of stay (LOS; MD -1.39 days, 95% CI [-1.99; -0.79], $p = 0.0001$). No significant differences were found in reoperation rates, surgical time, dural tears, or improvements in PROMs, with the exception of back pain assessed by the Visual Analog Scale (VAS-B). While the random-effects model showed no significant change in VAS-B scores, the common-effect model revealed a significant reduction (MD = -0.66, 95% CI [-0.88; -0.45], $p < 0.0001$). **Conclusion:** MI tubular surgery showed significantly reduced overall complication rates, rates of surgical site infections, EBL, and hospital LOS compared to open surgery. Additionally, results indicate a favorable trend in reducing VAS-B scores. These findings strongly support MI tubular-assisted decompression as the preferred surgical approach versus open decompression for LSS.

ID: AGS26/1070
P0912: Postoperative chyle-related complications in lumbar spine surgery: a systematic review of risk factors, management approaches, and clinical outcomes

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Introduction: Postoperative chyle-related complications in lumbar spine surgery are rare and pose significant diagnostic and management challenges. Delayed diagnosis can lead to severe complications, including nutritional deficiencies, infection, and prolonged recovery. This systematic review aims to provide a comprehensive analysis of all reported cases of chyle-related complications in lumbar spine surgery, to better understand the demographics, clinical presentations, management options, and outcomes associated with this rare complication. Additionally, we propose a diagnostic and management algorithms based on the evidence generated from this review and the relevant literature. **Material and**

Methods: We conducted a systematic search using PubMed, Embase, and Scopus to identify articles on postoperative chyle-related complications in lumbar spine surgery. Case reports, series, and observational studies were included. We excluded studies involving thoracic duct injuries, abnormal lymphatic system conditions, and those with insufficient clinical data. Two reviewers independently screened the articles for inclusion. Data was extracted on demographics, surgical details, clinical presentation, management, and outcomes. **Results:** We included 25 studies with a total of 55 patients. The mean age was 60.1 years, with 58.2% being female. Spinal deformity was the most common surgical indication (51.9%), followed by degenerative spine disease (25%). The majority of patients (95.3%) underwent an anterior lumbar spine approach. The most common chyle-related complication was isolated intra-abdominal lymphocele (90.9%). Abdominal swelling (52.7%) and pain (45.4%) were the most common presenting symptoms, with a median onset of 14 days postoperatively. Computed tomography was the most frequently used diagnostic tool (83.6%). Conservative treatment with observation or percutaneous drainage and dietary modification was started in (83.6%), with a success rate of (81.7%). Regardless of the initial treatment, most patients (93%) experienced complete resolution, with a few recurrences requiring further intervention. **Conclusion:** Postoperative chyle-related complications following lumbar spine surgery are rare, but early diagnosis and intervention are crucial for achieving favorable outcomes. We believe that this systematic review and algorithms summarize the existing literature and provides an up-to-date understanding of the presentation, management, and outcome of this condition.

ID: AGS26/1104
P0913: Usefulness of spinal anesthesia in spine surgery for elderly patients

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Introduction: Spinal surgery in patients for whom general anesthesia is difficult, such as the elderly or those with compromised cardiopulmonary function, poses significant challenges in perioperative management. We evaluated the efficacy and safety of performing spinal surgery using spinal anesthesia in elderly patients deemed high-risk for general anesthesia. **Subjects:** Eight cases undergoing spinal surgery at our institution between October 2023 and July 2025, deemed high-risk for general anesthesia and thus performed under spinal anesthesia. Ages ranged from 74 to 90 years (mean 86.0 years); 3 males and 5 females. Underlying conditions included cardiac disease (4 cases), respiratory disease (2 cases), and neurological disease (2 cases). Surgeries included: L4/5 posterior decompression (2 cases), L1 BKP (3 cases), L3 BKP (1 case), L5 BKP (1 case). All patients were ASA-PS Class III. **Methods:** Spinal anesthesia was administered by an anesthesiologist using 0.5% isobaric bupivacaine. Dexmedetomidine was used as a sedative adjunct during surgery as needed. The presence of intraoperative and perioperative complications was evaluated. **Results:** None of the 8 patients experienced unstable respiratory or circulatory status during surgery, and no cases required conversion to general anesthesia. No nausea, vomiting, or delirium was observed. Furthermore, no serious complications occurred. **Discussion:** Spinal anesthesia preserves spontaneous breathing and maintains stable hemodynamics, allowing safe implementation even in patients difficult to anesthetize under general anesthesia. While spinal anesthesia has been reported to reduce perioperative complications compared to general anesthesia in elderly patients with proximal femoral fractures, similar benefits are likely achievable in spinal surgery for short-duration, localized procedures. However, spinal anesthesia has limited applicability for lengthy fixation procedures or multi-level spinal surgeries. Challenges remain regarding adjustment of the anesthetic block and unexpected prolongation of surgery time, necessitating careful case selection. Although the number of cases in this study was limited, it suggests spinal anesthesia may be a viable option for patients with general anesthesia contraindications. **Conclusion:** Spinal anesthesia may be a viable option for spinal surgery in elderly patients and those with contraindications to general anesthesia. Future studies with larger case numbers are needed to further clarify its indications and limitations.

ID: AGS26/1167
P0914: Post-op complications after thoracic and lumbar spine long-fursion surgery in children: what does Clavien-Dindo classification show?

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Introduction: Correction of spinal deformities in children with a long (4+ instrumented spinal segments) fusion associates with a risk of perioperative complications. However, in rutine practice, some events are systematically not registered

and analyzed. The Clavien-Dindo classification (CDC) provides a standardized framework for grading surgical complications. The aim of this study was to assess perioperative and early postoperative complications after long spinal fusion in pediatric patients and to identify risk factors for severe complications. **Material and Methods:** A retrospective single-center cohort study included 136 children (1-17 years, mean 11.7 ± 4.6) consecutively operated between 2020 and 2023 on thoracic and lumbar spine deformities - idiopathic (50), congenital (61), syndromic (5) , neuromuscular (14) scoliosis, and Scheuermann's kyphosis(6), - with open posterior fixation instrumentation on a 4+ motion segments. Complications were classified according to Clavien-Dindo. Statistical analysis evaluated associations between patient/surgical factors and complications grade IIIB or higher.Patients with short-fusion (ex. hemivertebra exision) were exluded. All complication were registed from medical charts by independent reseacher whom not participate in the treatment of patients. **Results:** Overall, 55 complications/events were documented (40.4%). The majority were grade I-II (41; 30.1%), not affecting treatment tactics. Complications of grade III-IV occurred in 13 cases (9.6%), including 10 grade IIIB (stability failures, early surgical site infections, neurological deterioration), and 1 grade IVA (massive intraoperative blood loss with hemodynamic instability). One patient (0.7%) died from pulmonary embolism (grade V). Risk analysis revealed that insurtion of 18+ pedicle screws significantly correlated with prolonged surgery, increased intraoperative blood loss, and higher risk of grade IIIB-IVA complications ($p < 0.05$). Etiology of deformity, sex, age, and underweight were not associated with severe peri- and early post-op complications. **Conclusion:** Clavien-Dindo classification in pediatric spinal deformity surgery with a long fusion provides a comprehensive and reproducible assessment of complications. Most complications were minor (grades I-II), nearly 10% required active surgical or intensive care management (grades IIIb - V according CDC). The number of anchor elements (>18) was the most important predictor of severe complications correlated with continious surgery and blood loos.

ID: AGS26/1196
P0915: External anal sphincter monitoring in spine surgery: enhanced amplitude with coccygeal reference and comparative effects of needle versus seal electrodes

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Introduction: Intraoperative monitoring of the external anal sphincter (EAS) helps detect sacral nerve injury during spine surgery, but conventional placement of two needle electrodes within the sphincter often produces small or absent responses. We investigated whether using the coccyx as the reference electrode increases signal amplitude and compared needle versus adhesive coccygeal electrodes. **Material and Methods:** First, we reviewed 28 spine surgeries monitored with both the traditional double-needle method and a single-needle EAS recording using a coccygeal adhesive (seal) reference. Recordability and peak-to-peak amplitudes were compared. Next, ten consecutive patients underwent transcranial Br-MsEP monitoring with the recording needle in the EAS and the reference electrode either a needle inserted into the coccyx or an adhesive seal. We analysed peak-to-peak amplitude, onset latency and waveform morphology. **Results:** In the retrospective series, recordable EAS responses were obtained in 23/28 cases (82%) with the coccygeal seal reference but only 9/28 cases (32%) with the double-needle method, and mean amplitude increased from 54.6 μV to 84.0 μV. In the prospective trial, mean amplitudes were 119.0 μV with the coccygeal needle reference and 105.8 μV with the seal reference; this difference was not significant ($p = 0.36$). Latencies and phase were identical, and only two patients showed minor waveform differences. No postoperative bladder or rectal dysfunction occurred. **Conclusion:** A single-needle EAS recording with a coccygeal reference yields more reliable and larger Br-MsEPs than the traditional double-needle method. The type of coccygeal reference (needle vs adhesive) does not significantly affect amplitude, although the needle tends to produce slightly larger signals. We recommend starting with an adhesive coccygeal reference for safety and cost reasons and switching to a needle reference only when amplitudes are inadequate.

ID: AGS26/1202
P0916: Recent COVID-19 infection increases risk of 90-day complications following single and multiple level lumbar spinal fusion: a propensity-matched analysis

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Introduction: The impact of recent COVID-19 infection on postoperative complications, specifically venous thromboembolism (VTE), following elective orthopedic procedures is increasingly recognized. However, it remains unclear whether postoperative VTE risk differs in patients with recent preoperative COVID-19 undergoing single versus multi-level lumbar fusion. This study aimed to evaluate 90-day postoperative VTE risk following single and multi-level lumbar fusion in patients with a recent COVID-19 diagnosis. **Material and Methods:** Using the

TriNetX global electronic health record database, we identified adults 18 years and older who underwent single or multi-level lumbar arthrodesis between February 1, 2020, and February 1, 2025. Patients with a COVID-19 diagnosis within 30 days prior to surgery were compared to controls without recent infection. Propensity matching accounted for demographics and comorbidities. Primary outcomes included VTE, deep and superficial surgical site infection (SSI), emergency department (ED) visits, readmission (after postoperative day five), wound dehiscence, pneumonia, acute respiratory failure, acute respiratory distress syndrome, intubation, myocardial infarction, pericarditis, acute renal failure, sepsis, and stroke. Outcomes were assessed at 90 days using risk ratios (RR) and 95% confidence intervals (CI). Significance was defined as $p < 0.05$. **Results:** There were 334 matched pairs in the single-level fusion analysis. The study group was 51.2% female and 45.2% male, with mean age 61.6 ± 12.9 years. Recent COVID-19 infection within 30 days of single-level fusion was associated with increased ED utilization (RR 1.621, 95% CI 1.047 - 2.510). No differences were observed for the remaining complications at 90 days. In the multi-level fusion analysis, 379 matched pairs were included. The study group was 43.3% female and 54.6% male, mean age 62.2 ± 14.8 years. Patients with recent COVID-19 were at increased risk of pneumonia (RR 3.300, 95% CI 1.650 - 6.599), acute respiratory failure (RR 3.400, 95% CI 1.704 - 6.782), acute renal failure (RR 2.364, 95% CI 1.185 - 4.715), and readmission (RR 1.436, 95% CI 1.179 - 1.750). No other significant differences were found. **Conclusion:** VTE risk did not differ between COVID-19 positive and negative patients in either group. However, recent infection was associated with increased ED use after single-level fusion and elevated respiratory, renal, and readmission risks following multi-level fusion. These findings suggest additional antithrombotic prophylaxis is not warranted, though vigilance for pulmonary and renal complications is advised.

ID: AGS26/1242
P0917: Risk factors of surgical site infection after posterior fixation of thoracolumbar junction fractures

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Introduction: Thoracolumbar junction fractures are among the most frequent spinal injuries requiring surgical management. Despite improvements in surgical techniques and perioperative care, postoperative infection remains one of the most feared complications, as it may compromise fixation stability, prolong hospitalization, and impair functional recovery. Reported infection rates after thoracolumbar fracture surgery vary between 2% and 10%. Identifying risk factors is therefore essential to guide perioperative prevention strategies. The objective of this study is to determine the risk factors for surgical site infection after posterior instrumentation of thoracolumbar junction fracture. **Material and Methods:** We conducted a retrospective study of 120 patients operated on for thoracolumbar junction fractures in our Department of Orthopedic Surgery between January 2010 and January 2020. All patients were treated by posterior fusion assembly using short, long, or mixed assembly. Infections were classified as early (< 30 days) or late (≥ 30 days). Demographic variables, comorbidities, fracture patterns, surgical characteristics, and perioperative complications were analyzed. Statistical analysis included calculation of odds ratios (OR) with 95% confidence intervals (CI). **Results:** Seven cases of postoperative infection were recorded (incidence 5.8%), including 4 early infections. We found that diabetes was a significant independent risk factor (OR = 15.15; 95% CI: 2.7-84.89; p = 0.02). In addition, postoperative urinary tract infection was also strongly associated with surgical site infection (OR = 20.4; 95% CI: 3.38-123.51; p = 0.04). Other variables such as age > 60 years, sex, obesity/overweight, fracture characteristics, and the type of fixation (short, long, or mixed constructs) had not a statistically significant impact on the risk of infection. Furthermore, no associations were found between the neurological deficit, pedicular fractures, associated chest injury, laminectomy, or grafting and the risk factors for surgical site infection. **Conclusion:** Although relatively infrequent, postoperative infections after thoracolumbar fracture surgery carry considerable morbidity. Our findings highlight diabetes and urinary tract infection as major risk factors. These results emphasize the importance of thorough preoperative assessment, optimization of glycemic control, and systematic screening and treatment of urinary tract infections before surgery. Preventive measures targeting these modifiable factors may contribute to reducing postoperative infectious complications and improving surgical outcomes in thoracolumbar fractures.

ID: AGS26/1250
P0918: Lumbar artery pseudoaneurysm after transpedicular fixation of thoracolumbar tuberculous spondylitis: case report

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Introduction: Injury of the lumbar arteries after the use of transpedicular screws in spinal tuberculosis fixation is a relatively rare complication. In general, vascular complications of spinal instrumentation incidence have a range from 0.01% to 0,22 % with reported high morbidity and mortality. Lumbar arteries are small branches of vessel arising from abdominal aorta, iliac lumbar artery, or medial artery, which has a diameter of up to 2.6-2.9 mm. Due to its proximity from the main artery, it can cause a potentially fatal haemorrhage if not evaluated and treated properly. Most of cases have a rapid progression of disease with hemodynamic shock. We hereby report a patient with a retroperitoneal hematomas secondary to a pseudoaneurysm of lumbar artery iatrogenic injury due to pedicle screw fixation. **Material and Methods:** A 19-year-old female with moderate right flank to abdominal pain was admitted to our department. He had already undergone Th12/L1 and L3/L4 transpedicular fixation using the free-hand technique at previous hospital. The symptoms are also accompanied by slowly progressing bulging mass on her right side of the abdomen. Initial clinical evaluation upon arrival to our department as follows: heart rate was 140 beats per minute with systolic / diastolic blood pressure 85/60 mmHg. The physical examination revealed abdominal pain with bloating, low back pain, with no sign of neurological deficit of lower extremities. Laboratory finding shows low level of Haemoglobin (6.5 g/dl). **Results:** After the patient was considered stable following resuscitation, we conduct a serial radiographic survey to determine the cause of hypovolemic shock. An initial urgent MRI with contrast of the abdomen shows a large volume retroperitoneal accumulation of fluid that have a mixed intensity of abscess and haemorrhage segment. Further investigation with CT angiography reveals lumbar artery pseudoaneurysm just posterior to right renal artery. The patient was referred to the interventional-radiology department where arteriography was performed and followed by embolization of the pseudoaneurysm. Due to large volume of retroperitoneal abscess and haemorrhage (1500 cc), we perform clot and abscess evacuation through right lateral lumbotomy, and a large amount of consolidated clot was found at retroperitoneal space. After several days, the patient's symptoms and general performance improved significantly. She started walking by herself with walker and was discharged. **Conclusion:** Lumbar artery pseudoaneurysm followed by retroperitoneal haemorrhage is a relatively rare complication faced in spinal instrumentation. Diagnosis can be difficult for many reasons by its nonspecific and delayed presentation of symptoms and signs, that renders unawareness of this condition. A hemodynamically unstable patient with a large retroperitoneal hematoma and no obvious intraabdominal injury should undergo urgent arteriography. Simultaneous embolization should be considered to halt the disease progression.

ID: AGS26/1264

P0919: Polyethylene glycol (PEG) coated collagen pad (Hemopatch) as a dural sealant, with or without primary sutures in uniportal endoscopic spine surgery: early experiences and a technical note

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Introduction: Dural tears during spinal surgery are a significant challenge, especially with the increasing use of endoscopic techniques, which are prone to such injuries due to their small working channels. Hemopatch, composed of a protein-reactive polyethylene glycol (PEG) monomer with a bovine-derived collagen backing, is designed for dural repair. When applied, its active PEG binds to tissue proteins, promoting rapid hemostasis and forming a barrier to prevent cerebrospinal fluid (CSF) leakage. This study shares our experience using Hemopatch for endoscopic spinal dural repairs and reviews the relevant literature. **Material and Methods:** We describe a series of patients in whom Hemopatch was used intra-operatively. The first 2 of these patients, hemopatch was used as a primary repair agent while in 2 others, it was used as an add-on pad after the primary suture under full endoscope. We also describe the surgical technique of patch placement and primary dural repair under endoscopic system. **Results:** Four patients with an average age of 64.8 ± 33 years underwent full endoscopic lumbar decompression or discectomy for lumbar degenerative spine issues. The dural tear was successfully closed in all cases. Hemopatch was used in all cases, and in 2 cases, primary suturing with prolene was performed before applying the dural sealant. A Valsalva maneuver was performed, showing no leakage after repair. Immediately after surgery, there were no symptoms related to dural leakage. Only one patient experienced mild dizziness without headache on postoperative day 1, which subsided the next day, allowing discharge on postoperative day 2. All patients were followed up for more than 6 months, and there were no complications related to cerebrospinal fluid leakage, infection, wound dehiscence, wound swelling, or postdural puncture headaches. **Conclusion:** Dural injury is a significant and challenging issue in endoscopic spine surgery. In this case series, all dural defects were effectively closed using the described technique, and no subsequent complications occurred. The use of Hemopatch, either with or without primary repair, could be a successful alternative sealant for dural tears in full endoscopic spine surgery.

ID: AGS26/1407
P0920: Negative pressure wound therapy in spine surgery: enhancing healing, reducing infections, and navigating the challenges

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Introduction: Surgical site infections (SSIs) in spinal surgery pose a major challenge, incidence remains high despite standard preventive measures. Negative pressure wound therapy (NPWT) has gained attention as a strategy to reduce infection rates, enhance wound healing, and minimize the need for reoperations. **Material and Methods:** A narrative review of the current literature was conducted, focusing on clinical applications, outcomes, and limitations of NPWT in spinal surgery. Key studies evaluating infection rates, wound healing parameters, and complication profiles were analyzed. **Results:** Recent studies indicate that prophylactic NPWT in spinal fusion surgery may reduce SSIs by up to 40%. Additional benefits include improved wound stability, reduced dehiscence rates, and enhanced tissue perfusion. However, evidence remains mixed regarding cost-effectiveness and optimal duration of therapy. Reported complications include skin blistering, increased drainage, and, in rare cases, bleeding or retained dressing fragments. **Conclusion:** NPWT is a promising adjunct in spine surgery, particularly for high-risk patients undergoing extensive posterior instrumentation or revision procedures. While evidence supports its role in reducing SSIs and improving wound healing, cost considerations and patient selection criteria require further investigation to optimize clinical application.

ID: AGS26/1413
P0921: Ovarian vein thrombosis a complication in spine surgey: case report and literature reveiw

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Introduction: Ovarian vein thrombosis (OVT) is a rare vascular complication, usually associated with postpartum period or gynecological conditions. Its occurrence, as a postoperative event in spinal surgeries, is rare and represents a diagnostic challenge due to its nonspecific clinical presentation. **Case presentation:** We report the case of a 28-year-old woman with a history of juvenile idiopathic scoliosis who underwent two-stage thoracolumbar fusion. Three weeks after the second surgical procedure, the patient presented with abdominal pain and non-palpable mass sensation in the left abdomen. Contrast-enhanced computed tomography revealed bilateral pelvic varices and a filling defect in the right gonadal vein, consistent with OVT. Anticoagulant therapy with enoxaparin was initiated, followed by clinical monitoring with anticoagulation, with favorable clinical outcome and no complications. **Discussion:** In this case, risk factors for thrombosis were identified, suchas: postoperative immobility, opioid analgesia, and venous compression due to prolonged surgical positioning. The absence of gynecological and obstetric factors highlights the need to include OVT in the differential diagnosis of postoperative abdominal pain in young women. CT angiography was crucial for timely diagnosis and the prevention of major complications such as pulmonary thromboembolism. **Conclusion:** OVT can present itself as a rare postoperative complication in spinal surgery. Early recognition allows for effective treatment and prevention of adverse outcomes. This case highlights the importance of a comprehensive assessment of postoperative abdominal pain.

ID: AGS26/1443
P0922: Diabetic neuropathy and perioperative complications in anterior cervical discectomy and fusion

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Introduction: Diabetic neuropathy (DN), a common complication of longstanding diabetes mellitus (DM), has been linked to adverse musculoskeletal outcomes in prior literature. However, its role in perioperative risk following anterior cervical discectomy and fusion (ACDF) remains unclear. This study aims to evaluate DN as an independent risk factor for perioperative complications in ACDF and to compare outcomes among patients with DN, DM without neuropathy, and those without DM. **Material and Methods:** A retrospective analysis was performed on primary ACDF patients identified from the TriNetX database. DN and DM were identified by ICD-10 diagnostic codes. The primary outcomes were postoperative infection, postoperative spinal implant infection (PSII), mechanical complication, pseudoarthrosis, revision rates, deep venous thrombosis and pulmonary embolism rates, sepsis, wound disruption, and readmission. Propensity score matching was used to control for demographics and Charlson Comorbidity Index between cohorts. Between DM and DN

patients, hemoglobin A1c was also matched to control for severity of diabetes. Multivariate regression compared primary outcome rates among patients with DN, DM without neuropathy, and non-diabetic controls. Risk ratios (RR) were calculated for individual variables. Statistical significance was defined as $p < 0.05$. **Results:** A total of 30,210 patients, aged 40-90 years, who underwent primary ACDF were identified. After successful matching, there were three comparative cohorts with a population of 18,922 in DM vs no DM, 5,616 in DN vs DM, and 5,672 in DN vs no DM. DN patients had significantly increased risk of postoperative infection (RR 1.43; CI 1.05-1.95; p = 0.024), PSII (RR 1.47; CI 1.09-1.97; p = 0.011), revision (RR 1.23; CI 1.04-1.45; p = 0.016), sepsis (RR 1.92; CI 1.55-2.37; p < 0.001), wound disruption (RR 1.95; CI 1.33-2.87; p < 0.001), and readmission (RR 1.48; CI 1.33-1.65; p < 0.001) compared to patients without DM. DM patients had significantly increased risk of postoperative infection (RR 1.22; CI 1.01-1.48; p = 0.038), sepsis (RR 1.26; CI 1.1-1.44; p < 0.001), and readmission (RR 1.18; CI 1.11-1.25; p < 0.001) compared to patients without DM. Patients with DN had significantly increased risk of mechanical complication (RR 1.43; CI 1.11-1.84; p = 0.006), revision (RR 1.31; CI 1.12-1.55; p = 0.001), sepsis (RR 1.36; CI 1.14-1.62; p < 0.001), and readmission (RR 1.32; CI 1.19-1.47; p < 0.001) compared to patients with DM. **Conclusion:** DN is associated with a significantly increased risk of both surgical and medical complications following ACDF surgery, surpassing the risks observed in patients with DM alone. Compared to non-DM patients, those with DN showed markedly elevated rates of postoperative infection, PSII, revision, sepsis, wound disruption, and readmission. Even among diabetic patients, the presence of neuropathy significantly increased the risk of mechanical complication, revision, sepsis, and readmission. These findings underscore the importance of distinguishing DN from DM alone in preoperative risk assessment and highlight the need for tailored perioperative management strategies in this population.

ID: AGS26/1445
P0923: A comparison of opioid-inclusive anesthesia and opioid-sparing anesthesia in complication development post-anterior cervical discectomy and fusion

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Introduction: Opioid-inclusive anesthesia (OIA) has been a cornerstone of intraoperative management in spine surgery, but mounting evidence links perioperative opioids to immunosuppressive effects and histamine-mediated vasodilation that can precipitate intraoperative hypotension. This has prompted a shift toward opioid-sparing anesthesia (OSA). While prior spine studies suggest improved outcomes with OSA, its impact on perioperative complications in anterior cervical discectomy and fusion (ACDF) remains underexplored. This study compares complication rates between ACDF patients receiving OSA versus OIA to assess whether OSA is associated with a measurable reduction in perioperative risk. **Material and Methods:** A retrospective analysis was performed on primary ACDF patients identified from the TriNetX database. Patients were divided into groups based on if they received OSA or OIA. Anesthesia type (OSA or OIA) was identified from intraoperative anesthesia records. The primary outcomes were postoperative infection, postoperative spinal implant infection (PSII), rates of revision, deep vein thrombosis (DVT) and pulmonary embolism rates, sepsis, wound disruption, readmission, transfusion rates, and ileus. Propensity score matching was used to control for age, sex, BMI, in addition to other comorbidities and surgical conditions, ensuring similar cohorts. Multivariate regression compared primary outcome rates between the groups. Risk ratios (RR) were calculated for individual variables. Statistical significance was defined as p < 0.05. **Results:** A total of 94,785 patients, aged 40-90 years, who underwent primary ACDF surgery were included. After successful matching, we had 27,820 patients divided equally between OIA and OSA groups. Patients who received OSA during surgery had significantly decreased risk of revision (RR 0.88; CI 0.80-0.97; p = 0.012), pulmonary embolism (RR 0.67; CI 0.52-0.85; p < 0.001), sepsis (RR 0.71; CI 0.58-0.86; p < 0.001), readmission (RR 0.55; CI 0.52-0.58; p < 0.001), transfusion (RR 0.53; CI 0.42-0.67; p < 0.001), and ileus (RR 0.68; CI 0.53-0.88; p = 0.004) following ACDF. Other primary outcomes - including postoperative infection, PSII, wound disruption, and DVT - failed to show any difference in risk between OSA and OIA cohorts. **Conclusion:** OSA was associated with significantly lower risks of several serious perioperative medical and surgical complications, including revision surgery, pulmonary embolism, sepsis, readmission, need for transfusion, and postoperative ileus. Compared with OIA, OSA was associated with a 30-50% relative risk reduction for these complications. The findings suggest that OIA may pose a significant increase in perioperative complications throughout ACDF surgery, supporting the consideration of OSA as a preferred anesthetic approach to enhance postoperative outcomes while mitigating opioid-related risks.

ID: AGS26/1498
P0924: Comparative risk of spinal epidural hematoma following laminoplasty and laminectomy with fusion in patients with degenerative cervical myelopathy

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Introduction: Degenerative cervical myelopathy (DCM) is the leading cause of spinal cord dysfunction in adults, typically due to cervical spondylosis or ossified posterior longitudinal ligament (OPLL). Surgical decompression is indicated for patients with mild to severe DCM, with laminoplasty (LP) and laminectomy with fusion (LF) being two commonly employed posterior approaches. Although symptomatic epidural hematoma (EDH) is rare, it remains a potentially catastrophic complication that can result in paralysis or death. This study aims to compare the incidence, risk, and timing of EDH within 7 days following LP vs LF in patients with DCM. **Material and Methods:** The PearlDiver national database was queried to identify patients with DCM who underwent LP or LF from 2010 to 2023. Patients with concomitant anterior cervical surgery were excluded. EDH occurring within 7 days postoperatively was identified using ICD coding. Secondary outcomes included hospital readmission, time to EDH presentation, and time from symptom onset to reoperation. Chi-squared testing was used to compare incidence between groups, and multivariable logistic regression was used to assess risk, adjusting for age, gender, Elixhauser Comorbidity Index (ECI), and presence of OPLL. **Results:** Among 104,170 included patients, 6,477 (6.2%) underwent LP and 97,693 (93.8%) underwent LF. The LP cohort was slightly older (61.81 vs 61.35, $p < 0.001$), had a lower mean ECI (7.03 vs 7.69, $p < 0.001$), lower proportion of females (37.33% vs 42.36%, $p < 0.001$), and a higher prevalence of OPLL (3.57% vs 2.15%, $p < 0.001$). The incidence of EDH was significantly lower in the LP group (0.29% vs 0.73%, $p < 0.001$), and multivariate regression confirmed a reduced risk of EDH with LP (aOR: 0.41, $p < 0.001$). Among patients who developed EDH, most cases occurred after discharge and required hospital readmission-68.4% in the LP group vs 81.3% in the LF group. The mean time to EDH presentation was 4.63 ± 2.03 days for LP and 3.91 ± 2.07 days for LF. The time from symptom onset to reoperation was 3.40 ± 2.22 days for LP and 3.13 ± 2.47 days for LF. **Conclusion:** Laminoplasty is associated with a significantly lower incidence and risk of postoperative epidural hematoma compared to laminectomy with fusion in patients with DCM. Given that most hematomas presented after discharge, strategies such as extended inpatient monitoring and perioperative risk mitigation-including delayed anticoagulation and use of surgical drains-should be considered for high-risk patients to minimize delays in diagnosis and optimize outcomes. While there was a significant difference in relative rates of EDH between treatment modalities, absolute risk only decreased by 0.44% in the LP group, owing to the relatively rare nature of this complication. In patients who may be deemed equipoise for LP or LF, laminoplasty may be favorable in those patients at higher risk for epidural hematoma including patients with underlying coagulopathy or patients who may require early postoperative anticoagulation due to cardiac comorbidities or venous thromboembolism risk factors.

ID: AGS26/1521
P0925: Perioperative complications following common spine procedures in patients with myasthenia gravis: a nationwide claims analysis

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Introduction: Myasthenia gravis (MG) is an autoimmune neuromuscular disorder characterized by fluctuating weakness and fatigability. While perioperative complications in MG have been described in general surgery and arthroplasty, outcomes after spine surgery remain poorly understood. Given the prevalence of spine surgery in older, comorbid patients, it is important to define the complication profile in MG. This study evaluated perioperative complications in MG compared with non-MG patients undergoing common spine procedures and compared anterior versus posterior cervical approaches. **Materials and Methods:** We performed a retrospective cohort study using the PearlDiver Mariner database (2010-2022). Adult patients undergoing one-level lumbar decompression, one-level lumbar fusion, one- to two-level anterior cervical discectomy and fusion (ACDF), and one- to two-level posterior cervical laminectomy with or without fusion were identified using CPT, ICD-9-PCS, and ICD-10-PCS codes. MG patients were identified by ICD-9/10 diagnosis codes prior to surgery. Controls were matched 1:3 based on age, sex, and comorbidity index. Outcomes included inpatient complications, 90-day readmissions and reoperations, and MG-specific complications such as perioperative myasthenic crisis. Univariate analysis was used to calculate odds ratios (OR). **Results:** After matching, MG cohorts included 306 lumbar fusions, 1,248 lumbar decompressions, 471 ACDF, and 116 posterior cervical procedures compared with appropriately matched controls. Baseline demographics were well balanced with standardized mean differences < 0.01, although MG patients demonstrated slightly higher comorbidity indices. For lumbar fusion, MG patients had higher rates of sepsis (3.9% vs < 1%, OR 4.12, $p = 0.001$). In the lumbar decompression cohort, MG patients experienced increased respiratory failure (4.8% vs 2.3%, OR 2.17), surgical site infections (SSIs, 2.6% vs 1.5%, OR 1.73), and readmissions (9.7% vs 6.3%, OR 1.60) (all $p < 0.05$). For ACDF, MG

patients had higher likelihood of anemia (10.2% vs 6.6%, OR 1.61), respiratory failure (4.9% vs 2.9%, OR 1.72), and re-admissions (7.2% vs 4.6%, OR 1.61) (all $p < 0.05$). Posterior cervical procedures had higher 90-day anemia (25.0% vs 15.8%, OR 1.78, $p = 0.027$). When directly comparing ACDF with posterior cervical laminectomy and fusion, posterior procedures were associated with higher rates of respiratory failure (12.1% vs 4.0%), anemia (21.6% vs 10.2%), and acute kidney injury (all $p < 0.05$). At 90 days, posterior patients continued to have more respiratory failure (12.1% vs 4.9%), anemia (25.0% vs 12.3%), acute kidney injury, and SSIs (all $p < 0.05$). Rates of readmission and myasthenic crisis were similar by approach. **Conclusion:** MG patients undergoing spine surgery face significantly higher risks of perioperative complications, including respiratory failure, sepsis, anemia, and readmission, with perioperative myasthenic crisis occurring exclusively in this population. Sub-analysis of cervical procedures showed that posterior approaches were associated with greater risks of respiratory, hematologic, and infectious complications compared with ACDF. These findings underscore the importance of tailored perioperative planning, vigilant monitoring, and careful surgical approach selection in MG patients to optimize safety.

ID: AGS26/1524
P0926: Sacroiliac joint fusion for treating lower back pain in patients with Ehlers-Danlos syndrome: case series

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Introduction: Sacroiliac joint (SIJ) fusion is a surgical option for individuals with SIJ dysfunction who have not experienced symptomatic improvement through non-surgical treatments. This approach may also be beneficial for patients with Ehlers-Danlos syndrome (EDS) who are more prone to acquiring SIJ dysfunction. The purpose of this study is to compile existing literature on patient outcomes following SIJ fusion for the treatment of lower back pain (LBP) secondary to SIJ dysfunction in EDS and to present a retrospective case series of this intervention using validated measures of pain, disability, and quality of life. **Material and Methods:** A search was conducted across three databases in April 2025. Studies from the past 10 years were included if they provided data on SIJ fusion for the treatment of LBP in EDS patients. Additionally, a retrospective case series looking at 17 SIJ fusion cases performed by one neurosurgeon across 10 EDS patients with a concomitant diagnosis of SIJ dysfunction was performed, analysing surgeries performed between July 2019 and December 202 4. The data analysed looked at demographics, procedural details, clinical outcomes, and complication rates. **Results:** Only one study, a case series, met the inclusion criteria for our literature review. Although this study measured outcomes related to pain, disability, and quality of life, these results were reported using a 'Satisfaction score' rather than validated questionnaires. The study did note nerve impingement due to implant malpositioning in one patient, and a lack of pain relief in another. Our case series assessed these outcomes using validated scales and found an improvement in all of them postoperatively compared to baseline. There were statistically significant improvements in pain, disability, and quality of life post-SIJ fusion according to the following PROMs: VAS back (Δmean = -2.643, $p < 0.001$), VAS leg, (Δmean = -1.929, $p < 0.001$), RMDQ (Δmean = -2.667, $p < 0.05$), and the EQ-5D-5L subcategories 'Mobility' (Δmean = -0.8462, $p < 0.05$) and 'Activities' (Δmean = -0.6923, $p < 0.05$). However, improvements in pain and disability according to ODI (Δmean = -3.647%, $p = 0.4630$), EQ-5D Overall (Δmean = +8.000, $p = 0.3340$), and the EQ-5D-5L subcategories 'Self-care' (Δmean = -0.4615, $p = 0.1390$), 'Pain' (Δmean = -0.6154, $p = 0.0876$) and 'Depression' (Δmean = -0.2308, $p = 0.5845$) were not statistically significant. **Conclusion:** Although evidence regarding the effectiveness of SIJ fusion for alleviating LBP in patients with EDS is limited, it may prove to be a beneficial treatment option. The results of our case series and the study included from the literature review show promising results for the benefits of this intervention in this subpopulation. A trial registry specific to EDS should be established to explore this further.

ID: AGS26/1577
P0927: Anterior wall perforation and cranially directed trajectory of pedicle screws are the risk factors for upper instrumented vertebral fracture after spinal fixation in patients with osteoporotic vertebral fracture

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Introduction: Spinal fixation in patients with osteoporotic vertebral fractures (OVF) is widely employed to reduce instability and facilitate early mobilization. However, upper instrumented vertebral fractures (UIVF) sometimes occur postoperatively, frequently necessitating revision surgery with cephalad extension of fixation due to pedicle screw loosening or cutout. This study aimed to elucidate the risk factors associated with UIVF following spinal fixation in OVF patients. **Material and Methods:** This retrospective cohort study included 49 patients who underwent spinal fixation for OVF between 2019 and 2025. Patients were divided into UIVF group (n=9, 18%) and non-UIVF group (n=40, 82%). Comparative analyses were conducted for demographic characteristics, preoperative vertebral height and angle, Hounsfield unit (HU) values of the UIV on CT, pedicle screw diameter and length at the UIV, occupancy rate of pedicle screw (ORPS)-defined as the ratio of pedicle screw length to the anteroposterior vertebral body diameter at the UIV, UIV pedicle screw-vertebral endplate angle (UIV-PVA) (positive values indicating cranially directed screws, negative values indicating caudally directed screws), and the presence of anterior wall perforation. **Results:** The mean patient age was 78 years (range, 55-92), with a mean follow-up of 23 months (range, 3-50). No significant differences were observed between groups in sex, body mass index, surgical time, estimated blood loss, length of hospital stay, preoperative vertebral height and angle, or CT-derived HU values. Although the degree of correction of the instrumented vertebral angle from preoperative to immediate postoperative measurements did not differ between groups, the UIVF group demonstrated a significant loss of correction at final follow-up ($p < 0.001$). Compared with the non-UIVF group, the UIVF group exhibited significantly longer pedicle screws (49 mm vs. 45 mm, p=0.027), higher ORPS (94% vs. 88%, $p = 0.01$), and more frequent anterior wall perforation (78% vs. 38%, $p < 0.001$). Furthermore, the UIVF group demonstrated significantly greater UIV-PVA (-3.8° vs. -9.7°, $p = 0.022$). Receiver operating characteristic (ROC) analysis identified a UIV-PVA cutoff value of -0.5°. **Conclusion:** These findings indicate that anterior wall perforation of the UIV due to long pedicle screw insertion and cranially directed screw trajectory are significant risk factors of UIVF following spinal fixation in patients with OVF. Meticulous intraoperative attention to screw length and upward angulation may mitigate the risk of postoperative UIVF.

ID: AGS26/1599
P0928: Cement leakage in cement-augmented pedicle screw instrumentation: a clinical analysis of 230 screws

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Introduction: Cement-augmented pedicle screws (CAPS) are useful devices for enhancing implant fixation in patients with osteoporosis. However, cement leakage is a frequent complication. This study investigated cement leakage associated with CAPS currently available in Japan, focusing on the systems available from Depuy Synthes and Medtronic. **Material and Methods:** Between 2023 and 2025, a total of 46 patients underwent spinal instrumentation with CAPS at our institution (mean age, 76.2 years; 21 males, 25 females; 154 screws by Depuy Synthes and 76 screws by Medtronic). Postoperative CT was used to evaluate the presence of cement leakage. The investigated parameters included patient demographics, overall leakage rates, laterality (right vs left), and spinal level (thoracic vs lumbar). Statistical analyses were performed using the chi-square test and the significance level was set at 0.05. **Results:** There were no significant differences in age (76.1 ± 6.9 years in the Depuy Synthes group vs 76.5 ± 7.5 years in the Medtronic group, $p = 0.65$) or sex ($p = 0.30$) between the two groups. The overall cement leakage rate was 29.1% (95% CI 23.2-35.0). Device-specific leakage rates were 24.0% (95% CI 17.3-30.7) in the Depuy Synthes group and 39.5% (95% CI 28.5-50.5) in the Medtronic group. Leakage rates according to laterality were higher on the right side in both groups: Depuy Synthes group (right 29.9% [95% CI 19.8-40.0] vs left 18.2% [95% CI 9.5-26.9]) and Medtronic group (right 47.4% [95% CI 31.6-63.2] vs left 31.6% [95% CI 16.7-46.5]), although these differences were not statistically significant. When analyzed in total, right-sided screws showed a significantly higher leakage rate than left-sided screws (35.7% [95% CI 26.9-44.4] vs 22.6% [95% CI 15.0-30.3]; OR 1.90, 95% CI 1.06-3.39, $p = 0.042$). Leakage rates according

to spinal region were significantly higher in the thoracic spine (35.7% [95% CI 26.8-44.6]) than in the lumbar spine (22.8% [95% CI 15.3-30.5]; OR 1.87, 95% CI 1.05-3.34, p = 0.04). **Conclusion:** Cement leakage in CAPS was predominantly observed in the thoracic spine and on the right side. These findings suggest that spinal level and screw trajectory should be carefully considered during preoperative planning and intraoperative procedures to minimize the risk.

ID: AGS26/1633
P0929: Pulmonary embolism after cement augmentation

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Introduction: Loosening and pullout of pedicle screws is a common problem in spine surgery. For this reason, pedicle screws are increasingly used in combination with cement augmentation, especially in osteoporotic bone. A feared complication is cement leakage into the venous system with subsequent pulmonary cement embolism. Evidence-based recommendations for dealing with these complications are rare. **Material and Methods:** In a 59-year-old patient with a burst fracture of the first lumbar vertebra, cement leakage into the inferior vena cava over a distance of 4 cm occurred during a spondylodesis with cement-augmented pedicle screws. After a literature review and a subsequent interdisciplinary discussion with a trauma surgeon, a vascular surgeon, an angiologist and an interventional radiologist, the most suitable procedure with the lowest possible patient risk was determined. **Results:** Cases of cement leakage are very rarely reported in the literature. Most cases are asymptomatic and the most common complication is pulmonary cement embolism. Treatment recommendations include observation, temporary oral anticoagulation, percutaneous interventional removal, and open procedures. In our case, due to the thromboembolic risk and the relatively young patient, we decided to attempt percutaneous cement removal by an interventional radiologist with a vascular surgeon and a cardiac surgeon on standby. After collecting the cement line with a snare, the cement became abnormal and migrated into the right atrium. From the right atrium, most of it could be secured piecemeal with the snare. However, a small portion caused peripheral pulmonary cement embolism. Within the first three months postoperatively, the patient remained asymptomatic on oral anticoagulation with Phenprocoumon. **Conclusion:** Recommendations for the treatment of cement leakage in augmented pedicle screws are only available on the basis of observations in small series and case reports. Prospective clinical studies are not expected in the near future. An interdisciplinary approach is essential for a satisfactory result.

ID: AGS26/1759
P0930: Vascular injury following two-level anterior lumbar interbody fusion: a large database analysis

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Introduction: Anterior lumbar interbody fusion (ALIF) is utilized for the management of degenerative lumbar pathology. It carries risk of vascular injury due to the anterior approach. To focus on cases with the greatest vascular exposure, we examined specifically two-level ALIF, where mobilization of the iliac vessels increases technical complexity. Reported rates vary widely in the literature, and large-scale, population-level data are limited. We aimed to characterize the incidence, risk factors, and outcomes associated with vascular injury following two-level ALIF using a large national, multi-insurance, administrative claims database. **Material and Methods:** We queried the PearlDiver Mariner database (2013-2022) for patients undergoing two-level ALIF, identified using CPT codes 22558 and 22585. Patients with arterial and venous injuries were identified using ICD-9/10 diagnosis codes. Demographics, comorbidities, and perioperative factors were collected, including age, sex, payer type, region, Charlson comorbidity indices, and social determinants of health. The primary outcomes of interest included intraoperative arterial injury, intraoperative venous injury, and all intraoperative vascular injuries, including undefined vascular injuries. Multivariable regression was planned to identify independent risk factors for vascular injury. **Results:** A total of 21,475 patients undergoing two-level ALIF were identified. The incidence of all intraoperative vascular injury was 0.44%, with 0.05% arterial and 0.35% venous. On multivariable analysis, regional differences were the only independent predictor of intraoperative vascular injury. Significant associations were observed for the Northeast (OR 0.05, 95% CI 0.003-0.23, p = 0.003) and the Midwest (OR 0.41, 95% CI 0.21-0.77, p = 0.0067). All other clinical factors, including age, sex, comorbidity indices, and payer status, were non-significant. **Conclusion:** Vascular injury following two-level ALIF occurs in approximately 0.44% of cases. Regional differences were the only independent predictor, suggesting that nonclinical factors may play a role in outcomes. These findings indicate that regional variation exists and warrant further study to better understand the factors underlying these differences.

ID: AGS26/1770
P0931: Cerebrospinal fluid leaks after intradural spinal tumor surgery: prevention and management

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Introduction: Cerebrospinal fluid (CSF) leakage is a common complication after intradural spinal tumor surgery. It may lead to pseudomeningocele, wound infection, meningitis, and delayed recovery. Identifying preventive strategies and effective management is essential to reduce morbidity**. Materials and Methods:** We retrospectively reviewed 40 patients who underwent intradural spinal tumor resection over a 5-year period. Surgical techniques for dural closure, use of sealants, and postoperative drainage were analyzed. Patients with postoperative CSF leakage were evaluated for clinical presentation, management, and outcomes. **Results:** CSF leakage occurred in 8 patients. Risk factors included large dural openings, tumors adherent to the pia, and revision surgery. Preventive measures included watertight dural suturing with fine non-absorbable material, reinforcement with autologous fat or fascia grafts, and selective use of fibrin sealants. Management varied: 4 patients were treated successfully with bed rest and pressure dressing, 3 required lumbar drainage, and 1 underwent surgical re-exploration with dural repair. No patient developed meningitis. At final follow-up, all patients achieved favorable neurological outcomes. **Conclusion:** CSF leaks remain a significant challenge after intradural spinal tumor surgery. Meticulous watertight dural closure, reinforcement with grafts or sealants, and judicious use of drains are key preventive measures. Early recognition and tailored management-ranging from conservative therapy to surgical re-exploration-can prevent serious complications and ensure good clinical outcomes.

ID: AGS26/1834
P0932: Paradoxical malnutrition in obese patients undergoing anterior cervical discectomy and fusion: a propensity-matched analysis of postoperative outcomes

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Introduction: Obesity, as defined by body mass index (BMI) > 30 kg/m^2, and malnutrition are well-known risk factors for postoperative complications following anterior cervical discectomy and fusion (ACDF). Historically, these two nutritional states have been considered mutually exclusive; however, an emerging body of evidence supports the theory of paradoxical malnutrition, in which patients exhibit both an elevated BMI and a deficiency in either macro- or micronutrients. These patients may be underrecognized in spine surgery populations where BMI alone is used for risk stratification. The purpose of this study is to investigate postoperative outcomes following single-level anterior cervical discectomy and fusion in obese patients with protein-calorie malnutrition. **Material and Methods:** This study utilized the TriNetX Research Network, a global deidentified electronic medical record database, to identify adults > 18 years who underwent ACDF between January 1, 2015, and January 1, 2025. The study group included patients BMI > 30 kg/m^2 diagnosed with protein-calorie malnutrition (ICD-10-CM E43 or E44) within 90 days before ACDF, compared to a control group comprised of patients BMI > 30 kg/m^2 without protein-calorie malnutrition. Cohorts were 1:1 propensity-matched based on baseline demographic characteristics and comorbidities. The caliper for successful matching was set at a standard difference (std diff) < 0.1. Primary outcomes were evaluated within 90 days following the index procedure utilizing risk ratios (RR) and 95% confidence intervals (CI). P-value < 0.05 denotes statistical significance. **Results:** A total of 174 matched pairs were analyzed. The cohorts were balanced across all covariates included in the propensity score except for mean BMI at index; mean BMI was 33.3 ± 6.6 kg/m^2 in the paradoxical malnutrition group compared with 35.7 ± 6.4 kg/m^2 in the control group (std diff 0.371). Within 90 days postoperatively, paradoxical malnutrition was associated with increased risk of venous thromboembolism (RR 2.727, 95% CI 1.412-5.267; p = 0.002), pneumonia (RR 3.000, 95% CI 1.514-5.946; p = 0.001), acute respiratory failure (RR 5.300, 95% CI 2.788-10.074; p < 0.001), acute renal failure (RR 3.700, 95% CI 1.901-7.203; p < 0.001), sepsis (RR 3.800, 95% CI 1.956-7.383; p < 0.001), unplanned intubation (RR 2.300, 95% CI 1.128-4.688; p = 0.017), dysphagia (RR 2.565, 95% CI 1.662-3.959; p < 0.001), and all-cause readmission (RR 4.654, 95% CI 3.220-6.726; p < 0.001). **Conclusion:** Paradoxical malnutrition is associated with a significantly increased risk of postoperative complications following anterior cervical discectomy and fusion compared to matched obese controls. These findings highlight that reliance on BMI alone is insufficient for preoperative risk stratification. A more nuanced approach to preoperative clearance that accounts for both BMI and nutritional status is warranted. Early identification of paradoxical malnutrition would enable targeted nutritional optimization, with the potential to reduce preventable morbidity and resource use. Prospective

studies are warranted to validate nutritional assessment tools for patients with obesity.

ID: AGS26/2143

P0933: Sacral fracture as a rare complication of circumferential lumbosacral fusion with ALIF, OLIF, and pedicular fixation in a young patient

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Introduction: Sacral fractures following circumferential lumbosacral arthrodesis are rare but clinically significant. Risk factors include pre-existing spondylolysis, poor bone quality, and insufficient pelvic support, all of which predispose to structural failure at S1 in complex constructs. **Objective:** To describe the surgical management and clinical course of a patient who developed a sacral fracture after L4-S1 circumferential fusion, highlighting biomechanical considerations and risk factors. **Case Report:** A 55-year-old male presented with irritative and deficit lumbosciatica due to lytic spondylolisthesis and L5-S1 foraminal stenosis. He underwent a three-stage circumferential fusion: ALIF at L5-S1, OLIF at L4-L5, and posterior pedicular fixation from L4 to S1. Postoperatively, he was diagnosed with interstitial lung disease requiring prolonged high-dose corticosteroids. The initial outcome was favorable; however, two months later, progressive paresthetic lumbosciatica developed. CT imaging revealed a fracture of the superior endplate of the S1 dome, cage subsidence, and partial recurrence of listhesis. Revision surgery via a posterior approach included foraminal decompression, S1 screw replacement, and resection of a free bone fragment, leading to progressive symptom relief, functional recovery, and bone consolidation. **Discussion and Conclusion:** This case highlights a rare complication after a circumferential construct generally considered biomechanically stable, most likely precipitated by corticosteroid-induced bone fragility. The outcome emphasizes the critical role of bone quality and construct design in preventing such failures, particularly in patients with systemic risk factors. Revision surgery successfully restored stability and improved symptoms. Careful preoperative evaluation of bone density and systemic conditions is essential when planning lumbosacral fusions.

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P0934: Preoperative antidepressants are associated with increased risk of opioid use and overall complications following anterior and posterior cervical fusion: A nationwide propensity-matched cohort study

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Introduction: Antidepressant use has been linked to adverse perioperative outcomes across surgical specialties. However, its impact on postoperative opioid utilization and complications following cervical fusion remains unclear. This study investigated the association between preoperative antidepressant use and postoperative outcomes after anterior cervical fusion (ACF) and posterior cervical fusion (PCF). **Material and Methods:** We conducted parallel retrospective cohort analyses utilizing TriNetX for patients undergoing primary ACF and PCF between December 31, 2006, and December 31, 2022. Patients aged $\geq$ 18 years old with $\geq$ 2-year follow-up were stratified by 90 days preoperative use of antidepressants. Cohorts were 1:1 propensity matched for demographics and comorbidities resulting in 4,575 ACF and 3,497 PCF pairs. Medical outcomes, opioid abuse, healthcare utilization, mechanical and surgical outcomes were assessed through risk ratios (RR), risk differences, p-values, and Kaplan-Meier analysis. **Results:** Antidepressant use was associated with increased new opioid prescriptions from 2 weeks to 2 years (ACF RR 1.090-1.130, $p < 0.001$; PCF RR 1.060-1.078, $p < 0.001$), higher hospital readmissions (RR 1.484, $p < 0.001$), prolonged inpatient stays (RR 1.329, $p < 0.001$), and ED visits from 6 weeks to 2 years (ACF RR 1.150-1.184, $p < 0.001$; PCF RR 1.092-1.144, $p \leq 0.034$). Postoperative infections were elevated at 2 years (ACF RR 1.679-2.060, $p \leq 0.008$; PCF RR 1.375-1.677, $p \leq 0.020$). Opioid abuse was higher at 2 years (ACF RR 2.8000, $p = 0.003$; PCF RR 2.667, $p = 0.001$), and pulmonary embolism increased in ACF at 2 years (RR 1.633, $p = 0.032$). Reoperations were elevated at 1 and 2 years (RR 1.238-1.371, $p \leq 0.045$), with reduced 2-year

reoperation-free survival in ACF (p = 0.001) and PCF (p = 0.045). **Conclusion:** Preoperative antidepressant use is associated with significantly increased risks of postoperative opioid utilization and both medical and surgical complications, including sepsis, infections, adjacent segment disease, and reoperations, up to two years after primary anterior or posterior cervical fusion. These findings suggest that antidepressant use may serve as an important marker of perioperative risk and should be considered when counseling patients and optimizing care before cervical fusion.

ID: AGS26/2241
P0935: Can ChatGPT prevent wrong level spine surgery?

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Introduction: Wrong level spine surgery is considered a preventable surgical error. It can lead to adverse patient outcomes, litigation, and a compromised professional reputation. Artificial intelligence assets such as Open AI's ChatGPT could help as the latest release supports imaging, performs tasks at human-like levels, and is widely available. Furthermore image analysis has been seen as a strength of AI in spinal surgery. We sought to study the accuracy of ChatGPT in identifying spinal level of intraoperative markers placed during spine surgery on fluoroscopic imaging. **Material and Methods:** A prospectively maintained neurosurgical database was queried for degenerative spine cases between 2024 to 2025. Intraoperative fluoroscopic images were obtained from the electronic medical record, anonymized, and used in the body of a prompt asking ChatGPT to identify the spinal level where the marker was located. This confirmed against the reported level of the marker by the radiologist and the operative note of the surgeon. **Results:** A total of 75 degenerative spine cases were reviewed with 37.3 % being cervical, 6.6% thoracic , and 56% lumbar. There were no cases of transitional anatomy. ChatGPT agreed with a board certified neurosurgeon in just 28% of cases. **Conclusion:** No, the current iteration of ChatGPT does not reliably identify correct levels of spine surgery. Responses are generated based on the knowledge and patterns trained on (with a cutoff in 2024), not from accumulating experience with individual users or cases.

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P0936: Impact of hypothyroidism on short-term and long-term outcomes following anterior cervical discectomy and fusion (ACDF): a nationwide propensity-matched cohort study

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Introduction: Hypothyroidism has been implicated in adverse perioperative outcomes across several surgical specialties, including lumbar spine surgery. However, its influence on anterior cervical discectomy and fusion (ACDF) remains insufficiently characterized. This study aimed to determine the association between preoperative hypothyroidism and postoperative medical and mechanical complications following ACDF. **Material and Methods:** A retrospective propensity-matched cohort analysis was conducted using the TriNetX database, encompassing patients who underwent primary ACDF between 2010 and 2025 across 54 U.S. academic centers. Patients with a diagnosis of hypothyroidism (n = 3,246; ICD-10-CM code E03.9) were matched 1:1 to euthyroid controls based on demographic and clinical covariates. Outcomes of interest included 90-day medical complications and 2-year mechanical complications. **Results:** Among 3,239 matched pairs at 90-day follow-up, patients with hypothyroidism experienced significantly higher rates of pneumonia (1.9% vs. 1.0%; p = 0.004; relative risk [RR], 1.85; 95% confidence interval [CI], 1.21-2.82) and hematologic complications (1.5% vs. 0.8%; p = 0.008; RR, 1.85; 95% CI, 1.16-2.95). At 2-year follow-up (3,085 matched pairs), hypothyroidism was independently associated with an increased incidence of adjacent segment disease (1.3% vs. 0.7%; p = 0.023; RR, 1.94; 95% CI, 1.08-3.48). **Conclusion:**

Preoperative hypothyroidism is associated with elevated risks of both short-term and long-term complications after ACDF, particularly pneumonia, hematologic events, and adjacent segment disease. These findings underscore the importance of preoperative optimization of thyroid function as a potentially modifiable risk factor to improve outcomes in this surgical population.

ID: AGS26/2268
P0937: Disease-modifying antirheumatic drugs are associated with higher reoperation rates after anterior cervical discectomy and fusion: a nationwide cohort analysis

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Introduction: Rheumatoid arthritis (RA) is an inflammatory autoimmune disease that compromises joint integrity, often necessitating surgical interventions such as anterior cervical discectomy and fusion (ACDF). The association of Disease-Modifying Anti-Rheumatic Drugs (DMARDs) on ACDF outcomes remains unclear. This study evaluates the impact of DMARD therapy on short- and long-term postoperative complications including reoperation rates in RA patients undergoing ACDF. **Material and Methods:** We retrospectively queried the TriNetX database (2010-2023) to identify adults (18-90 years) undergoing primary single- or two-level ACDF. Patients with trauma, malignancies, or revision fusion were excluded. Patents with RA were subcategorized based on DMARD use within 1 year prior to their surgery. All patients were matched 1:1 via propensity score matching (508 DMARD users, 508 non-users). Postoperative outcomes included medical and mechanical complications at 90 days and 2-year follow-up. Kaplan-Meier analysis assessed reoperation-free survival. Statistical significance was set at $p < 0.05$. **Results:** RA patients on DMARDs experienced significantly higher rates of readmission (4.3% vs 2.0%; p = .031) and reoperation (4.1% vs 2.0%; p = .045) within 90 days postoperatively, compared to matched controls. At 2-year follow-up, reoperation rates remained elevated in the DMARD cohort (8.3% vs 4.1%; p = .006). Kaplan-Meier analysis demonstrated a significantly reduced reoperation-free survival among DMARD users (p = .0083). **Conclusion:** DMARD use in RA patients undergoing ACDF is linked to higher short- and long-term reoperation rates and reduced reoperation-free survival. This indicates that while DMARDs may provide symptomatic relief to patients with RA, they may compromise surgical durability. Such risks and benefits should be considered by clinicians when managing RA patients requiring ACDF.

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P0938: Three-stage ALIF revision surgery for failed TLIF cages

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Introduction: Revision of transforaminal lumbar interbody fusion (TLIF) surgeries presents substantial surgical challenges due to dense scar tissue and pre-existing instrumentation. While anterior approaches offer superior visualization for cage retrieval, existing posterior constructs often impede the adequate intervertebral distraction essential for comprehensive cage removal and deformity correction. **Material and Methods:** We describe a three-stage surgical strategy (back-front-back) developed to overcome these limitations. We retrospectively reviewed 11 consecutive patients who underwent this revision surgery for indications including pseudarthrosis, cage subsidence, or sagittal malalignment to evaluate the procedure's safety and its efficacy in restoring sagittal alignment. **Results:** The three-stage procedure was technically successful in all 11 patients. The mean surgical time was 258.2 ± 51.7 minutes, and the mean blood loss was 492.7 ± 391.3 ml, metrics comparable to those reported for standard two-stage revisions. Postoperative imaging confirmed satisfactory cage placement and led to significant improvements in key sagittal alignment parameters, including lumbar lordosis. **Conclusion:** Our preliminary results suggest that this three-stage approach for TLIF revision safely addresses the challenges posed by existing posterior instrumentation. The technique effectively facilitates cage removal and restoration of sagittal alignment with acceptable operative times, offering a promising strategy for complex revision cases.

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P0939: Characterization of variables associated with alterations in electrophysiological monitoring in pediatric patients undergoing scoliosis correction surgery: a comparative study

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Introduction: Intraoperative neurophysiological monitoring (IONM) is crucial in scoliosis correction surgeries, as it allows for the early detection of iatrogenic spinal cord injuries, facilitating timely intervention to prevent permanent neurological sequelae. IONM has been essential, providing real-time information on changes in the neurophysiological tracing of structures at risk, with high sensitivity and specificity. Although complications in spine surgery correction are rare (1-1.6%), in severe cases, complications can increase to 13-31%, which has promoted the routine use of IONM. Factors such as a high Cobb angle, intraoperative bleeding, instrumented levels, spinal cord morphology, and surgical time are also correlated with an increased risk of neurological injury. This study seeks to identify the variables associated with increased neurological risk in patients with spinal deformities, using a population from a national referral center in spine surgery. **Material and Methods:** A comparative analytical study will be conducted to evaluate the demographic, clinical, and intraoperative characteristics of pediatric patients undergoing scoliosis correction surgery between 2015 and 2025 at a national referral center. Patients with alterations in intraoperative neurophysiological monitoring (decrease in somatosensory evoked potential (SSEP) amplitude > 50%, increase in SSEP latency > 10%, or complete loss of Transcranial motor evoked potentials (TcMEP) signals) will be compared with those without alterations. Information will be collected from medical records and monitoring records, and the data will be analyzed using logistic regression in RStudio to identify the variables associated with the alterations. Patients with incomplete data or who underwent surgery at other institutions will be excluded. The data will be entered and protected using the REDCap platform, and analyses will be performed to compare the two groups and determine the risk variables. **Results:** The results of this study are expected to demonstrate a direct correlation between specific demographic, clinical, and intraoperative variables and an increased risk of intraoperative neurological alterations during scoliosis correction surgery. Factors such as the severity of the deformity, the degree of associated kyphosis, the etiology, and the patient's nutritional status are expected to be key predictors of an altered response in evoked potentials. With a large patient cohort, this analysis will provide a solid evidence base for refining and optimizing safety protocols, contributing to the reduction of neurological complications. Furthermore, the findings will enable the creation of risk models that will guide advance decision-making both in preoperative planning and throughout the surgical procedure. **Conclusion:** The characterization of demographic, clinical, and intraoperative variables in scoliosis surgery is essential for understanding and mitigating the risk of intraoperative neurological injuries. By identifying the risk factors associated with alterations in neurophysiological monitoring, this study will provide a scientific basis for refining clinical management protocols. The results are expected to enable more accurate patient stratification and optimize intraoperative decision-making, contributing to safety and improved clinical outcomes in scoliosis surgery. This work will contribute to the scientific literature by providing specific evidence from a national reference center, strengthening the scientific community in this area.

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P0940: Novel radiological predictors for proximal junctional kyphosis in osteoporotic vertebral compression fracture (OVCF) with kyphosis following posterior corrective surgery

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Introduction: This study aimed to identify the effect of some novel risk factors associated with L1 vertebrae and parameters closely related to the sagittal alignment for the occurrence of proximal junctional kyphosis (PJK) following surgery for patients with osteoporotic vertebral compression fractures (OVCF) kyphosis. **Material and Methods:** 105 OVCF patients undergoing posterior corrective surgery between January 2008 and June 2021 with a minimum 2-year follow-up were included. These patients were divided into PJK and non-PJK groups. Spinopelvic parameters, including thoracolumbar slope (TLS) and the L1 plumb line (L1PL) were measured preoperatively, postoperatively, and at follow-up. Multivariate

logistic analysis was performed on various risk factors and Global Alignment and Proportion (GAP) scores. Associations between novel parameters and PJK were analyzed using receiver operating characteristic (ROC) analysis. **Results:** PJK was identified in 21.9% of patients. The mean age and follow-up were 64.87+8.96 years and 36.84+8.29 months, respectively. There were no statistically significant differences ($p > 0.05$) in confounding factors such as baseline demographic characteristics and preoperative/immediate postoperative PI-LL mismatch between the PJK group and the non-PJK group. Multiple comparisons showed that the proportion of PJK in the severely disproportioned group (the group with the highest GAP scores) and that of the other two groups with lower GAP scores were statistically different ($P < 0.001$). Regarding sagittal parameters, potential risk factors for PJK included preoperative TK ($p = 0.002$), preoperative TLS ($p = 0.037$), postoperative TLS ($p = 0.003$), and postoperative L1PL ($p = 0.001$). Among these, postoperative TLS ($\geq 14.69°$) and L1PL ($\leq$ -1.91 cm) were identified as independent risk factors. **Conclusion:** TLS and L1PL can be used to predict the occurrence of PJK in patients undergoing surgery for OVCF and are crucial for preventing the progression of PJK. Achieving a proportionate GAP Score postoperatively seems to be a viable option as higher GAP scores were associated with higher rates of PJK.

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P0941: Clinical and biomechanical analysis of postoperative rod fracture in spinal deformity

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Introduction: At present, the phenomenon of postoperative rod fracture has become a hot topic of current research. It not only brings physical and psychological burden to patients, but also brings economic burden to patients. However, there is no consensus on how to design the connecting rod according to the characteristics of the patient and how to determine the most suitable curvature of the connecting rod. Therefore, we hope to explore how to avoid rod fracture from the aspects of sagittal parameter, rod design and rod curvature through this study. **Material and Methods:** The rod fracture group had a mean age of 52.76 ± 13.16 years, with 9 females and 8 males among them. While the non-rod fracture group had a mean age of 60.54 ± 11.46 years, with 55 females and 30 males among them. We compared postoperative Cobb angle, SVA, CL, LL, TK, PT, PI, SS and the average curvature of the fixed rod between rod-fracture group and the control gruop. In finite element simulation analysis, TC4 titanium alloy is chosen as the modeling material, and a titanium alloy rod model is established, and finite element modeling is carried out by ABAQUS, with the model parameters of 5.5mm in diameter and 360mm in length. The rod was pre-bent to different curvatures to analyze the corresponding residual stresses, and to investigate the effect of different plastic deformation on the residual stresses caused by different pre-bending degrees of the titanium alloy rod. **Results:** We found that for sagittal parameters, greater postoperative TK (26.13 ± 13.04 vs. 36.14 ± 18.96, P=0.012), SVA (18.13±45.63 vs. 49.41±54.93, P=0.018), and LL (8.12±39.91 vs. 45.21±16.06, P<0.001) were risk factors for rod fracture, as reflected in the mean curvature of the fixed rods (1.94±0.69 vs. 3.91±1.49, P<0.001). At the same time, we find that the residual stresses in the fixed rods increase as the curvature increases, and the maximum residual stresses are distributed in the center of the rods. In the cross-section, as the curvature increases, the maximum residual stress distribution point gradually moves from the surface of the rod to the center of the rod, which indicates that the rod fracture occurrence sites are usually located at the surface and the center of the bar. Finally, the increase in curvature and residual stress leads to a smaller factor of safety for the rod and a decrease in its ability to withstand stress, resulting in a higher incidence of rod fracture. **Conclusion:** All in all, the occurrence of rod fracture is closely related to the postoperative sagittal parameters, which can be reflected in the average curvature of the fixed rod implanted in the spine. At the same time, biomechanical finite element analysis confirms this. Based on this result it has prospective implications for the specific design of spinal fixation rods and the elimination of residual stresses in the fixation rods to minimize the occurrence of rod fracture.

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P0942: Placement of a new screw from the next to the broken screw in revision spinal surgery; case series

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Introduction: As is well known, cases requiring revision spinal surgery present the most challenges for spine surgeons due to the risks involved and the challenges involved in spinal reconstruction and patient rehabilitation. Screw loosening, fractured instruments, adjacent segment disease, and surgical site infection are the primary conditions requiring revision. We aimed to present patients who underwent revision spinal surgery and, upon discovery of a broken screw during surgery, we placed a new transpeduncular screw adjacent to the broken screw and in the same peduncle. **Material and Methods:** We reviewed 15 patients who underwent revision spinal surgery at our clinic between 2021 and 2024. Upon discovery of a broken screw during surgery, we placed a new transpeduncular screw adjacent to the fractured screw that had been retained within the vertebra. **Results:** Thirteen patients with long-term follow-up were included in the study. The mean follow-up period was 20.3 months. Eleven were female and two were male. The mean age of the patients was 62.46 years (37-77 years). The presenting complaint in all patients was low back pain, followed by pain in both legs (n = 10). Nearly half of the patients had neurological claudication (n = 6). The most common level of broken screws was the L5 vertebra (n = 10). New transpeduncular screws were placed in both L5 peduncles of five patients (38.46%), adjacent to the broken screws. All patients underwent revision surgery. According to early postoperative imaging, one transpedicular screw was revised in each of two patients. All patients had better VAS, ODI, and JOA scores in the early postoperative period compared to the preoperative period. **Conclusion:** Revision instrumentation is one of the most challenging operations in spinal surgery due to the risks involved and the difficulty of the approach. Especially in cases where the broken screw must be left in the vertebra, the ability to use the same vertebra for reoperation is an advantage for both the patient and the surgeon. This eliminates the need to skip segments when instrumenting and contributes to the new spinal restoration. Because this approach is, to our knowledge, rarely encountered in the literature, we believe our case series will contribute to spinal surgery.

ID: AGS26/2729
P0943: Risk factors for hardware failure following posterior fixation of thoracolumbar junction fractures

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Introduction: Thoracolumbar junction fractures are frequent due to the biomechanical vulnerability of this transitional zone between the rigid thoracic spine and mobile lumbar spine. Posterior fixation is considered the gold standard for stabilization. However, implant failure remains a significant complication that compromises correction and long-term outcomes. The aim of our study is to identify the predictive risk factors for hardware failure following posterior fixation of thoracolumbar fractures. **Material and Methods:** We conducted a retrospective study of 120 patients who underwent posterior fixation for thoracolumbar junction fractures between January 2010 and January 2020. In our series, we noted nine cases of hardware failure. Several potential risk factors were analyzed, including demographic parameters, comorbidities, neurological status, and fracture-related characteristics. Surgical parameters and complications were included. **Results:** Several risk factors for hardware failure were identified: Advanced age (≥ 60 years) was a significant factor (p = 0.02, OR = 0.19, CI [0.04-0.80]). Diabetes was strongly associated with failure (p = 0.07, OR = 7.83, CI: 1.88-32.51), while obesity/overweight showed a statistical trend (p = 0.09). Short-segment fixation carried a high risk (p = 0.00, OR = 23.75, CI: 4.47-125.99), and nonunion was the most powerful predictor (p < 0.001, OR = 22.8, CI: 9.67-53.72). However, long fusion assembly (p = 0.04, OR = 0.04, CI: 0.04-1.09) and mixed fixation had protective effects. Furthermore, gender, neurological deficit, vertebral level, fracture types B and C, luxation, sepsis, and laminectomy did not reach statistical significance. **Conclusion:** In our series, the risk factors were advanced age, diabetes, obesity, short-segment fixation, and nonunion. Long-segment and mixed fusion assembly demonstrated protective roles. Careful surgical planning based on the patient's comorbidities and the morphology of the fracture is essential to reduce the risk of implant failure.

ID: AGS26/2747
P0946: Analyze of the risk factors for nonunion after posterior fixation of thoracolumbar junction fractures

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Introduction: Thoracolumbar junction fractures are the most common traumatic spinal injuries due to the biomechanical vulnerability of this transition zone. Posterior fixation is widely considered the gold standard for stabilization. However, nonunion remains a severe complication that compromises spinal fusion, increases the risk of implant failure, and negatively impacts long-term functional outcomes. The aim of this study is to identify the predictive risk factors for nonunion after posterior surgical treatment of thoracolumbar junction fractures. **Material and Methods:** We conducted a

retrospective study of 120 patients treated surgically for thoracolumbar fractures by posterior instrumentation between January 2010 and January 2020. In our series, we observed four cases of nonunion. Several demographic, clinical, radiological, and surgical parameters were analyzed, including age, gender, diabetes, obesity/overweight, neurological status, fractured vertebra (T12 or L1), fracture-related features (pedicular fracture, articular fracture, luxation, fracture type A2/A3), as well as fixation strategies (short-segment, long-segment, or mixed fixation), bone grafting, and postoperative complications such as sepsis and implant failure. Statistical analysis was performed using odds ratios (OR) with 95% confidence intervals (CI) and p-values. **Results:** Regarding the demographic parameters, we found a several risk factors for nonunion: Advanced age (≥ 60 years) was significantly associated with nonunion ($p = 0.076$). Female gender showed a higher risk ($p = 0.021$). Diabetes was a strong predictor ($p = 0.001$), as well as overweight/obesity ($p = 0.032$). Among surgical parameters, long-segment fixation was protective ($p = 0.04$, OR = 0.53, CI: 0.05-5.3), whereas short-segment fixation significantly increased the risk ($p = 0.01$). Sepsis was also correlated with nonunion ($p = 0.18$, OR = 7.3, CI: 0.64-83.6). Other factors such as neurological deficit, fractured vertebra (T12 vs. L1), fracture pedicle, luxation, fracture type (A2, A3), mixed fixation, bone grafting, and infection did not reach statistical significance. **Conclusion:** After posterior fixation for thoracolumbar junction fractures, nonunion is a rare and serious complications. In our series, the main risk factors were advanced age, female gender, diabetes, obesity, short-segment fixation, and sepsis. Conversely, long-segment fixation demonstrated a protective role. Identifying patients at risk of nonunion is crucial for optimizing surgical strategy, selecting adequate fixation length in order to reduce the incidence of this serious complication.

ID: AGS26/2803
P0947: Suction-induced intradural nerve root kinking following lumbar decompression

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Introduction: Postoperative radiculopathy after lumbar decompression is typically attributed to hematoma, residual stenosis, or nerve injury. Suction drain-induced intradural nerve root kinking is a rarely reported mechanical cause. We present a unique case with direct imaging correlation and rapid symptom resolution. **Material and Methods:** A 67-year-old male underwent standard L4/5 interlaminar decompression with bilateral undercutting facetectomies. A subfascial closed-suction drain was placed. Within 18 hours, the patient developed severe bilateral radiculopathy. MRI revealed posterior deviation of intradural nerve roots toward the drain site. **Results:** Suspecting mechanical distortion from negative pressure, the suction was immediately disengaged. Repeat MRI showed restoration of normal nerve root configuration. Symptoms resolved rapidly, and the patient was discharged without recurrence. **Conclusion:** Suction-induced intradural nerve root kinking is a rare but reversible complication. Surgeons should consider drain-related mechanical effects in the differential diagnosis of early postoperative radiculopathy.

ID: AGS26/2885
P0948: Unexpected challenges in endoscopic spine surgery: systematic insights and thoracic case study

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Introduction: Endoscopic spine surgery has emerged as a minimally invasive alternative to open techniques, offering reduced tissue trauma and faster recovery. Nevertheless, this approach is not free from complications, which range from dural tears and nerve injuries to rare, unexpected systemic events. **Materials and Methods** A systematic review of recent literature was performed focusing on complications of spinal endoscopy. Additionally, we report a case of a 71-year-old female admitted with thoracic radiculopathy and left lower limb paresis due to a T6/7 disc herniation, who underwent endoscopic discectomy. **Results** The review demonstrates a generally low incidence of complications, most of which were minor, although re-operations and infection-related issues were described. In our case, while the herniation was completely removed and neurological symptoms improved, the patient developed acute dyspnea on the second postoperative day. Imaging revealed a right-sided pleural effusion, and thoracocentesis drained 2000 mL of clear fluid. The patient recovered well and returned to the neurosurgical ward in good

general condition. **Conclusion** Although spinal endoscopy is associated with fewer complications than traditional open surgery, unexpected systemic complications can occur. Thoracic cases in particular demand careful perioperative monitoring. Awareness of both common and rare complications is crucial to ensure optimal patient outcomes and safety.

ID: AGS26/3135
P0949: A systematic review on predictors for outcomes in patients undergoing spinal surgery above 80 years of age

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Introduction: The global population aged 80 and above is rapidly increasing and is projected to triple between 2020 and 2050, reaching approximately 426 million individuals worldwide. This demographic shift is accompanied by increased incidence of degenerative spinal conditions, particularly lumbar spinal stenosis, degenerative spondylolisthesis, and osteoporotic vertebral fractures. Despite advances in surgical techniques and perioperative care, the elderly remain at increased risk for postoperative complications, mortality, and delayed recovery. However, chronological age alone may be an inadequate predictor of perioperative outcomes. **Objectives:** This review aims to systematically evaluate which preoperative factors, including frailty, other comorbidities, cognitive status, and surgical complexity, predict postoperative outcomes including complications, mortality, functional and neurological recovery, and cognitive decline. **Methods:** Our review was conducted according to the guidelines put by PRISMA for systematic review *and* the protocol was registered in PROSPERO (ID: 1186596). A search of PubMed Central, Cochrane, and Google Scholar from 2015 to 7/5/25 was performed. All titles, abstracts, and full text articles were screened by two independent reviewers at all stages. The Newcastle Ottawa Scale (NOS) was used to assess the quality of the studies, and narrative synthesis was performed as, due to the heterogeneity of the outcomes data, a meta-analysis was not possible. **Results:** Ten observational studies met the criteria, with sample sizes ranging from 36 to 7880. The most consistently reported and statistically supported predictors were frailty (via modified Frailty Index, mFI), ASA classification, and surgical complexity as demonstrated by spinal instrumentation. Within the individual cohorts, chronological age alone was not a significant determinant of outcomes when adjusted for frailty and comorbidity burden. Kweh et al. found that patients with mFI $\geq$3 had a major complication rate of 29.2% compared to 13.0% for low-frailty patients (mFI <3), *and* Jang et al. reported that mFI $\geq$0.27 significantly predicted 3-month mortality (p=0.024). ECOG-CCI was a strong predictor for severe complications (OR 1.6, p=0.004), *and* instrumented fusion showed a 15.7% delirium rate (p=0.017). Liao et al. noted improvements in ODI and VAS pain scores (ODI: 61.8 $\rightarrow$ 30.0; p<0.001), *and* Kuo et al. found no significant difference in 2-year mortality between octogenarians and younger patients after adjusting for comorbidities. The certainty of the current evidence is low because of heterogeneous reporting and limited follow-up among studies. **Conclusions:** Frailty (mFI) consistently outperformed age and ASA class in predicting complications and early mortality. The age threshold of $\geq$85 did not exhibit an independent association with unfavourable outcomes, thereby highlighting the importance of prioritizing functional and physiological health over mere chronological age. While ASA is a useful screening tool for rapid risk identification, our review suggests it should alone not be the deciding factor for operative planning in octogenarians. These findings should be cautiously interpreted, however, given the GRADE Low Certainty of this evidence, until validation through a large prospective trial is conducted in this population.

ID: AGS26/3193
P0950: Non-operative management of late-onset cerebrospinal fluid leak following full-endoscopic spine surgery with epidural blood patch: a technical note, case report, and scoping review

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Introduction: Incidental durotomy is an acknowledged complication of endoscopic spine surgery, but late-onset cerebrospinal fluid (CSF) leaks presenting weeks after the index procedure are exceedingly rare and pose a significant management challenge. Standard treatment often involves conservative measures or revision surgery, the latter of which carries inherent risks of infection, neurological injury, and complications arising from dissecting through scar tissue. The epidural blood patch (EPB), which long-time considered a cornerstone in managing post-dural puncture headaches, is not well-established as a definitive treatment in this specific delayed following a spinal endoscopy procedure. This work reports a unique case of a late-onset CSF leak with significant symptomatology successfully treated with a targeted EPB and presents a scoping review of current literature on this non-operative technique. **Material and Methods:** We present the case of a 44-year-old female who underwent a successful lumbar endoscopic unilateral laminotomy for bilateral decompression (LE-ULBD) at L4/5. The patient's postoperative

course and the technical details of the EPB procedure are described. Additionally, a scoping review of the PubMed and Scopus databases was conducted to identify all published reports on the use of epidural blood patch for the treatment of CSF leaks that occur as a delayed complication of endoscopic spinal surgery. **Results:** The patient was discharged on the first postoperative day with complete resolution of her initial radicular pain. Three weeks later, she developed severe, debilitating postural headaches without diplopia, and nausea, with an MRI confirming a large pseudomeningocele at the surgical site, diagnostic of a late-onset dural tear. After a brief period of conservative management failed to provide relief, a targeted epidural blood patch with 15 cc of autologous blood was performed. The patient experienced immediate and complete resolution of her symptoms. At subsequent follow-ups, she remained asymptomatic with no recurrence, thereby avoiding the need for revision surgery. Our scoping review of the literature revealed a paucity of data, underscoring the novelty of this management approach for this specific complication. **Conclusion:** In our experience, a targeted epidural blood patch is a feasible, safe, and highly effective non-operative treatment for late-onset CSF leakage following full-endoscopic spine surgery. This technique provides an option of definitive solution that circumvents the significant morbidity associated with revision surgery. We assert that the epidural blood patch could be considered a primary and valuable tool in the management algorithm for this rare but challenging complication.

ID: AGS26/3283
P0951: Clinical sequelae of rod fracture: functional and opioid outcomes in adult spinal deformity

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Introduction: Rod fracture (RF) is one of the most frequent mechanical complications of adult spinal deformity (ASD) surgery. While its predictors are increasingly well understood, less is known about its clinical impact on patient-reported outcomes and postoperative recovery. This study evaluated pain, opioid use, and functional disability in patients with and without RF. **Material and Methods:** We retrospectively reviewed 140 ASD patients who underwent long-segment posterior spinal fusion (≥7 levels) between 2015 and 2023 at a single academic center. RF was confirmed radiographically during follow-up. Postoperative outcomes assessed included average and maximum pain scores (VAS), opioid use rate and duration, and functional disability measured by the Oswestry Disability Index (ODI). Statistical comparisons were conducted using Spearman's correlation. **Results:** RF occurred in 35.7% of patients at a median of 761 days postoperatively. Pain levels were similar between groups, as median average pain was 5.0 in both RF and non-RF patients ($p = 0.940$), and median maximum pain was also comparable (9.0 vs. 9.0, $p = 0.944$). The rate of opioid use did not differ significantly (94% RF vs. 89.7% non-RF, $p = 0.390$). However, RF patients required significantly longer opioid therapy (36.7 ± 25.7 vs. 26.6 ± 25.5 days, rho = 0.210, $p = 0.016$). Functional outcomes were also impaired. ODI scores were higher in RF patients (median 18 vs. 14, rho = 0.258, $p = 0.003$), indicating greater postoperative disability. **Conclusion:** Rod fracture did not translate into increased pain or higher opioid initiation rates but was associated with prolonged opioid dependence and worse functional disability. These findings underscore the clinical burden of RF, highlighting its role in extended recovery and reduced quality of life despite unchanged pain scores. Preventing RF through surgical and biomechanical optimization may therefore yield substantial benefits not only in construct longevity but also in reducing postoperative opioid exposure and improving functional outcomes.

ID: AGS26/3307
P0952: A rare complication of a broken spinal needle during lumbar puncture: a case report

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Introduction: Lumbar puncture (LP) is a routine diagnostic and therapeutic procedure widely used in neurology, intensive care, and anesthesiology. Most complications are benign, such as post-dural puncture headache or local back pain. Needle breakage is an extremely rare but alarming complication that may result in neurological injury or foreign body migration. We report a rare case of spinal needle fracture during lumbar puncture, which required surgical extraction. **Material and Methods:** We present the case of a 54-year-old male who was admitted to the intensive care unit with prolonged fever and clinical suspicion of meningitis. A lumbar puncture was attempted for diagnostic purposes. During the procedure, accidental breakage of the spinal needle occurred. Lumbar spinal ultrasound confirmed the presence of a retained metallic fragment at the lumbar level. **Results:** The patient was

immediately transferred to the orthopedic operating room. Surgical extraction was performed via a posterior lumbar approach, which allowed complete retrieval of the broken needle under direct visualization. The procedure was uneventful. Postoperative recovery was favorable, with no neurological deficit or secondary complication. **Conclusion:** Needle fracture during lumbar puncture is exceedingly rare, with only a few cases reported in the literature. Potential risk factors included the use of low-quality or fragile needles, the excessive force or repeated attempts at puncture and an inappropriate technique of insertion. Complications can be serious, including migration of the fragment, neurological injury, or infection.

ID: AGS26/3386
P0953: Effect of pseudarthrosis after ACDF on development of adjacent segment degeneration: a minimum of 5 years follow-up

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Introduction: Pseudarthrosis after anterior cervical discectomy and fusion (ACDF) is failure of fusion and featured by the postoperative segmental motion at the index level. Ironically, the segmental motion is spotlighted as the advantage of cervical disc replacement (CDR) for prevention of adjacent segment degeneration (ASD). It was hypothesized that the segmental motion of pseudarthrosis may have protective effect against ASD just same as that of CDR. The objective of this study is to elucidate the effect of pseudarthrosis after ACDF on surgical outcomes and development of ASD. **Material and Methods:** Retrospective cohort studies were performed. Fusion status and ASD were evaluated at 2 years and minimum 5 year final follow-up. The patients were allocated based on the fusion status at 2 years. Radiological and clinical outcomes were compared between the fusion group and the pseudarthrosis group. **Results:** One-hundred four patients were enrolled for 2 year short-term evaluation. There was no significant difference in radiological and clinical outcomes between two groups. The ASD rates were 36.9% and 7.7% in the fusion group and the pseudarthrosis group, respectively ($p < 0.001$). 92 patients were enrolled for minimum 5year long-term evaluation. Radiological and clinical outcomes demonstrated no significant difference between two groups. The ASD rates were 55.6% and 15.8% in the fusion group and the pseudarthrosis group, respectively ($p<0.001$). Multivariate logistic regression analysis demonstrated that fusion at 2 years, single level surgeries, and larger postoperative T1 slope were significantly correlated with development of ASD. **Conclusion:** Pseudarthrosis caused significantly less ASD compared to fusion both in the short-term and long-term follow-up after ACDF. The segmental motion of pseudarthrosis after ACDF may have a preventive effect on ASD.

ID: AGS26/3486
P0954: Lumbar posterior instrumentation complicated by postoperative cerebrospinal fluid leak, PRES and multidrug-resistant infection: a rare case

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Introduction: Posterior reversible encephalopathy syndrome (PRES) is a rare but potentially reversible neurological condition typically associated with hypertension, immunosuppressive therapy, renal dysfunction, or systemic infections. PRES following spinal surgery is exceedingly uncommon, with only isolated case reports available in the literature. Postoperative cerebrospinal fluid (CSF) leakage and infection have been suggested as possible triggers. We report an unusual case of PRES after revision lumbar surgery, complicated by CSF leakage, John Cunningham virus (JC virus) positivity and multidrug-resistant Acinetobacter infection. **Material and Methods:** Clinical data from a 58-year-old female patient who underwent posterior instrumentation for recurrent lumbar disc herniation were retrospectively reviewed. Information was obtained from electronic medical records, operative reports, neuroimaging studies, microbiology results, and laboratory parameters. Brain and spinal MRI, CSF and blood cultures, and urine PCR for JC virus were analyzed. The management course, including dural repair, wound revision, and prolonged intravenous antibiotic therapy under multidisciplinary care, was documented. **Results / Case Presentation:** A 58-year-old female underwent posterior instrumentation for recurrent lumbar disc herniation. Two weeks after discharge, she presented with acute left hemiplegia and cognitive impairment. Brain MRI demonstrated radiological features consistent with PRES. CSF culture was negative, although JC virus was detected in urine. During hospitalization, the patient developed a wound CSF leak, requiring dural repair and wound revision. Wound culture grew Acinetobacter baumannii and prolonged targeted antibiotic therapy (vancomycin, meropenem, colistin, and trimethoprim-sulfamethoxazole) was administered. Despite severe neurological deterioration, subsequent MRI revealed regression of PRES-related lesions, while CRP levels decreased from 140 mg/L to 5 mg/L. After a total of 10 weeks of multidisciplinary inpatient management, the patient was transferred to rehabilitation without active wound leakage. **Conclusion:** PRES after spinal surgery is extremely rare, with only sporadic reports describing its occurrence in the postoperative setting. Potential mechanisms include altered cerebrovascular autoregulation due to CSF

leakage, infection-related inflammatory response and hemodynamic instability. The coexistence of PRES, JC virus detection and multidrug-resistant infection in our patient underscores the multifactorial pathogenesis and highlights diagnostic challenges. This case represents an exceptionally rare scenario of PRES following spinal surgery, emphasizing the importance of considering PRES in the differential diagnosis of acute neurological decline in the postoperative period. Early recognition and multidisciplinary management are essential for improved outcomes.

Trauma – cervical

ID: AGS26/22
P0955: Modified halter traction for severe post-traumatic cervical kyphosis: a novel preoperative technique

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Introduction: Cervical fractures in diffuse idiopathic skeletal hyperostosis (DISH) patients are highly unstable, with 73.5% experiencing complications. Progressive cervical kyphosis often requires extensive osteotomies with significant morbidity. Traditional halo traction has limitations in elderly patients with comorbidities. We present a modified halter traction technique for preoperative correction of severe post-traumatic cervical kyphosis. **Material and Methods:** A 78-year-old male with DISH sustained a C5-C6 disc space fracture from a ground-level fall. Poor collar compliance led to progressive kyphosis from 24 degrees to 35 degrees at four weeks with chin-on-chest deformity. Modified halter traction was implemented five days preoperatively using mandible/occipital straps with foam padding, a 35-degree patient incline, and neck support. Traction started at 2 pounds and gradually increased to 10 pounds. Daily radiographs monitored correction. During breaks, the patient tolerated 3-4 hour sessions with Miami J collar. Staged surgeries included C5-6 anterior discectomy/fusion and posterior C3-T2 instrumentation/fusion. **Results:** Serial radiographs demonstrated progressive correction over five days, transforming 36 degrees of kyphosis to 17 degrees of lordosis - a total correction of 53 degrees. This eliminated chin-on-chest deformity and achieved near-neutral alignment. Preoperative correction avoided extensive cervical osteotomies. Surgical blood loss was minimal (25cc anterior, 200cc posterior). The technique was well-tolerated and manageable by nursing staff and family, with periodic breaks for hygiene and meals. **Conclusion:** Modified halter traction provides an effective alternative to halo traction for severe post-traumatic cervical kyphosis in DISH patients. Advantages include superior patient tolerance, removable application, and reduced surgical complexity by avoiding extensive osteotomies, blood loss, and operative time. The technique is ideal for elderly patients unsuitable for halo traction. Prospective studies are needed to validate efficacy and establish selection criteria.

ID: AGS26/129
P0956: Outcomes of anterior cervical discectomy and fusion with cage and plate construct in patients with traumatic cervical spine injury

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Introduction: Anterior cervical discectomy and fusion (ACDF) has become a standard treatment of degenerative cervical spine disease due to its favorable complication profile and high rates of fusion. Utilizing this approach for traumatic cervical spine injuries, however, has been debated in the literature. Anterior, posterior, or combined approaches can be selected based on fracture type and location. In traumatic cervical instability, ACDF is generally supplemented with posterior instrumentation for additional stability and to mitigate the risk of hardware failure. This can increase the risk of complications, add operative time/exposure, and may necessitate additional levels of fusion. A novel technique utilizing the ACDF with a hybrid construct including a cage and plate may provide sufficient stability while negating complications associated with posterior approaches. This case series assesses the reliability of ACDF with a cage plate construct (CPC) in cases of cervical spine trauma. **Material and Methods:** Patients at a single institution who underwent ACDF with CPC after cervical spine trauma were retrospectively reviewed. The primary outcome was hardware failure and return to the operating room. Patient demographics, co-morbidities, mechanism/type of injury, operative procedure and average follow up duration were also recorded. Descriptive statistics were used to represent the data. **Results:** Fourteen patients (6 males and 8 females) met inclusion criteria, and the procedure was performed by 2 surgeons over a span of 4 years. Average age was 52 ± 20.8 years with an average operative time of 134 ± 74 minutes. Seven patients were injured from motor vehicle collisions while 7 sustained falls. Eight patients had vertebral fractures, 3 had traumatic spondylolisthesis, 2 had disc herniations and 1 patient had a combination of spondylolisthesis and a disc herniation. Eleven patients underwent single level fusion while 3 underwent 2 level fusion. Eight out of 14 patients had a fusion at the C6/7 level. Average follow up was 6.5 +/- 4.3 months. Two patients were immediately lost to follow up and were excluded from the average. Two other patients died from unrelated medical

conditions before 6 months of follow up. Zero out of 14 patients suffered from hardware failure, peri-operative complications or returned to the operating room for additional spinal procedures. **Conclusion:** ACDF in the context of traumatic spinal injury is often supplemented with posterior instrumentation to ensure a stable construct. This combined approach increases the risk of perioperative complications due to increased operative time and multiple incision sites. Importantly, posterior operations may require more extensive levels of fusion which ultimately reduces range of motion while ACDF with CPC only involves the injured level. The results of our limited case series provide evidence for the safety and efficacy of ACDF with CPC without the need for posterior instrumentation. All patients in our study had stable constructs in the immediate post-operative period and sustained no perioperative complications. With longer follow up, rates of successful fusion can also be determined. Future studies could better characterize the utility of ACDF with CPC in the context of specific injury patterns.

ID: AGS26/132
P0957: Complex type 3 odontoid fracture with C2 body comminution presenting as a rare post-traumatic anterior atlanto-axial subluxtaion: a brief description of management

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Introduction: Odontoid fractures of the second cervical vertebra (C2) are categorized into three types (Anderson-D'Alonzo system) with type III extending into the body of the axis. A type 3 fracture can be termed as complex when comminution involves more than 50% of the lateral mass or additional fracture lines extend into the vertebral body or pars. These fractures are usually the result of high energy trauma often causing significant instability and neurological issues.The usual C1-C2 subluxation pattern is of the dens being displaced posteriorly causing spinal cord compression . Our case is unique where the C1-C2 is anteriorly subluxated with the C1-dens complex translating anteriorly as a whole. This case report discusses the management of a 50-year-old female with a complex Type III odontoid fracture with severe C2 body comminution and C1-C2 anterior subluxation. **Material and Methods:** A 50-year female presented to the emergency department with alleged history of road traffic accident with injury to the neck . Her initial evaluation was done according to ATLS protocol and a collar was applied till full clinicoradiological diagnosis was done. Cervical spine tenderness was noted and neck movements were restricted .Her neurological examination was unremarkable with no neurological deficits post injury .A CT polytrauma protocol was done for her which revealed a complex type 3 odontoid fracture with severe C2 body comminution and anterior translation of the C1-Dens complex with C1-C2 anterior subluxation. MRI was also done which confirmed the diagnosis with no spinal cord compression or any protruding disc fragment .As there was no neurological deficit but an unstable C1-C2 injury and hence it was decided to go ahead with C1-C3 posterior fixation to achieve reduction and stabilisation.With the help of mayfeild clamp the patient was positioned prone and then through a midline incision from the base of occiput to the C4 the posterior elements were exposed and step by step fixation was done starting with C1 lateral mass screws bilaterally , then C2 bilateral pars screws and C3 lateral mass screws. Then with appropriate reduction maneuvres the C1-dens complex was brought posteriorly to reduce the C1-C2 subluxation and then the rods were fixed to the screws to achieve C1-C3 fixation.All the above steps were carefully monitored with intraoperative neuromonitoring. **Results:** Post operatively a hard cervical collar was applied. She was made to stand and walk on the next day itself. No post operative neurological deficits were noted. She was started on incentive spirometry and was allowed to do daily light activities . No major complications after the surgery were noted and she was discharged on post operative day 2. She was told to continue with the collar for at least 6 weeks. Follow-up radiographs showed no signs of displacement and showed signs of union in the C2 body. **Conclusion:** This case highlights that the current classification systems may not fully capture rare but clinically important variants and thus reinforcing the need for improvements in the classification system and allow for flexible surgical planning and incorporation of C3 fixation when C2 anatomy is severely disrupted.

ID: AGS26/227
P0958: Atypical cause of cardiac arrest: traumatic instability at the craniocervical junction

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Introduction: Managing cardiac arrest in the context of polytrauma represents a highly complex, interdisciplinary emergency scenario. Traumatic cardiac arrests presenting with pulseless electrical activity (PEA) are associated with a poor prognosis. Diagnostic efforts typically focus on the well-known reversible causes (the 4 Hs and HITS). However, injuries of the upper cervical spine are rarely considered as differential diagnoses in the acute phase. Prehospital diagnosis

is further hampered by the lack of imaging modalities, making early detection of potentially unstable dislocations difficult. **Case Presentation:** A 31-year-old forestry worker was struck on the back of the head and thoracoabdominal region by a falling log approximately 30 cm in diameter while felling a tree. His left lower limb was trapped. Upon arrival of the emergency physician, the patient was unconscious and exhibited agonal breathing. He was intubated for airway protection, and cardiopulmonary resuscitation was initiated due to a PEA rhythm. He was airlifted to our emergency department. On arrival in the trauma bay, the patient was intubated, ventilated, had a GCS score of 3, and continued to show PEA on ECG. Following ATLS-protocol, a whole-body CT scan was performed, which revealed both atlanto-occipital and atlanto-axial dislocations. Additional findings included multiple thoracic, abdominal, and extremity injuries, without evidence of intracranial hemorrhage. Due to the severe craniocervical instability, a halo fixator was applied immediately on the CT table, resulting in morphological realignment of the dislocation. Subsequently, return of spontaneous circulation (ROSC) was achieved-after a total resuscitation time of 115 minutes. However, due to rapidly progressive multi-organ failure, further surgical intervention was not feasible. The patient died shortly thereafter in the emergency department. **Discussion:** This case illustrates the rare but clinically significant scenario of traumatic cardiac arrest caused by a high cervical spine injury. Damage to cardiorespiratory centers in the brainstem can lead to neurogenic circulatory collapse presenting as PEA. In unconscious patients, classical clinical signs (e.g., neurological deficits) may be absent, increasing the risk of delayed diagnosis. In this case, whole-body CT enabled timely identification of the injury, and immediate halo fixation likely contributed causally to achieving ROSC-despite an extremely prolonged low-flow time. This suggests that mechanical stabilization in high cervical dislocations may represent a potentially life-saving intervention in exceptional circumstances. **Conclusion:** Injuries at the craniocervical junction should be considered in the differential diagnosis of traumatic cardiac arrest. Early imaging in the trauma bay and prompt application of a halo fixator can be crucial. This case reveals a critical gap in current trauma care and emphasizes the need to expand clinical algorithms to include this specific injury pattern.

ID: AGS26/491
P0959: Predictors of return to work following cervicothoracic spinal cord injury

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Introduction: Following spinal cord injury (SCI), approximately 65% of individuals do not return to paid employment, which can significantly impact quality of life and long-term independence. Being able to identify early which patients are more likely to return to work (RTW) allows clinicians to provide targeted support. However, accurate prediction remains challenging due to heterogeneity in injury severity, socio-demographics, and clinical course. By using the National Spinal Cord Injury Model Systems Database, this study seeks to identify predictors of RTW after a cervicothoracic SCI at one year post-injury through a tiered logistic regression modeling approach. **Material and Methods:** A retrospective analysis of de-identified data from the National Spinal Cord Injury Model Systems Database was performed. Inclusion criteria required patients (1) sustained a traumatic cervical or thoracic SCI, (2) had documented neurological level of injury at index admission, and (3) were a part of the competitive labor market pre-injury (n = 6043). RTW was defined as resuming any form of employment, including full-time, part-time, self-employed, supported work, or military service, after injury. Individuals with missing data essential to model construction were excluded. Logistic regression was used to identify predictors of RTW, incorporating demographic, injury, clinical, discharge, and socioeconomic variables. Model performance was evaluated using 5-fold stratified cross-validation with AUC-ROC, accuracy, and F1-score as performance metrics. **Results:** Multivariate analysis consistently identified ASIA Motor Index Score at discharge and rehab admission as a significant predictor of RTW (OR 1.01-1.02, $p < 0.001$). Discharge motor level, neurologic level, and ASIA Impairment Scale Grade were significant predictors of RTW. Among socioeconomic indicators, job type, marital status, and family income were found to contribute to predictive performance. Individuals in skilled professional occupations, service/manual labor jobs, and skilled labor positions had significantly lower odds of returning to work (Model 3 ORs 0.07-0.56, $p < 0.001$). Although sex, race, and intermittent catheter use were significant in Models 1 and 2, they were not retained in the other multivariate models after adjustment for more granular clinical and socioeconomic variables, suggesting their effects may be mediated by these factors. Models using only broad demographic and neurologic variables predicted RTW poorly (accuracy 58-60%, AUC-ROC 0.61-0.62 across models 1-2). Incorporating more granular clinical and socioeconomic variables improved performance substantially (77-81% accuracy, AUC-ROC 0.82-0.88 across models 3-7). **Conclusion:** This study highlights several key predictors of RTW after cervicothoracic SCI, including neurological function (ASIA Motor Index Score, motor and neurologic level, ASIA Impairment Scale), specific job types, trauma etiology, bladder management methods, marital status, and family income. Incorporating these factors allows for a more holistic approach to post-injury care. While no prior models exist specifically for cervicothoracic SCI, the best-performing model (AUC-ROC 0.88, F1 0.83) outperforms or matches

most published prognostic models for RTW and related outcomes in other injury populations, including orthopedic trauma, low-back surgery, and traumatic brain injury. A free, interactive online tool implementing these predictors is available at https://rtw-sci.streamlit.app/. Future studies should focus on validating these predictors prospectively.

ID: AGS26/657

P0961: Surgical versus conservative management in ASIA D central cord syndrome: a retrospective study of functional outcomes and impact of frailty on mildly symptomatic central cord syndrome patients

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Introduction: Central cord syndrome (CCS) is the most common type of incomplete spinal cord injury (SCI), and is associated with advanced age, cervical spondylosis, and low-velocity injuries in the elderly. This demographic frequently presents with comorbidities and frailty, raising questions about the benefits of surgery, particularly in ASIA D CCS patients with relatively mild symptoms. Early surgery (within 24 hours) is increasingly supported for many SCI; however, its role in CCS remains contentious. Some centres advocate early surgery for ASIA D CCS, while others favour conservative management unless deterioration occurs. The optimal management of ASIA D CCS remains a subject of debate. This study aims to provide a direct comparison of functional outcomes between surgical intervention and conservative management in patients with ASIA D CCS, addressing a critical gap in existing evidence and guiding clinical decision-making. **Material and Methods:** A retrospective cohort study was conducted at 2 Singapore hospitals from January 2015 to December 2023. CCS was defined as a traumatic injury resulting in a cervical neurological level of injury and greater weakness in the upper limbs compared to the lower limbs, evidenced by a lower average bilateral motor score for the C5-T1 segments below the neurological level of injury, as compared to the L2-S1 segments. **Results:** A total of 54 patients were included: 28 in the conservative group (mean age 67.7 years) and 26 in the surgical group (mean age 61.5 years). Surgical timing was 65.4% after 72 hours, 26.9% within 24-72 hours, and 7.7% within 6-24 hours. There were no statistically significant differences between surgical and conservative groups in ASIA scores at 1, 3, 6, or 12 months ($p > 0.05$), FIM change from admission to discharge ($p = 0.162$), or one-year mortality ($p = 1.0$). Subgroup analyses showed no significant differences in outcomes based on timing of surgery or injury impact (88.9% low-impact, 11.1% high-impact; $p = 0.778$). While BMI categories showed significant differences in ASIA 1-month scores ($p < 0.001$) and age categories in ASIA 3-month scores ($p = 0.021$), direct comparisons between both groups within these categories revealed no significant differences. The Modified Frailty Index showed a trend towards significance ($p = 0.060$), but analysis within frailty categories found no significant differences between both groups in the low frailty category, with insufficient data for the high frailty category. **Discussion:** In this study, most patients in the surgical group underwent intervention > 72 hours after injury. Our results showed that functional outcomes did not differ significantly between patients treated surgically and those managed conservatively. However, the small sample size limited our ability to determine whether factors such as frailty influenced outcomes between the two groups. Despite this, the findings suggest that high BMI and frailty may negatively impact recovery in both groups. Further research is needed to investigate the optimal management strategy for ASIA D CCS patients. **Conclusion:** This study found no significant difference in functional outcomes between surgically and conservatively managed ASIA D CCS patients. While limited by sample size, the findings highlight the potential negative impact of high BMI and frailty on recovery in both groups.

ID: AGS26/758

P0962: Individualised fracture specific tricortical autograft for cervical flexion teardrop fractures

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Introduction: Cervical flexion teardrop fractures are hyperflexion injuries in which the anteroinferior part of the vertebral body is fractured. They commonly occur at the C5 level due to a stress increaser and can result in a localized kyphotic angle and deformity. They are highly unstable and warrant surgical treatment. Although an anterior approach is most commonly used, the surgical technique depends on the size and morphology of the fracture fragment. In cases involving a large fragment, corpectomy is the preferred standard of treatment, as

ACDF with a PEEK or titanium cage risks hardware migration due to endplate compromise. In this technical report, we describe a new "puzzle" technique in which ACDF is performed with a custom individualized tricortical iliac graft that is custom-fitted and individualized according to the specific morphology and shape of the fracture of the patient. **Materials and Methods:** We retrospectively reviewed patients with flexion teardrop fractures treated at our institution using the puzzle technique. Inclusion criteria were the diagnosis of flexion teardrop fracture involving a large anterior vertebral body fragment and treatment with a patient-specific tricortical iliac crest autograft. Demographic data, surgical technique, radiographic results, complications and patient-reported results were analyzed. **Results:** Two patients with cervical flexion teardrop fractures were treated using the puzzle technique. In both cases, the fractured fragment was removed, and a custom tricortical iliac crest autograft was shaped to match the vertebral defect and the space of the intervertebral disc, followed by anterior plating, ensuring a stable construct. Postoperative imaging confirmed an adequate graft position without subsidence or hardware failure. Both patients reported good neck function with reduced VAS pain scores. **Conclusion:** The puzzle technique enables an adequate reconstruction of the vertebral defect and disc space. It is an excellent alternative to corpectomy, as it preserves bone and an additional healthy segment. Early outcomes in two patients demonstrate encouraging results without hardware failure or migration.

ID: AGS26/1234

P0963: Predictive factors for adjacent segment degenerative changes following anterior surgical treatment of rotational injuries of the lower cervical spine

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Introduction: Disc degeneration is a physiological aging process. The disc above or below a spinal fixation appears to be exposed to accelerated degeneration. Adjacent segment degeneration (ASD) is a potential long-term complication after cervical spine surgery. Identifying risk factors is essential to optimize patient follow-up and prevent late complications. The objective of our work is to determine the predictive factors of adjacent segment degeneration after treatment of rotational injuries of the lower cervical spine. **Material and Methods:** This is a retrospective study including 38 patients treated surgically via an anterior approach for lower cervical rotational spine injuries between 2015 and 2022. According to the UCLA grading system at the last follow-up, patients were divided into two groups:

- **Group A:** patients without significant degeneration (UCLA < 3, n = 34).
- **Group B:** patients with advanced degeneration (UCLA grade 3 or 4, n = 4). The following parameters were analyzed and compared between the two groups: age, gender, BMI, smoking, diabetes, posterior wall involvement, intracanal fragment, and Argenson classification. **Results:** Our series included 38 patients with a mean age of 41.86years. The sex ratio was 8.5. The body mass index (BMI) was 25.28 kg/m2 with extremes of 20.47 kg/m2 and 28.72 kg/m2. The most commonly affected level was C5-C6 (52.6% of cases). The average oh anthelisthesis was 4.29 mm. The mean of Cobb angle was 17.74°. According to the Argenson classification, the unilateral facet fracture was the most frequent (47.4% of cases). The average follow-up was 15.82 months. ASD was reported in 10.52% of cases**.** In a univariate study, the predictive factors for ASD were: the older age (p = 0.018; OR = 1.346; CI [1.005-1.850]), diabetes (p = 0.09; OR = 31; CI [2.409-398.879]) and posterior wall involvement (p = 0.047; OR = 16; CI [1.415-180.896]). However, we didn't find a significant relationship between gender (p = 0.628; OR = 0.882; CI [0.780-0.998]), BMI (p = 0.627; OR = 2.26; CI [0.223-25.140]), smoking (p = 0.52; OR = 1.61; CI [0.20-12.9]), and the anatomical characteristics of the fracture and the risk evolution for ASD. In a multivariate study, the only factor predicting osteoarthritic degeneration was age (p = 0.01). **Conclusion:** The causative factors of adjacent-segment disease are controversial. Disc degeneration is a normal manifestation of the ageing process. Nevertheless, disc disease is more prevalent at levels adjacent to interbody fusion than in the normal population, suggesting accelerated disc degeneration due to increased loading of the adjacent levels. Furthermore, lesions that are missed during the pre-operative work-up may play a role, as the available investigations do not always have high negative predictive values

ID: AGS26/1324

P0964: Does age influence the clinical and radiological outcomes of surgical treatment via the anterior approach for lower cervical rotational spine fractures?

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Introduction: Rotational injuries of the lower cervical spine are rare but potentially debilitating. Age-related anatomical

and physiological differences can influence healing and postoperative outcomes. It is essential to understand the impact of age on clinical and radiological parameters in order to optimize management strategies. The aim of our study is to evaluate the influence of patient age on functional and radiological outcomes following anterior surgical treatment of lower cervical rotational spine injuries. **Material and Methods:** It is a retrospective study including 38 patients treated surgically via an anterior approach for lower cervical spine rotational injuries from 2015 to 2022. Patients were divided into two age groups:

• Group A included patients under 50 years,

• Group B included patients older than 50 years. Functional outcomes were assessed using the Visual Analog Scale (VAS), Neck Disability Index (NDI), and cervical spine mobility. Radiological outcomes were evaluated by the Bridwell fusion score and the different radiological measurements at the last follow up. **Results:** Group A included 23 patients. Their average age was 31.96 years (range from 18 to 58), with male predominance (82.6%). The mean BMI was 24.56 kg/m2 . Two patients are diabetic. Unilateral facet fracture was noted in 10 cases (43.5%). The mean of follow up was 41.13 months. Group B included 15 patients. Their average age was 61.20 years (range from 52 to 76). All patients are male. The mean BMI was 26.39 kg/m2 . Diabetes was noted in 26.7% of cases. According to Argenson classification, unilateral facet fracture was noted in 5 cases (33.3%), unilateral facet dislocation in 5 cases and fracture-separation of the articular mass in 5 cases. The average of follow-up was 40.36 months. Patients of group A have better range of motion of rotation and inclination (Right rotation (64.26° vs 57.07°, p = 0.03), (Left rotation (64.13° vs 52.40°, p = 0.04), (Right inclination (35.87° vs 24.47°, p = 0.001), (Left inclination (35.87° vs 24.40°, p = 0.001). However, we didn't found any difference in flexion (p = 0.83), extension (p = 0.13) and NDI score (p = 0.19). VAS scores were lower in group A (2 vs 2.8, p = 0.042), indicating reduced postoperative pain. Regarding the radiological results, the Bridwell fusion score was significantly better in the younger group (1.39 vs 1.87, p = 0.03). when compare group A to group B, we noticed a statistically significant difference in Cobb angle (4.7° vs 10°; p = 0.001) and segmental rotation angle (5.47° vs 9.06; p = 0.02). We couldn't find any statistically significant difference in others parameters: Anthelesthesis (1.13 mm vs 1.1 8mm; p = 0.09), Cobb angle C2-C7 (24.17° vs 27.6°; p = 0.31) and absolute rotation angle (7.39° vs 6.8°; p = 0.76). **Conclusion:** Patients under 50 years of age exhibit superior functional and radiological outcomes following anterior surgical treatment of lower cervical rotational injuries. These findings suggest age as a relevant prognostic factor.

ID: AGS26/1329

P0965: Effect of Body Mass Index on postoperative outcomes following anterior surgical management of lower cervical rotational spine injuries

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Introduction: Body mass index (BMI) is often considered a potential risk factor for poor postoperative outcomes in spine surgery. However, its actual influence on clinical and radiological results remains debated, particularly in cases of cervical spine trauma. The aim of our study is to assess the impact of BMI on functional, clinical, and radiological outcomes following anterior surgical treatment of rotational injuries of the lower cervical spine. **Material and Methods:** We conducted a retrospective study including 38 patients surgically treated via an anterior approach for rotational fractures of the lower cervical spine between January 2015 and December 2022. Patients were divided into two groups based on BMI: Group A: Normal weight (BMI < 25), Group B: Overweight/obese (BMI ≥ 25). Clinical outcomes were assessed using the Visual Analog Scale (VAS), Neck Disability Index (NDI), and cervical spine mobility parameters. Radiological outcomes were evaluated using the Bridwell fusion score and the different radiological measurements at the last follow up. **Results:** Group A included 16 patients. Their average age was 33.5 years, with male predominance (81.3%). The mean BMI was 31.51 kg/m2. Two patients are diabetic. Unilateral facet fracture and unilateral facet dislocation were noted in 6 cases each. The mean of follow up was 41.13 months. Group B included 15 patients. Their average age was 50.77 years with male predominance (95.5%). The mean BMI was 26.57 kg/m2 . Diabetes was noted in 13.6% of cases. According to Argenson classification, unilateral facet fracture was the most reported (40.9% of cases). The average of follow-up was 40 months. No statistically significant differences were observed between the two groups across all parameters:

• VAS (2.19 vs 2.41, p = 0.56),

• NDI (10.88 vs 11.59, p = 0.78),

• Cervical flexion, extension, rotation, and lateral inclination (all p > 0.2),

• Bridwell fusion score (1.56 vs 1.59, p = 0.90). Regarding the radiological results, we didn't found a statistically significant difference for all radiological measurements: Anthelesthesis (p = 0.07), Cobb angle (p = 0.85), absolute rotation angle (p = 0.36) and segmental rotation angle (p = 0.9). **Conclusion:** In patients undergoing anterior surgical management of lower cervical rotational spine injuries, BMI does not appear to significantly influence functional recovery, pain levels, or fusion quality. These findings support that overweight and obese patients can achieve comparable outcomes to those with normal BMI in this specific surgical context.

ID: AGS26/1363
P0966: Influence of fracture pattern on functional and radiological outcomes after anterior surgical management of lower cervical rotational injuries

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Introduction: Rotational injuries of the lower cervical spine may present in various anatomical patterns, including unilateral facet dislocation (UFD), fracture-separation of the articular mass (FSAM), and unilateral facet fracture (UFF). Identifying the prognostic value of these fracture types is essential for surgical planning and outcome prediction. The aim of our study is to compare clinical and radiological outcomes following anterior surgical treatment based on fracture type: UFD, FSAM, and UFF. **Material and Methods:** It is a retrospective study including 38 patients who underwent anterior cervical spine surgery between 2015 and 2022 for rotational lower cervical spine injuries. Patients were categorized into three groups:

• **Group A:** included 13 patients who had operated for Unilateral Facet Dislocation,

• **Group B:** included 10 patients who had operated for Fracture-Separation of the Articular Mass,

• **Group C:** included 15 patients who had operated for Unilateral Facet Fracture. Functional and clinical results were evaluated by the Visual Analogue Scale (VAS), Neck Disability Index (NDI) and cervical range of motion (flexion, extension, rotation, inclination). Radiological outcomes were evaluated using the Bridwell fusion score and the different radiological measurements at the last follow up. **Results:** The mean age was 42.54 years in group A, 41.3 years in group B and 45.80 years in group C. We noted a male predominance in all group. The mean follow-up was 15.82 months. Patients of group C have significantly better cervical mobility and functional outcomes compared to patients in group A: Right rotation (65.47° vs 56.77°, p = 0.03) and left rotation (65° vs 54.31°, p = 0.02). Furthermore, functional and clinical outcomes and spinal mobility are better at the last follow-up in patients of group B compared to patients in group A. The difference is not statistically significant. Spinal extension (47.6 vs 38.4 p = 0.03) and NDI score (8.13 vs 15.9 p = 0.008) were better in patients in group C compared with patient in group B, with a statistically significant difference. Regarding radiological results, we found a statistically significant difference between patient in group A and B only for the regional Cobb angle (8.63 vs 4.22 p = 0.02). Furthermore, we did not find a significant difference between the various radiological parameters between patients in group A and C except for the regional Cobb angle (8.63 vs 5.05 p = 0.05). No statistically significant difference was found between patients in groups B and C with regard to the various radiological parameters at the last follow-up. **Conclusion:** Unilateral facet fractures (UFF) are associated with significantly better functional recovery and cervical mobility compared to other fracture types following anterior surgical treatment. Fracture morphology appears to be an important prognostic factor and may assist in tailoring postoperative management.

ID: AGS26/1388
P0967: Urgent surgery in subaxial cervical spinal cord injury

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To evaluate the clinical characteristics, treatment, and functional evolution of patients with subaxial cervical spinal cord injury treated in our hospital over the course of one year. Prognostic factors, the type of injury according to the ASIA classification, the therapeutic approaches used, and short- and medium-term functional outcomes are analyzed. **Material and Methods:** A prospective and observational study was conducted in patients with traumatic subaxial cervical spinal cord injury admitted to the Department of Trauma Surgery of our hospital in 2024, with a minimum follow-up of 6 months. Patients with a confirmed diagnosis through clinical evaluation and imaging studies (X-ray, computed tomography, and magnetic resonance imaging) were included. Epidemiological data, mechanism of injury, neurological level, and ASIA classification at admission and discharge were recorded. The treatment performed, length of hospital stay, and associated complications were documented. Functional evolution was assessed using the ASIA Scale and Frankel scale during the preoperative follow-up, at hospital discharge, and during follow-up at the Reference Center for spinal cord injury. **Results :** Five patients were included, with a median age of 43 years (IQR 23-74); 60% were women. The injury mechanism was high-energy traffic accidents in 80% of cases.

Radiologically, 60% presented a type C lesion according to the AOSpine classification, 20% type B3, and 20% type B2. The Allen and Ferguson classification in the series showed a predominance of extension-distraction mechanism (40%). The ASIA scale at admission showed 1 case of grade A (20%), 2 cases of grade B (40%), and 2 cases of grade C (40%). In all patients, urgent anterior fixation (cage and plated screws) was performed within the first 24 hours (< 12 h in 80% of cases) and posterior fixation (lateral mass or pedicle screws) was performed either urgently (20%) or in a second stage (80%), with a median of 10 days. Sixty percent of the patients showed neurological improvement at discharge. **Conclusions:** Acute spinal cord injury is a devastating and highly disabling condition. There is evidence in the literature that early decompression surgery within 24 hours after spinal cord injury is associated with neurological improvement, especially in incomplete injuries, with potential recovery of up to 2 ASIA levels.

ID: AGS26/1560
P0968: New algorithm for managing cranio-cervical dissociation: narrative review and case series

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Introduction: The occipitocervical junction represents a critical region for craniospinal stability, supported by osteoligamentous structures whose disruption may immediately endanger the patient's life. Occipitocervical dissociation (OCD) is a rare injury resulting from high-energy trauma, often overlooked during the initial evaluation and associated with severe neurological and vascular complications. Despite advances in imaging, diagnosis remains a clinical challenge, underscoring the need for standardized diagnostic and therapeutic strategies. This study reviews the literature and the cases managed at our center, proposing a comprehensive management algorithm based on clinical and imaging findings. **Material and Methods:** A narrative review was conducted in PubMed, Cochrane, and Google Scholar, including experimental, observational, and case reports published between 1990 and 2024. Mechanisms of injury, imaging parameters, classifications, and therapeutic modalities were analyzed. In parallel, a retrospective review of nine surgically treated patients with OCD at our institution was performed, recording clinical characteristics, imaging findings, surgical techniques employed, and clinical outcomes at six months. Based on this synthesis, a diagnostic-therapeutic algorithm was developed. **Results:** The literature search identified 213 titles, of which 28 relevant articles were selected. In our institutional series, the patients had a mean age of 28.8 years, predominantly male (7/9), with high-energy trauma mechanisms, mainly traffic accidents. All presented associated injuries, including traumatic brain injury and vascular damage in two cases. The surgical approach involved posterior instrumented fixation and occipitocervical arthrodesis, achieving radiological consolidation in all patients at six months. The proposed algorithm begins with computed tomography to assess Harris lines and the C0-C1 interval. A positive finding indicates OCD and mandates surgical management after CT-angiography. In negative cases, secondary findings such as occipital condyle avulsion or pre-/retro-odontoid hematoma are evaluated. If present, magnetic resonance imaging is indicated. Findings of C0-C1 synovitis, tectorial membrane disruption, posterior ligamentous complex injury, or soft-tissue hematoma/edema support surgical management, whereas their absence favors conservative orthopedic treatment and follow-up. This stepwise approach integrates clinical and radiological parameters, guiding safe and reproducible therapeutic decisions. **Conclusion:** Although infrequent, occipitocervical dissociation constitutes a life-threatening emergency in which prognosis depends on early diagnosis and prompt surgical treatment. The combination of validated imaging parameters within a structured algorithm enhances diagnostic accuracy and guides therapeutic decisions, minimizing the risk of neurological deterioration and favoring bone consolidation. Our clinical experience supports the application of a standardized diagnostic-therapeutic algorithm as an effective tool to optimize the management of these complex injuries in contemporary spine surgery.

ID: AGS26/1567
P0969: Anterior fixation in type ii odontoid fractures and a rare three-part fracture of the axis

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Introduction: Type II odontoid fractures are common upper cervical injuries that often require surgery to ensure union and stability. Anterior odontoid screw fixation provides direct stabilization while preserving the C1-2 motion segment and normal atlantoaxial rotation. In contrast, posterior C1-2 fusion, although effective for stability, can eliminate ~50% of cervical rotation. We present a single-center retrospective series of 14 patients (Jan 2015-May 2024) with Type II odontoid fractures treated by anterior screw fixation, reporting clinical and radiological outcomes, complication rates and cervical rotational range of motion. The series includes a unique case of a "three-part fracture of the axis" (combined Type II odontoid + Hangman fracture), a rare injury (~1% incidence) successfully managed in a single session with combined anterior and posterior fixation, while preserving cervical rotational

motion. **Material and Methods:** Fourteen patients with Type II odontoid fractures were retrospectively reviewed. Clinical outcomes (neurologic status, complications, range of motion) and fracture union on imaging were assessed at final follow-up. All patients underwent anterior odontoid screw osteosynthesis. In one patient with a combined odontoid + Hangman's fracture, a supplemental posterior C2 pedicle screw fixation with C2-3 wiring was performed in the same session. Postoperative cervical rotational range of motion was assessed clinically in degrees at a minimum of 6 months follow-up, once fracture healing was confirmed. Any perioperative complications were documented. **Results:** All patients achieved fracture union. All were neurologically intact at final follow-up, and most reported excellent neck function with minimal pain. Mean postoperative total cervical rotation was 158 ± 11°, indicating near-normal C1-2 mobility and reflecting ∼80-90% preservation of atlantoaxial rotation as reported in the literature. Complications were minimal: no neurovascular injuries occurred, and one patient had transient dysphagia that resolved spontaneously. In the three-part fracture case, the combined anterior-posterior approach achieved solid fusion and similarly preserved cervical rotation. This demonstrates that a one-stage motion-preserving fixation can successfully stabilize even complex axis fractures. **Conclusion:** Anterior odontoid screw fixation in this series yielded a high fusion rate and favorable outcomes while preserving cervical rotation. Even in a rare complex three-part fracture of the axis, a motion-preserving surgical strategy was feasible and led to good functional recovery. Therefore, when not contraindicated, anterior fixation should be considered the preferred approach for Type II odontoid fractures due to its clear advantage in maintaining atlantoaxial motion.

ID: AGS26/1604
P0970: Efficacy, safety and reliability of surgery by single anterior approach in neglected, lately presented sub-axial cervical spine injury

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Introduction: The optimal method for the management of neglected traumatic fracture dislocation of the subaxial cervical spine has not been well established. Management of a patient who presents late, more than three weeks after the initial injury, is challenging and differs from that of the patient who is seen early. 3 established surgical approach have been practiced in cervical spine injuries: 1. Anterior, 2. posterior, and 3. combined Anterior - posterior. Due to complex presentation of injury morphology and locked facet in late and neglected cases, most of the surgeon practice Combined approach in surgical management of such cases. Our country is resource constrained and here cost effectiveness plays a big role in decision-making. So, we need a method which is cost-effective, can be done with fewer implants and is safe and effective. In this case series, we performed a single Approach to correct dislocation and decompression of spinal cord and outcome was measured scientifically. **Material and Methods:** It is a prospective interventional study done in Our tertiary care centers. Study period: 10 years. Sample size 65. Cases operated at least 21 days after injury were included. Surgery was done by single anterior approach (ACDF). Using Stand-alone cage or Tricortical bone graft and anterior cervical plates and screws. Outcome analysis done by ASIA grading, VAS, and ODI scoring. Bridwell fusion grading was used to assess interbody fusion. Minimum follow-up period was 6 months. **Results:** Total sample size was 195. Age range was 21-55 (44.53 ± 12.5). 86.7% male (n = 168). The most common mechanism of injury fell from height 46.7% (n = 90); the most commonly injured level was C 5/6, 60% (n = 117). Average preoperative delay was 25 (±4) days. 66% (n = 126) patients had 1 grade ASIA impairment score (AIS) improvement, 20% (n = 39) had 2 AIS grade improvement, and 13% (n = 15) patients had no improvement of the postoperative ASIA score. Postoperative VAS and Macnab scores improved significantly. 80% (n = 156) patients achieved grade 1 fusion according to Bridwell fusion grading. 2 Patient had post operative dysphagia 1 patient had neck pain, No patient had any post-op neurological deterioration. **Conclusion:** Late and neglected cases of cervical spine injury can be managed by only anterior surgery with significantly good neurological and functional outcomes. Specially in a resource-constrained and poor patient-loaded country like us, this method is effective to reduce the cost of surgery and post-surgical morbidity of combined anterior and posterior surgery.

ID: AGS26/1739
P0971: Epidemiology of traumatic cervical spine fracture at tertiary level trauma center in Nepal

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Introduction: The cervical spine usually protects the spinal cord; thus, injury to the cervical spine may lead to paralysis,

damage, and is considered a medical emergency condition that needs an appropriate response to prevent further injury. Traumatic cervical spine fracture outcome is different based on poor road conditions and challenging geographical terrain, road traffic accidents, and falls in developing countries. Along with placing a heavy socioeconomic load on families and nations, it also contributes to high rates of mortality and morbidity. Timely diagnosis and management of the patients can affect the overall outcome. Similarly, there is a shift in the trend of presentation of traumatic cervical spine fractures in young individuals to the late 40s population in Western countries, which might be changed in developing countries. However, the epidemiology of cervical spine fractures is less well documented. The availability of these data can aid in building protocols for reducing and managing disease burden. The primary objective of our study is to evaluate the epidemiology of traumatic cervical spine fractures in patients presenting to a tertiary-level trauma hospital in Nepal. **Material and Methods:** The data for this descriptive cross-sectional study were gathered retrospectively from the National Trauma Centre's records of patients who visited the trauma center between December 2019 and December 2024, a span of five years. All cases of traumatic cervical spine fractures have been included in this study. The records with incomplete or missing data were excluded from the study. Demographics, the type and extent of the injury, the admission outcome, and the involvement of neurology are all covered. **Results:** We have registered 727 patients with traumatic cervical spine fractures among the patients presented. The mean age of the patient was 47.18 years, with the majority falling within the age group 40-59 years, 325 (44.70%) patients. The male and female comprise 555 (76.43%) and 172 (23.65%), respectively. The most common mechanism of injury was falling injury 467 (64.23%), followed by road traffic accidents 80 (11%). The most frequently affected cervical level was C5-C6. Among the patients admitted to the trauma center, patients who recovered were 532 (73.17%), and deaths were 40 (5.52%). Of the total patients, 106 (14.66%) were admitted to the ICU. The average length of hospital stays for the patients admitted in ICU was 20.26 days. **Conclusion:** Patients with cervical traumatic damage are more likely to be male, and most cases involve people between the ages of 40 and 60. Fall injuries are the most frequent source of injuries, which is in line with results from other research. After suffering catastrophic cervical spine fractures, almost two-third of patients healed. These findings highlight the need for preventive strategies, improved trauma care protocols, and early intervention to reduce morbidity and mortality in resource limited settings.

ID: AGS26/1829
P0972: Enhancing accuracy and confidence in cervical pedicle screw insertion: a case series on intraoperative Doppler use

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Introduction: In cases of traumatic cervical spine injury requiring surgical stabilization, cervical pedicle screw (CPS) fixation can be considered as a method to achieve strong fixation. CPSs are known to provide approximately three to four times greater pull-out strength compared to lateral mass screws; however, due to technical difficulty and the risk of vertebral artery or spinal cord injury, their use has been limited. Intraoperative computed tomography-based navigation facilitates CPS insertion, but such equipment remains available only in a limited number of institutions due to its high cost. Hong et al. previously reported that the use of intraoperative Doppler ultrasonography could improve the accuracy of CPS insertion. In this study, we sought to evaluate whether the use of intraoperative Doppler during posterior fixation in patients with traumatic cervical spine injury influences operative time, estimated blood loss, accuracy of pedicle screw placement, and insertion angle. **Material and Methods:** We retrospectively reviewed patients who underwent surgery for cervical spine trauma at our institution between January 2019 and August 2025. A total of 196 patients were initially identified. Patients who underwent occipitocervical fusion, combined anterior-posterior fixation, extended fixation below T3, laminoplasty, or anterior cervical procedures alone were excluded. Fifty-nine patients remained for analysis. Demographic and surgical variables including age, sex, number of fused levels, number of laminectomy levels, operative time, estimated blood loss (EBL), screw insertion angle, and pedicle screw accuracy according to the Gertzbein-Robbins classification - Breadow modification for the cervical spine were analyzed to evaluate the impact of intraoperative Doppler use. **Results:** After covariate adjustment for age, sex, fused levels, and laminectomy levels, intraoperative Doppler use was associated with a significantly shorter operative time (β = -87.01 minutes; 95% CI, -125.17 to -48.86; $p < 0.001$) and reduced log-transformed EBL (β = -0.78; 95% CI, -1.34 to -0.22; $p = 0.006$). While raw-scale EBL showed only a borderline reduction (β = -516.17 mL; 95% CI, -1050.85 to 18.50; $p = 0.059$), Doppler monitoring markedly increased the odds of accurate screw placement (OR = 20.28; 95% CI, 6.10-67.44; $p < 0.001$). Analysis of screw insertion angles

demonstrated a trend toward more favorable trajectories in the Doppler group (β = 3.82 degrees; 95% CI, -0.07 to 7.72; p = 0.054), although this did not reach statistical significance. **Conclusion:** Intraoperative Doppler monitoring significantly improved the safety and efficiency of cervical pedicle screw insertion in traumatic cervical spine surgery. Its use was associated with shorter operative times, reduced blood loss, and markedly higher accuracy of screw placement, with a trend toward more favorable insertion angles. Given its relative simplicity and accessibility compared with intraoperative navigation systems, Doppler monitoring may serve as a valuable adjunct to enhance the safety and precision of CPS fixation in cervical spine trauma.

ID: AGS26/2493
P0973: Mortality following surgical management of traumatic sub-axial cervical spine injuries in a South African tertiary centre

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Introduction: Traumatic sub-axial cervical spine injuries frequently result in spinal cord injury and significant mortality and morbidity. These outcomes are particularly severe in low- and middle-income countries (LMIC), where access to healthcare resources is limited and local survival data are scarce. This study aims to evaluate the mortality of adult patients undergoing surgical intervention for traumatic sub-axial cervical spine injuries in a South African tertiary centre. **Material and Methods:** We conducted a retrospective observational study of adult patients who underwent surgery for sub-axial cervical spine injuries between 2018 and 2022. Mortality data were collected using the South African Medical Research Council death registry. Primary outcomes were 30-day mortality and medium-term mortality. Multivariate logistic regression was performed to determine factors independently associated with 30-day mortality, and Cox proportional hazard analysis assessed medium-term survival predictors. **Results:** Eighty-six patients were included. The medium-term mortality rate was 19.8% (17/86) at a mean follow-up of 4 years and 6 months (SD 14 months). The 30-day mortality rate was 12% (10/86). Univariate logistic regression identified spinal shock, ASIA grade on arrival, Injury Severity Score (ISS), and lower respiratory tract infection (LRTI) as significant factors associated with 30-day mortality. In a multivariate logistic regression analysis, the ASIA grade was the only independent factor associated with 30-day mortality (OR 0.34, 95%CI 0.12-0.995, p = 0.049). Similarly, Cox proportional hazard analysis showed that ASIA grade was the sole independent factor associated with medium-term mortality (OR 0.38, 95%CI 0.19-0.73, p = 0.004). Respiratory failure was the cause of death in all but one case. Among patients with complete spinal cord injury (ASIA A), 30-day survival was 60% (12/20), and medium-term survival was 35% (7/20). **Conclusion:** The ASIA neurological injury grade was the most significant factor associated with survival in patients undergoing surgery for traumatic cervical spine injuries. A high mortality rate was observed among patients with complete spinal cord injury in both the short- and medium-term. Nonetheless, a significant number of patients with complete neurological injury survive the first year post-injury, underscoring the need for ongoing multidisciplinary support to optimize their quality of life.

Keywords: Sub-axial cervical spine injury, spinal cord injury, ASIA grade, mortality, South Africa

ID: AGS26/2543
P0974: Posterior cervical fixation preserving semispinalis cervicis muscle

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Introduction: C2 hangman fracture is a cervical spine fracture that mainly occurs due to trauma involving hyperextension. Depending on the extent of the fracture, anterior or posterior cervical fixation surgery may be necessary. The semispinalis cervicis muscle is one of the strong posterior cervical support tissues, and there are reports of cervical laminoplasty and C2 pedicle screws that preserve this area. We report a case performed by posterior cervical fixation surgery, preserving the semispinalis cervicis muscle, for C1-3 fixation in a patient with a C2 hangman fracture. **Material and Methods:** The patient is a 30-year-old female. She sustained injuries when the car overturned in a traffic accident while driving. She was transported to our hospital. Cervical CT scan revealed a C2 hangman's fracture (Effendi type I). After hospitalization and observation, she was fitted with a rigid cervical collar and discharged. Conservative treatment was continued. Two months post-injury, non-union of the fracture site and worsening cervical alignment, along with severe neck pain, were observed. C1-3 posterior fixation surgery under general anesthesia was performed using navigation guidance. The semispinalis cervicis muscle attached to C2 was preserved, and an oblique screw insertion through the lateral side of the semispinalis cervicis at C3, targeting the C2-3 joint area and C3 pedicle screw entry point, was safely performed. Postoperative progress was favorable, and she was discharged home a week post-surgery. Postoperative CT scan showed that the C3 pedicle screws were well inserted from the lateral side of the semispinalis

cervicis, and no signs of muscle atrophy or other abnormalities were observed one year post-surgery. Bonny fusion at the fracture site was confirmed, so implant removal surgery was performed. Post-surgery, she did not state significant neck pain, her head rotation improved, and even months later, the semispinalis cervicis was well preserved. **Results:** There are some reports of inserting C2 pedicle screws and performing cervical laminoplasty while preserving the semispinalis cervicis muscle, but there are few reports regarding pedicle screw insertion at C3-4. In this case, we were able to achieve good accuracy by attaching a reference arm to the C2 spinous process and performing navigation. Postoperative CT scans showed that the muscles were well preserved, and muscle preservation was still achieved after hardware removal. The surgical method used in this case, which preserves the semispinalis cervicis, can be applied to posterior cervical fixation procedures, including occipito-cervical (O-C) fixation for degenerative diseases or trauma at the craniovertebral junction. However, it is suggested that the semispinalis cervicis muscle extends more laterally at higher levels because making surgical exposure and rod fixation would be challenging for lower cervical levels such as C5-7. Additionally, while attaching the reference arm to the C2 spinous process allowed for good navigation accuracy in this case, future challenges include how to implement navigation when high instability is present at the C2 spinous process. **Conclusion:** We experienced a case in which posterior C1-3 fixation was performed for a C2 hangman's fracture while preserving the semispinalis cervicis muscle. Further accumulation of cases is needed to determine the extent to which posterior fixation with preservation of the semispinalis cervicis can be applied to trauma and degenerative diseases.

ID: AGS26/2603
P0975: Risk factors of fracture instability and non-union of type II/III odontoid fracture

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Introduction: Odontoid fracture has been known to the second most common fracture of cervical spine. We preferentially give patients with Type II and III odontoid fracture conservative treatment using cervical brace for 6 weeks if possible. After conservative treatments, sound union was not found at CT images. Instead, we used the term of fracture stability was defined as no motion at fracture site is observed on dynamic flexion and extension cervical lateral radiograph. We analyzed the fracture stability of Type II and III odontoid fracture after conservative treatment and union rate of Type II and III odontoid fracture after one year. **Material and Methods:** Medical records and radiologic data were retrospectively reviewed on patients with Type II and III odontoid fracture at double center from January 2006 to December 2023. Total 54 patients visited hospitals for Type II or III odontoid fractures. 7 patients undergone posterior C1-C2 fusion emergently were excluded because they showed the injury of transverse atlas ligament and neurologic deficit. 8 patients undergone surgical treatment instantly were excluded because they delayed to diagnose odontoid fracture more than 3 months. One patients diagnosed the fracture induced by infection and one patients diagnosed pathologic fracture were excluded. Finally, 37 patients included in this study. Age, sex, body mass density (BMD), Anderson and D'Alonzo classification were evaluated for patients' risk factors. Sagittal tilt (ST), Sagittal gap (SG), Gap of fracture line (GF), and coronal tilt (CoT) were measured for radiologic risk factors. **Results:** The mean age was 61.1 years, and 70% of patients were men. Mean follow-up was 25.2 months. Among 37 patients, 11 patients had osteoporosis, and 9 patients was osteopenia. 17 patients had normal BMD. Anderson and D'Alonzo type III was accounted for 59%, Type II was 41%. The fracture stability of Type II/III odontoid fracture was 30% during 6 weeks. The union rate of Type II/III odontoid fracture was 78.4% during one year. **Conclusion:** Osteoporosis is the most important risk factor for fracture instability and non-union over one year. Either sagittal tilt > 11° or gap >2 mm as radiologic measurements are relative to fracture instability during conservative treatment. No radiologic measurements are not considering as risk factor for non-union of odontoid fracture over one year. Age is a single important risk factor for non-union over one year.

ID: AGS26/2717
P0976: Para-vertebral foramen screws in acute cervical trauma: a single-center series highlighting safety and early stability without navigation

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Introduction: Cervical pedicle screws (CPS) provide strong fixation but carry high risk of neurovascular injury, while lateral mass screws (LMS) are safer but mechanically weaker. Para-vertebral foramen screws (PVFS) are designed to

combine the advantages of both techniques. Although their biomechanical superiority over LMS has been suggested, clinical evidence in acute cervical trauma remains limited. We aimed to evaluate the safety and early stability of PVFS in the acute trauma setting. **Material and Methods:** We retrospectively reviewed 28 consecutive patients who underwent posterior cervical fixation with PVFS for acute cervical trauma. Twenty patients (121 screws) were available for ≥12 months of follow-up (mean 18 months). Surgical strategy included posterior-only fixation or posterior fixation with additional anterior reconstruction. Outcomes included radiographic screw loosening, symptomatic complications, and need for reoperation. **Results:** All PVFS were inserted without navigation using fluoroscopy alone. No symptomatic complications, vertebral artery injuries, or reoperations were observed. Radiographic loosening occurred in ~5% of screws, all within 3 months and only in the posterior-only group; all cases remained asymptomatic. In contrast, no loosening was observed in the anterior add-on group. Compared with historical data on LMS, which demonstrate loosening rates of 10-15%, PVFS provided greater initial stability while maintaining excellent safety even in high-energy trauma. **Conclusion:** PVFS can be safely and reproducibly inserted without navigation and provide stronger initial stability than LMS. These features make PVFS highly compatible with the acute trauma setting, offering a safe and effective alternative for posterior cervical fixation.

ID: AGS26/3130
P0977: Non-operative management of a cervical penetrating spinal cord injury presenting as Brown-Séquard syndrome: a case report

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Introduction: Traumatic Spinal Cord Injury (TSCI) caused by penetrating trauma, such as stab wounds, is a less common etiology but the main traumatic cause of Brown-Séquard Syndrome (BSS). BSS is characterized by incomplete hemisection of the spinal cord, resulting in ipsilateral motor paralysis and proprioception loss, along with contralateral loss of pain and temperature sensation. It is important to emphasize that BSS has the best ambulatory recovery prognosis among all incomplete spinal cord injuries. This case aims to discuss the successful non-operative management of a cervical zone II penetrating injury, in which initial imaging findings suggested complete cord transection, but clinical progression was consistent with BSS. **Material and Methods:** A 36-year-old male patient was admitted following an anterior right paramedian cervical stab wound (Zone II). On admission, he presented with severe flaccid tetraparesis. CT angiography excluded major vascular injury, and computed tomography showed no bony instability. Magnetic Resonance Imaging (MRI) revealed a linear, transfixing T2/STIR hyperintensity at C5-C6, with ligamentous discontinuity, suggesting transverse cord transection. Given hemodynamic stability, absence of compressive retained fragments, and preserved biomechanical stability of the spine, a non-operative approach was chosen, including broad-spectrum antibiotic therapy and intensive supportive care. **Results:** Conservative treatment led to asymmetric and progressive neurological improvement that began early, highlighting the superiority of clinical evaluation over initial imaging findings. During outpatient follow-up, the patient evolved into a pattern consistent with BSS, presenting with disproportionate and asymmetric tetraparesis, significant motor recovery in the left hemibody (C5-C7 5/5), and contralateral sensory improvement on the right side. Lower limb examination revealed motor strength up to 3/5 for hip and knee flexion, indicating movement against gravity. Clinically, the patient achieved resolution of post-traumatic neurogenic bladder and regained sphincter control. **Conclusion:** The success of the non-operative management is validated by the recovery of bladder control and motor function, reinforcing that diagnosis and prognosis in incomplete injuries should be guided by serial neurological examinations and the spinal cord's intrinsic recovery potential. The main lesson lies in exercising caution when interpreting MRI in penetrating injuries and emphasizing a conservative approach, which ensures the best functional outcomes in well-selected patients.

References

1. Yildirim AE, Divanlioglu D, Cetinalp NE, Dalgic A. Brown-Séquard syndrome associated with a spinal cord injury caused by a retained screwdriver: a case report. *Surg Neurol Int*. 2022;13:223.

2. De la Cruz R, Nogueira-Neto E, Rivas JJ, Martinez-Ramos A. Brown-Séquard syndrome without vascular injury associated with Horner's syndrome after a stab injury to the neck. *Spinal Cord Ser Cases*. 2015;1:15007.

3. Segar DJ, Caruso JP, Chang YF, Sundararajan S, Miele VJ. Traumatic Brown-Séquard syndrome: modern reminder of a neurological injury. *Spinal Cord Ser Cases*. 2020;6:61.

4. Bono CM, Heary RF. Management of Penetrating Injuries to the Spine. In: Vaccaro AR, ed. *Spine Trauma*. Philadelphia: Clinical Gate; 2015.

5. Van Toorn R, Basson J, Fieggen G. Imaging findings of penetrating spinal cord injuries secondary to stab wounds on magnetic resonance imaging in a tertiary trauma unit, South Africa. *S Afr J Radiol*. 2019;23(1):1674.

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P0978: Gunshot wound with projectile lodged at C1-C2 level submitted to bullet removal without neurological deficits: case report

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Introduction: Gunshot wounds (GSWs) are a major public health issue, most often affecting young men, and account for 14.3% of spinal cord injuries. When involving the spine and spinal cord, they frequently result in severe neurological deficits, with most patients classified as ASIA (American Spinal Injury Association Impairment Scale) grade A. Complete tetraplegia occurs in about 12.4%, while minimal or no deficits are observed in only 0.6%. High cervical injuries are the least common (25.6%) but represent the most severe presentations. This report highlights the rarity of the lesion site and bullet location, with the patient classified as ASIA-E and demonstrating excellent postoperative recovery. **Material and Methods:** A case report of a 29-year-old male sustained a gunshot wound to the cervical region and right upper limb (RUL). On admission, he was conscious (Glasgow 15), hemodynamically stable, with isochoric and photoreactive pupils. Wearing a cervical collar, he presented monoparesis and hypoesthesia in the RUL, with preserved motor and sensory function in other limbs. Initial radiography revealed a retained projectile in the occipital region, with an entry wound in posterior cervical zone III. Non-contrast cervical computed tomography showed metallic artifacts at the occipital bone with an adjacent fracture near the foramen magnum. A projectile was identified within the spinal canal at C1-C2, associated with a comminuted and misaligned fracture of the posterior arch of C1, along with a second projectile in posterior soft tissues near the left posterior arch of C1. Cervical CT angiography confirmed these findings and ruled out injury to major cervical vessels. Neurological status was graded as ASIA-E. **Results:** The patient underwent elective posterior C1-C2 arthrodesis with removal of retained projectiles, without intraoperative complications. Postoperatively, he remained in a cervical collar, with adequate pain control. Neurological evaluation revealed ulnar claw deformity of the right hand, consistent with ulnar nerve motor deficit. Postoperative cervical CT confirmed removal of the intracanalar projectile at C1. The patient remained stable, underwent active kinesiotherapy, ambulation, and sitting, with satisfactory postoperative recovery. **Conclusion:** High cervical GSWs are rare and usually severe; however, this case demonstrates a favorable outcome following bullet removal and C1-C2 arthrodesis in a patient without major neurological deficits. This report emphasizes the importance of individualized evaluation and timely surgical management to optimize prognosis.

References

1. National Spinal Cord Injury Statistical Center. *Spinal cord injury: facts and figures at a glance*. Birmingham, AL: University of Alabama; 2021 [cited 2022 Jul]. Available from: "https://medicine.umich.edu/sites/default/files/content/downloads/NSCISCSCIFactsandFigures 2021.pdf"

2. Ryu B, Kim SB, Choi MK, Kim KD. Radiculopathy as delayed presentations of retained spinal bullet. *J Korean Neurosurg Soc*. 2015;58:393-396. doi: 10.3340/jkns.2015.58.4.393. PMID: 26587197.

3. Morrow KD, Podet AG, Spinelli CP, Lasseigne LM, Crutcher CL, Wilson JD, Tender GC, DiGiorgio AM. A case series of penetrating spinal trauma: comparisons to blunt trauma, surgical indications, and outcomes. *Neurosurg Focus*. 2019 Mar 1;46(3):E4. doi: 10.3171/2018.12.FOCUS18577. PMID: 30835674.

4. Santangelo G, Wathen C, Pieters T, George DD, Worley L, Macaluso D, Dagli MM, Catanzaro S, Gu B, Welch WC, Petrov D, Vates GE, Ozturk AK, Schuster J, Stone JJ. Multi-institutional review of characteristics and management of gunshot wounds to the spine. *Spine J*. 2024 Sep;24(9):1553-1560. doi: 10.1016/j.spinee.2024.04.032. PMID: 38740190.

5. Bono CM, Heary RF. Gunshot wounds to the spine. *Spine J*. 2004 Mar-Apr;4(2):230-40. doi: 10.1016/S1529-9430(0300178-5). PMID: 15016402.

6. Beaty N, Slavin J, Diaz C, Zeleznick K, Ibrahimi D, Sansur CA. Cervical spine injury from gunshot wounds. *J Neurosurg Spine*. 2014 Sep;21(3):442-9. doi: 10.3171/2014.5.SPINE13522. PMID: 24926931.

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P0979: Acute traumatic sub-axial central cord syndrome: can delaying surgery causes disaster?

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Introduction: Traumatic central cord syndrome (TCCS) is an incomplete spinal cord injury defined by greater weakness in upper versus lower extremities, variable sensory loss, and variable bladder, bowel, and sexual dysfunction. The optimal timing of surgery for TCCS remains controversial. The purpose of this study was to evaluate whether timing of surgery for TCCS predicts neurological outcomes, length of stay, and complications. **Material and Methods:** Forty-two patients with TCCS without fracture or dislocation were identified and divided into two groups described as two groups i.e. early surgery and delayed surgery group. Clinical outcomes including ASIA Motor Score (AMS), Japanese Orthopaedic Association (JOA) score upon admission and follow-up, change in AMS, and JOA recovery rate were analyzed. Logistic regression analysis was performed to show the correlation between timing of surgery and clinical outcomes. **Results:** All patients received a minimum of 1-year follow-up and showed significant neurological recovery at the final follow-up. No statistical differences in final AMS and JOA scores were observed between the two groups. There is insufficient evidence that lengths of hospital or intensive care unit stay differ between patients who undergo early versus delayed surgery. Furthermore, there is insufficient evidence that timing between injury and surgery predicts mortality rates or serious or minor adverse events. **Conclusion:** Surgery for TCCS ,24 hours after injury appears safe and effective. Although there is insufficient evidence to provide a clear recommendation for Early surgery (24 hours), it is preferable to operate during the first hospital admission and within 2 weeks after injury in selected patients.

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P0980: Safety and outcomes of Goel-Harms dorsal stabilization in sitting position for dens fractures without navigation

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Introduction: Fractures of odontoid account for about 10-15% of all cervical spine fractures. Type II fractures are unstable and carry a morbidity and mortality rate of roughly 6%. Numerous techniques exist for C1/C2 stabilization, but the goal of this paper is to evaluate the safety and effectiveness of a modified Goel-Harms procedure performed freehand under lateral fluoroscopy in the sitting position. **Material and Methods:** This retrospective study describes 161 consecutive patients between 2014 and 2023 who underwent C1-C2 fixation using a modified Goel-Harms technique in the sitting position, without navigation. Postoperative CT scans confirmed screw positioning. Screw placement was graded according to Gertzbein and Robbins. Surgery-related complications were recorded. Bony fusion was evaluated at 3, 6, and 12 months. **Results:** A total of 161 patients (72 men [44.7%], 89 women [55.3%]; mean age 77 years) underwent surgery with 644 screws placed. Seven patients with a persistent foramen ovale were operated on in the prone position and were therefore excluded. In 53 cases (32.9%), extension to C3 was performed due to associated pars or pedicle fractures. 624 screws (96.8%) were Grade A and B, 16 (2.4%) Grade C, and 4 (0.6%) Grade D and E. Only these four screws required revision for misplacement. Dorsal decompression with a C1 laminectomy was performed in 21 patients (13%), and 6 (3.7%) underwent revision for wound healing disorder. Four C2 screws breached the vertebral artery canal but did not compress the artery (0,6%). Two patients experienced vertebral artery injuries with total occlusion on CTA due to screw misplacement (0,3%), however without resulting neurological deficits and therefore the screws were not revised. Average surgical duration was 165.8 minutes (median blood loss 120 ml). None of the patients experienced an intraoperative air embolism or developed new neurological deficits. Direct after surgery, 116 patients (72.0%) reported neck pain and 10 (6.2%) radicular pain. The pain rate and intensity improved over time, but we did not have a reported pain scale to quantify the changes. Fusion rates reached 29.8% at 3 months and 62.1% at 6 months, though only 27 patients (16.8%) returned for a one-year follow-up. **Conclusion:** The modified Goel-Harms C1-C2 dorsal fixation performed in the sitting position under lateral fluoroscopy without navigation is a safe and straightforward technique with low complication rates. It should be considered a viable option in the surgical treatment of C1-C2 fractures. The surgeon's experience plays a critical role in the success of this procedure.

ID: AGS26/3258
P0981: Cervical spine instability in high-energy trauma: biomechanical considerations for posterior fixation - Literature review

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Introduction: High-energy cervical spine trauma can result in complex instability patterns, including fractures, dislocations, and ligamentous injuries. Posterior fixation is often necessary to restore stability, but careful consideration of biomechanical principles is critical to optimize construct strength and minimize complications. **Material and Methods:** A systematic

review of PubMed and Google Scholar was conducted using the keywords: "cervical spine trauma," "posterior fixation," "biomechanics," "instability," and "pedicle screw." Included studies encompassed cadaveric, in vitro, finite element, and clinical analyses evaluating cervical spine stability, fixation techniques, and construct performance in traumatic settings. **Results:**

• High-energy trauma frequently produces multilevel ligamentous and osseous injuries, increasing motion and stress at affected segments.

• Pedicle screws provide superior stability compared to lateral mass screws, particularly under rotational and lateral bending loads.

• Short-segment fixation may be inadequate in certain fracture patterns, whereas long-segment constructs improve overall stability but reduce segmental mobility.

• Accurate screw placement, trajectory planning, and vertebral morphology considerations are essential to prevent neurovascular injury and construct failure.

• Intraoperative navigation and imaging significantly enhance placement accuracy and safety. **Conclusion:** Cervical spine instability after high-energy trauma poses considerable biomechanical challenges. Posterior fixation strategies must be individualized based on injury pattern, vertebral morphology, and load distribution to optimize stability while minimizing complications. Further clinical and biomechanical studies are needed to refine fixation techniques and improve outcomes in this high-risk population.

ID: AGS26/3267
P0982: Role of emergency physicians in initial triage of high-risk cervical spine trauma: clinical-imaging concordance - Literature review

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Introduction: Cervical spine injuries in high-energy trauma present a significant risk for morbidity and mortality. Emergency physicians often rely on clinical decision rules such as NEXUS and the Canadian C-Spine Rule to triage patients and determine the need for imaging. Understanding the concordance between these clinical assessments and radiological findings is crucial to optimize patient safety and resource utilization. **Material and Methods:** A systematic review of PubMed and Google Scholar was conducted using the keywords: "cervical spine trauma," "emergency triage," "NEXUS," "Canadian C-Spine Rule," "clinical decision rules," and "imaging concordance." Studies reporting sensitivity, specificity, and agreement between initial clinical evaluation by emergency physicians and radiological findings (CT or MRI) were included. Data on study design, patient population, and injury patterns were extracted. **Results:** • Clinical decision rules (NEXUS and Canadian C-Spine Rule) demonstrated high sensitivity (typically > 95%) for detecting clinically significant cervical spine injuries.

• Specificity varied widely (25-60%), reflecting over-triage in low-risk populations.

• Discordances were most often due to subtle ligamentous or soft tissue injuries detectable only on MRI.

• Studies emphasized that structured clinical assessment improves early triage, reduces unnecessary imaging, and enhances patient safety when combined with judicious use of advanced imaging. **Conclusion:** Emergency physician-led triage using validated clinical rules shows high sensitivity but limited specificity for high-risk cervical spine trauma. Imaging remains essential for detecting subtle injuries. Integration of structured clinical assessment with selective imaging ensures optimal balance between patient safety and resource utilization.

ID: AGS26/3287
P0983: Treatment of cervical spine injuries caused by air weapons - Case report

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Introduction: Injuries caused by air rifles and other air weapons are rare but potentially life-threatening. Most incidents occur in children and young adolescents, with the head and neck region being the most frequently affected. **Material and Methods:** We present a case of a 20-year-old male patient with a cervical spine injury caused by an air rifle. The patient was treated at the Department of Spine Surgery, University Clinical Center of Serbia (UKCS), and followed for three years on an outpatient basis. **Results:** The patient was admitted to the emergency department after sustaining a self-inflicted air rifle injury to the neck. Initially examined by an otorhinolaryngologist at another institution, he was referred to our center the following day for further evaluation. On admission, he was conscious, oriented, and communicative, with stable vital signs (blood pressure within normal limits, oxygen saturation 100% on room air, afebrile). He reported no dysphagia, dyspnea, or voice changes. Neurological examination showed GCS 15/15 and ASIA E. A small entry wound (1.5 cm) was observed on the right side of the neck, without hematoma, swelling, subcutaneous emphysema, or exit wound. A palpable thrill was present, but no pulsating masses were noted. CT of the cervical spine revealed a bullet lodged in the C4/C5 intervertebral space without fractures, dislocations,

or spinal cord compression. The patient was admitted for monitoring and antibiotic prophylaxis. Given the absence of vertebral fracture, spinal cord involvement, or neurological deficit, a non-operative approach was chosen. During a three-year follow-up, the patient reported no significant complaints. Serial radiographs and one follow-up CT confirmed the stable position of the foreign body. The patient continues to attend regular follow-up visits, showing no complications. **Conclusion:** Although cervical spine injuries from air rifles are extremely rare, they require careful evaluation due to the potential for life-threatening complications. In selected cases without vertebral instability or neurological compromise, conservative treatment combined with long-term follow-up may be an effective management strategy. Ongoing surveillance, as in this case, is essential to ensure patient safety and monitor for delayed complications.

ID: AGS26/3338
P0985: Clinical outcomes of lateral mass screw for traumatic subaxial facet dislocation

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Objective: This study aimed to analyze the functional and neurological outcome of patients diagnosed with subaxial cervical spine bilateral facet dislocation managed by standard posterior midline approach and lateral mass screw fixation by Margerl technique. **Material and Methods:** Methods: We retrospectively evaluated 22 patients with traumatic cervical spine injuries who presented at the Orthopaedics and Spine Centre Ghurki Trust Teaching Hospital, Lahore from March 2020 to October 2023. Patients included in this study who has subaxial cervical spine bilateral facet dislocation managed by standard posterior midline approach and lateral mass screw fixation by Magerl technique. Functional outcomes was assessed by neck disability index and ASIA impairment scale at last follow up. Preoperative and post operative neurological status was evaluated with ASIA impairment scale. All the data were analyzed using SPSS version 23. **Results:** Results: Total 22 patients participated in the study of which 72.73% were male and 27.27% female. Mean age was 39 ± 17.02 (13-70) years. Regarding level of dislocation, most common level was C5-6 which was involved in 12 patients, followed by C3-4 and C4-5 which was involved in five patients each. Pre-operatively 50% of the patients had intact neurology (ASIA E), followed by ASIA D which made up of the 27.27% patients, ASIA C 9.09%, ASIA B patients (4.55%), ASIA A 9.09% illustrating the severity of the neurological dysfunction. Postoperatively no neurological recovery was observed in ASIA A or ASIA B patients, while all ASIA C and D patients showed complete recovery. Mean Neck Disability Index (NDI) was 21 ± 19.44. **Conclusion:** Conclusion: After a good reduction, lateral mass screws fixation are a safe and reliable approach for cervical fixation that not only stabilizes the cervical spine but also leads to a patient's excellent functional recovery.

Keywords: Cervical Spine, Facet Dislocation, Lateral Mass Screw, Neck Disability IndeX

ID: AGS26/3467
P0986: Analysis of mortality following cervical spinal cord injury. Operation as added risk

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Introduction: We observed a relatively higher mortality in our patients with Cervical Spine Injury treated with operative stabilization. This is what prompted us to make a comparison with the non-operated cohort in terms of mortality. **Material and Methods:** We examined our records over a 12month period for the total number of SCI cases we received, the total number that died within the period and whether the death occurred before or after surgery. **Results:** Most of the deaths occurred in patients with cervical spinal cord Injury (CSCI). There was no significant difference in the population groups except that one group had surgery while the other did not. Over ninety percent of the patients had Complete SCI (ASIA A) Interestingly, we had an equal number of mortality in the two groups for CSCI, but in terms of percentage, mortality in the operated group was 24% while it was only 11.3%. This is of great significance. **Conclusion:** The mortality in the operated cohort of traumatic CSCI is significantly higher that the mortality in the non-operated group. We need to individualize convincing indications for surgery.

Trauma – Other

ID: AGS26/41
P0987: The urgent need of ICU guidelines for the management of cervical SCI

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Introduction: Spinal cord injury (SCI), in general, is a cause of deterioration, mortality and severe disability. Upper cervical spine injury is not only cause of quadriplegia but also it might

be a associated with increased mortality. On the othat hand, lower spinal cord injury could be a major cause of quadriplegia but also for paraplegia. Patients suffering from lower incomplete cervical SCI could eventually have better quality of life compared to those suffering from complete lower cervical SCI and upper cervical SCI. As expected many of those patients are admitted to the intensive case unit (ICU), accompanied by other injuries. However, some of those patients have SCI without any additional injuries and their ICU stay is prolonged because of lacking recommendation how to treat these patients. Therefore, the present study has the aim to summirize the issues related to the ICU management of SCI patients and make an appeal for the spine community to organize and recommend thereupetic approaches for patients with cervical spinal cord injury in the ICU. **Material and Methods:** The literature was investiageted on world engines such as MEDLINE, Cochrane, Wiley,clinicaltrials.gov for articles on cervical SCI and ICU management for the duration between 2000 and 2025. **Results:** The data on the cervical spinal cord injury despite of the many attempts remains vogue on the subject of ICU management. There are less than 10 clinical trials without any sufficient conclusions and even lower number of meta-analyses on the subject. The issues discussed are regarding the ventilation and tracheostomy of the patients with cervical SCI, hyperhypothermia, dysreflexia and timing/approach of surgery. **Conclusion:** Despite of the increased knowledge on SCI and how to prevent secondary SCI, little is known on the subject of the cervical SCI and ICU. The latter is a major key for the management of SCI patients not only because of the severity of these injuries but also for their outcome. More studies are needed in more organized and global attempt to provide better care for the patients.

ID: AGS26/179
P0988: Spine trauma resource priorities in Sub-Saharan Africa: a Delphi approach

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Introduction: Optimally caring for spine trauma patients requires significant resource availability and highly specialized training. In LMICs where there may be more barriers to resources and training, spine trauma represents a major source of disability and public health burden. The aim of this study was to evaluate the highest priority resource needs for spine surgeons in sub-Saharan Africa in order to provide safe, high-quality spine trauma care. **Material and Methods:** This study utilized a Delphi methodology with a series of three electronic surveys. Participants were identified through the Continental Association of African Neurosurgical Societies (CAANS) College of Surgeons East, Central, and Southern Africa (COSECSA) networks. Response collection lasted from August 2024 to May 2025. The initial survey was an open ended collection of all spine trauma resource priorities in the region. For each subsequent round of surveys, participants rated topics on a Likert scale from 1 (most important) to 9 (least important). Topics that reached consensus were defined as those ranked 1, 2 or 3 (highly important) by ≥ 70% of the sampled group. **Results:** Initial invitations were electronically sent to 75 potential participants across the CAANS and COSECSA networks. Of those 75 potential participants, a total of 36 participants agreed to participate and responded to the first round of the survey [Table 1]. Thirty-four participants (94.4%) completed the second round of the survey. The mean score on a likert-scale from 1 to 9 was calculated with 1 being most important and 9 being least important. The results for each resource are displayed in Table 2. Thirty-five (97.2%) completed the final round of the survey. Overall, fifty-one items reached consensus and were included in the scale, meaning they received >70% agreement of one, two or three on the likert scale indicating a high degree of importance [Table 2]. The most highly rated items included braces/c-collars (97.1%), training/education of emergency room physicians on spine trauma management (97.1%), spine-trained surgeons (97.1%), and access to spine implants - including anterior cervical systems (97.1%) and posterior instrumentation (97.1%). Many of the items that did not reach consensus and were seen as less important included those which are highly specialized spine care items and/or require additional training, including microscopes (54.3%), endoscopes (37.1%), navigation (31.4%) and specialized personnel such as neuroanesthesiologists (68.6%) or neuro-radiologist (57.1%). **Conclusion:** We performed a comprehensive survey of thirty-six spine trauma surgery experts in sub-Saharan Africa using a Delphi approach to gain consensus as to the highest priority resource needs for spine trauma care. The most highly rated items primarily pertained to preoperative and intraoperative stabilization of the spine itself, with lower priority given to highly specialized spine care items. Given the high burden of disease and resource needs in these regions, efforts should be focused on providing only the most essential needs before considering more specialized tools and technologies.

ID: AGS26/540

P0989: Impact of race/ethnicity on recovery and socioeconomic changes after spinal cord injury: a multicenter analysis

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Introduction: Spinal cord injury (SCI) results in profound motor, sensory, and autonomic dysfunction with lasting health and socioeconomic consequences. Despite advances in surgical and rehabilitative care, disparities in access, management, and recovery remain underexplored. Prior studies suggest that racial and ethnic minority patients experience higher odds of postoperative complications, delayed diagnosis, and differences in surgical management compared with White patients. This study aimed to investigate racial and ethnic differences in SCI presentation, management, and outcomes at discharge and one year post-injury, focusing on neurologic recovery and socioeconomic measures. **Material and Methods:** We performed a retrospective cohort analysis using the National Spinal Cord Injury Model Systems (SCIMS) database, the largest longitudinal U.S. SCI registry. Adults aged 18-65 years who sustained traumatic SCI between 2010 and 2020 with complete baseline hospitalization (Form I) and 1-year follow-up (Form II) records were included. Demographic, clinical, and socioeconomic variables were extracted, including race/ethnicity, mechanism of injury, insurance, family income, occupational status, and American Spinal Injury Association (ASIA) classification. Patients were stratified into White and Other Race, Non-White cohorts. Group comparisons employed chi-square and ANOVA tests. Logistic regression models, both univariate and multivariate, were constructed to assess associations between race/ethnicity and outcomes. **Results:** A total of 3,382 patients were analyzed (mean age 39.7 ± 14.4 years; BMI 26.9 ± 6.5). Non-White patients were younger, more often injured through violent mechanisms, had lower income, and were more frequently covered by Medicaid compared with White patients, who were more often injured in vehicular accidents and had higher private insurance coverage (63.9% vs. 40.3%). White patients were more likely to undergo spine surgery (89.1% vs. 70.9%, $p < 0.01$). At discharge, neurologic impairment distributions differed slightly, but ASIA Motor Scores were comparable. At one year, rehospitalization rates did not differ significantly (34.1% vs. 34.8%, $p = 0.75$). However, disparities persisted in insurance coverage, income, and occupational status, with Non-White patients more frequently unemployed or in lower-wage jobs ($p < 0.01$). Among 1,232 patients with complete ASIA follow-up data, no significant racial differences were observed in impairment categories or changes from baseline. Univariate models suggested that Non-White patients had lower odds of rehospitalization and ASIA improvement, and higher odds of changes in occupation and income. After adjustment for socioeconomic and clinical covariates, associations with neurologic outcomes and rehospitalization were no longer significant, whereas disparities in occupational change (OR 1.75, 95% CI 1.42-2.17, $p < 0.01$) and insurance status (OR 1.47, 95% CI 1.23-1.76, $p < 0.01$) remained robust. **Conclusion:** In this large multicenter cohort, race/ethnicity was not independently associated with neurologic recovery or rehospitalization after SCI once clinical and socioeconomic factors were considered. However, significant disparities in post-injury insurance coverage and occupational outcomes persisted, underscoring the need for targeted policies and interventions to address socioeconomic inequities in SCI recovery.

ID: AGS26/797

P0990: Anterior pelvis external fixation and prone distal femoral traction. A novel intraoperative technique for complex spinopelvic injuries

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Introduction: Spinopelvic trauma represents a complex range of injuries known for their surgical challenges. Unstable, combined, spinopelvic injury patterns can demand multiplanar fragment control as well as, strong, accurate reduction vectors maintained during prone positioning. Skeletal traction and external fixation are well known in spine and trauma surgery for their safety and simplicity as well as powerful deformity correction and fracture reduction. Whilst routine in supine surgery, practical application, particularly of both techniques simultaneously in prone surgery is not well described. **Material and Methods:** Two illustrative cases are described following informed consent. Case 1. A 37-year-old male with an AO 61C1.3 (vertical shear, Denis III) fracture following a car vs cyclist accident. His pattern consisted of complex segmental pubic rami fractures and his left hemipelvis was 5 cm rostral to his right. Initial surgical attempt consisted of unilateral distal femoral skeletal traction and anterior superior acetabular external fixation prior to proning. In the prone position without femoral traction, haemodynamic instability resulted in postponement of surgery and immediate CT angiogram demonstrated fracture position loss from earlier supine reduction. On second attempt, distal femoral traction and

pelvic binder in addition to the external fixator were used during proning and 20 kg distal femoral skeletal traction maintained through the bed intraoperatively allowing uncomplicated L5 to S2 alar-iliac (AI) posterior fixation and transiliac-transsacral. The anterior external fixator provided powerful counter traction against the bed bolster through the uninjured hemipelvis. Airway, chest, upper and lower limbs were checked regularly throughout the case. Case 2. A 67-year old female with osteoporosis, AO 61C3.3 fracture and distal femoral fracture following fall from a height. Bilateral lower limb skeletal traction was attempted for reduction of bilateral, posteriorly displaced sacral fractures. A previous fixed distal femoral fracture meant bilateral proximal tibial traction skeletal traction was used. An anterior external fixator was not used. The bilateral proximal tibial traction resulted in a more dorsal force vector (up from the bed) compared to the distal femoral traction point in the prone position. **Results:** In case one, safe prone positioning and maintenance of intraoperative traction was achieved. Midline posterior approach could be completed and minimal further direct fracture maneuvers required for anatomic reduction and posterior fixation using navigated L5 - S2 AI fixation and navigated transiliac-transsacal screw fixation. In case two. Bilateral distal proximal tibial traction without anterior external fixation counter traction resulted in the patient losing position on the bed and was abandoned for standard open reduction techniques. **Conclusion:** Technique utility of simultaneous anterior external fixation and skeletal femoral traction has been demonstrated in a case with good bone quality and unilateral vertical hemipelvis displacement and should be considered in these fracture patterns requiring a primarily posterior approach. Anterior external fixation provided excellent counter traction and in combination with distal femoral traction resulted in anatomic reduction and an excellent clinical outcome. Caution is advised in cases with bilateral sacral injuries, osteoporosis or polytrauma limiting safe distal femoral traction.

ID: AGS26/935
P0991: Mental health problems in spinal cord injury patients - An umbrella systematic review

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Introduction: Mental illness is a significant comorbidity in individuals with spinal cord injury (SCI), yet the evidence base is fragmented across multiple systematic reviews. This overview aims to synthesize findings from existing reviews to clarify prevalence estimates, associated factors, and methodological quality across mental health domains in SCI populations. **Materials & Methods:** We systematically identified and synthesized systematic reviews reporting on mental health disorders in SCI populations. Eligible reviews included adults or children with traumatic or non-traumatic SCI, assessed for conditions such as depression, anxiety, post-traumatic stress disorder (PTSD), substance use disorders, cognitive impairment, and related psychological outcomes. Data on study characteristics, populations, outcomes, and key findings were extracted. Methodological quality was appraised using AMSTAR 2, and primary study overlap was assessed. Narrative synthesis was performed without meta-analysis. **Results:** Included reviews spanned publication years 2002-2025 and addressed depression (n = 10), anxiety (n = 4), post-traumatic stress disorder (PTSD) (n = 4), substance use disorders (SUD) including alcohol and opioids (n = 5), and cognitive impairment (n = 1). Depression prevalence ranged from 17% to 52% depending on the assessment tool, while anxiety symptoms affected up to 27% of individuals, with PTSD rates varying from 14% to 44%. Substance use was prevalent post-injury, with alcohol misuse affecting up to 51% and opioid use reaching 39% in pooled estimates. Methodological quality was rated high in 5 reviews, moderate in 10, and low in 4. The mean CCA across reviews was 8.1%, indicating moderate overlap. Heterogeneity in outcome measures and populations limited direct comparisons but revealed consistent associations with pain, low quality of life, and poor social support. **Conclusions:** Mental illness is highly prevalent in SCI populations, with depression and substance use disorders most frequently studied. Despite methodological variability, consistent patterns of psychological vulnerability emerge across reviews. This overview highlights the need for harmonized outcome reporting and targeted interventions, especially in underrepresented subgroups such as pediatric and low-resource settings.

ID: AGS26/1103
P0992: Posttraumatic spinal deformity in patients after spine trauma with decreased health and function outcomes

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Introduction: Disability, pain, and decreased function in daily life are very important concerns for patients after a thoracolumbar spine trauma. Recently a new term Posttraumatic Spinal Deformity (PSD) was introduced defined as: condition

where trauma to the spine results in deformity in any plane and results in pain and impaired function with or without a neurological deficit. In this study we analyzed radiographic and patient specific factors in a group of patients after a trauma to the spine with significant and lasting impairment and their conformity to the new definition. **Material and Methods:** A patient cohort with impaired function (Oswestry Disability Index > 40%) (ODI) was selected from an existing database of patients after long-term follow-up after spine trauma (>12 months). Patient factors were analyzed such as: age, fracture region, type and treatment, comorbidities and work status. Radiographic measurements and Patient Reported Outcome Measurements were analyzed. Descriptive statistics and Spearman's rho for correlation were used. **Results:** In total, 31 patients were included with a median age of 52 years (IQR 33). A B-type fracture in the thoracic spine was mostly involved. Fulltime employment dropped from 62% to 26%. Strong correlation was seen between the total scores of the ODI and the AO Spine Patient Reported Outcome Spine Trauma (PROST). But a very small correlation was seen between the pain dimensions of the ODI and the AO Spine PROST. **Conclusion:** This patient cohort did fit within the newly developed definition of Posttraumatic Spinal Deformity. The amount of measured deformity was variable and did not correlate to an impaired function at long term follow-up.

ID: AGS26/1299
P0993: Open reduction of L5/S1 traumatic spondyloptosis with "double lever technique"

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Introduction: Spondyloptosis is a severe spinal injury characterized by complete dislocation of upper vertebra over the lower vertebra. It is also referred to as grade V spondylolisthesis (Meyerding Classification). Spondyloptosis of L5/S1 is often associated with neurological deficits and loss of bowel and bladder control. Traumatic L5/S1 spondyloptosis requires high energy trauma and is extremely rare, particularly in children. We report a case of traumatic L5/S1 spondyloptosis in a 13-year-old boy and emphasize on the reduction technique. **Case presentation:** A 13-year-old boy was involved in a high-speed motor vehicle accident. He was uncertain about the mechanism of injury due to retrograde amnesia. Neurological examination revealed bilateral L4 & L5 deficits, more severe on the right side, with muscle power graded 0/5 but sphincter function was preserved. Radiographs and CT scans showed L5/S1 spondyloptosis with bilateral pedicle fractures from L2 to L5, resulting in dissociation of posterior spinal columns. MRI demonstrated crowding of cauda equina nerve roots and disruption of posterior ligamentous complex from L2 to S1. The patient was initially resuscitated due to a serious intraabdominal injury with a shattered spleen. He underwent an emergency laparotomy with splenectomy. After stabilizing for one week, he was brought to operating theater again for spine surgery with open reduction via posterior surgery and instrumentation from T12 to the pelvis. **Results:** Intraoperatively, the entire posterior elements from L2 to L5 were floating due to bilateral pedicle fractures and severe disruption of posterior ligamentous complex. Decompression was performed first by removing the detached posterior elements at L4 and L5. The thecal sac was found to be intact. We insert two Schanz pins into L5 vertebral body and another two in posterior iliac bone in the same location and direction as intended pedicle screws. The Schanz pins were then connected to external fixator bars at L5 and S1 each. A Bristow was carefully introduced via an imaginary Kambin's triangle in L5/S1 as the first lever while a Hohmann retractor was applied as the second lever using S1 bar as a fulcrum to lift the L5 bar. This maneuver eased and allowed controlled reduction while minimizing risk of neural injury. We name the reduction technique as "double lever technique". The Schanz pins were subsequently replaced with pedicle screws and the posterior instrumentation was completed in the usual manner. **Conclusion:** Traumatic L5/S1 spondyloptosis in children is extremely rare but disastrous. Reduction is often difficult and carries a high risk of iatrogenic neural injury. The described "double lever technique" provides a controlled and safe reduction method while minimizing unwanted complications.

ID: AGS26/1625
P0994: Spinopelvic fixation in traumatic instability: case report and clinical decision-making algorithm

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Introduction: Spinopelvic instability represents a significant therapeutic challenge, typically resulting from high-energy trauma such as motor vehicle collisions or falls from substantial heights. These injuries are associated with high morbidity and mortality, with reported mortality rates approaching 50% and neurological deficits occurring in 30% to 100% of cases. Various surgical stabilization techniques are available; however, the selection of the optimal approach is multifactorial. This report presents a clinical case of traumatic spinopelvic dissociation managed with anterior pelvic ring fixation and posterior triangular stabilization. The case

underscores the limited existing literature on this pathology and includes a comprehensive review of current treatment strategies. Furthermore, a management algorithm is proposed to facilitate standardized and reproducible surgical decision-making in similar clinical contexts. **Material and Methods:** This case report describes a patient with an unstable C1 fracture classified according to the AO/OTA system, associated with a Denis II fracture of the right sacral ala, right sacroiliac joint dissociation, involvement of the superior articular facet of S1, ipsilateral iliopubic and ischiopubic rami fractures, and residual pubic symphysis diastasis. The patient was followed for two years with functional outcome assessment. For the literature review, a systematic search was performed in PubMed and Ovid using the MeSH term "Triangular osteosynthesis", identifying 527 articles. After exclusion of duplicates and non-relevant studies, 41 articles were included in the final analysis. **Results:** At the time of case resolution, the patient's postoperative course was uneventful, without requiring intensive care unit admission, and early rehabilitation was initiated. At the 2-year follow-up, the patient reported a Numerical Pain Rating Scale (NPRS) score of 3/10 and an Oswestry Disability Index (ODI) of 4%, with no associated sensory or motor deficits. The patient successfully resumed full daily activities. Based on the literature review, we propose an algorithm for the diagnostic evaluation of spinopelvic injuries, as well as a structured approach to fixation sequencing and surgical management options. **Conclusion:** Pelvic trauma and spinopelvic instability constitute a significant diagnostic and therapeutic challenge. In our experience, the systematization of pelvic trauma management through the development of standardized care protocols and diagnostic-therapeutic algorithms has been essential for optimizing clinical outcomes.

ID: AGS26/1660
P0995: Efficacy of sacral-alar-iliac screw fixation (SAIFIX) for pelvic ring fractures - Nine Case Series

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Introduction: Pelvic ring fractures are often caused by high-energy trauma or bone fragility. In particular, in cases of high-energy trauma, it is well known that the mortality rate is high due to severe hemorrhage and the coexistence of multiple injuries. Furthermore, with the progression of population aging, the incidence of fragility fractures of the pelvis (FFP) is expected to increase, along with the demand for sacral-alar-iliac screw fixation (SAIFIX). Posterior fixation using SAIFIX is minimally invasive while providing strong fixation. In cases with concomitant burst fractures, skip fusion can minimize range-of-motion loss and preserve postoperative function. We report nine cases of pelvic ring fractures treated with SAIFIX. **Material and Methods:** The subjects were nine cases of pelvic ring fractures (2 males and 7 females) treated with SAIFIX at our hospital between February 2021 and March 2025. The mean age was 63 years (range, 23-83 years). The injury mechanisms included five cases of high-energy trauma and four cases of FFP. The mean waiting period until surgery was 14 days, and three patients received temporary external fixation in the acute phase. We evaluated bone union, postoperative ambulatory ability, and the need for additional surgery. **Results:** No surgical complications were observed. Bone union was confirmed in all eight cases that could be followed for more than six months, and all nine patients were able to achieve independent ambulation. No cases required additional surgery, nor was any progression of fracture displacement observed. In addition, three patients had concomitant thoracolumbar burst fractures; however, skip fusion was performed, allowing preservation of lumbosacral mobility. **Conclusion:** SAIFIX is minimally invasive yet provides strong fixation, offering perioperative advantages such as early mobilization and reduced risk of infection. In cases of pelvic ring fractures complicated by spinal injuries, even in high-energy trauma cases that often require long fusion with conventional techniques, skip fusion can be selected, potentially minimizing postoperative functional impairment. Further studies are needed to evaluate long-term outcomes and to compare SAIFIX with other surgical methods.

ID: AGS26/1664
P0996: Prehospital spinal immobilization in trauma patients with sensorimotor deficits: a systematic review

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Introduction: Spinal immobilization is widely used in prehospital trauma care to prevent secondary spinal cord injury, although evidence is limited. Reported harms include airway compromise, raised intracranial pressure, transport delays, and pressure injuries. International guidelines generally cite

sensorimotor deficit as the only absolute indication, yet clinical evidence remains inconsistent. This review specifically addressed the question of whether adult patients with blunt or penetrating spinal trauma and concomitant sensorimotor deficits benefit from prehospital immobilization with respect to neurological outcomes and survival. **Material and Methods:** We conducted a PRISMA-compliant systematic review (*PROSPERO: CRD420251035627*) of observational studies comparing prehospital spinal immobilization with no or selective immobilization in adult trauma. Databases (Pubmed, Cochrane Library, BASE, Google Scholar) were searched from inception to August 2025. Studies were eligible if they included adults (≥ 16 years) with traumatic injury, specified immobilization status, and reported neurological or mortality outcomes. Primary outcomes were neurological deterioration and all-cause mortality. Risk of bias was assessed using ROBINS-I. **Results:** Eighteen studies published between 1989 and 2024, encompassing over 72,000 adult trauma patients across North America, Europe, the Middle East, and Asia, met inclusion criteria. The majority were retrospective cohort studies (n = 16), with only two prospective investigations. Methodological heterogeneity, confounded by indication, and retrospective designs resulted in a high overall risk of bias and very limited confidence in the available evidence. Trauma mechanisms included both blunt (62.5%) and penetrating (37.5%) injuries, with immobilization strategies ranging from cervical collars to rigid backboards, vacuum mattresses, and full spinal motion restriction. Evidence specific to patients with sensorimotor deficits was sparse. The largest prospective cohort reported neurological deterioration in 59% of non-immobilized patients (n = 19), while a large retrospective (N = 454) registry paradoxically found higher odds of neurological disability among immobilized patients (OR 2.03, 95% CI 1.03-3.99). Smaller retrospective series described deterioration in both groups, with isolated cases in non-immobilized patients as well as in immobilized patients. Across broader trauma populations, immobilization did not consistently reduce neurological decline, mortality, or spinal cord injury confirmation. **Conclusion:** Marked heterogeneity and methodological limitations preclude quantitative synthesis of available studies, leaving no robust effect estimate for neurological or survival benefit. The only consistent recommendation remains immobilization in patients presenting with sensorimotor deficits, as endorsed uniformly across international guidelines. In unselected trauma populations, the balance of evidence indicates no clear benefit and potential harm, underscoring the need for selective, risk-adapted protocols. Until high-quality, mechanism-stratified trials are available, guideline-based immobilization in the presence of neurological deficits remains the most defensible standard of care.

ID: AGS26/1809

P0997: When trauma and chemistry collide: successful management of an open spinal fracture with burn injury

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Introduction: Open spinal fractures represent a rare but formidable orthopedic challenge due to the complex anatomy involved and the significant risk of complications. These injuries typically result from high-energy trauma, such as motor vehicle collisions or falls from height, and are frequently associated with extensive soft-tissue and neurovascular damage. **Materials and Methods:** We report the case of a 75-year-old farmer admitted with a severe dorsolumbar burn following the explosion of a backpack sprayer (containing a mixture of hydrofluoric and phosphoric acid) that he was carrying while cycling. On admission, the patient exhibited no pelvic instability or motor deficits but presented with an extensive third-degree dorsolumbar burn exposing gluteal musculature, accompanied by localized pain and mild paresthesia in both feet. The Poison Control Center was contacted, and, given the risk of deep tissue progression and systemic hypocalcemia or hypomagnesemia, topical calcium gluconate or carbonate gel was promptly administered. Radiographic evaluation revealed an acute L3 fracture (AO: B2(A3)) associated with right transverse process fractures of L2-L3 and left transverse process fractures of L1-L4, without neurological deficits. Conservative management was initiated with bed rest, log-roll transfers, and block mobilization. Due to the extent of the burn injury, the patient was transferred to a dedicated Burn and Trauma Unit, where urgent plastic surgical debridement was performed. Three weeks later, he underwent reintervention for lumbar seroma drainage, followed by continued wound care. One month later, with pain well controlled and paresthesia resolved, the patient underwent open posterior transpedicular fixation from L1 to L4. **Results:** The early postoperative course was favorable, with effective pain control, absence of infection, and preserved neurovascular function. The patient began ambulation with a Jewett brace shortly thereafter. At 4 weeks, wounds were fully healed, no inflammatory signs were noted, and radiographs demonstrated ongoing fracture consolidation, allowing initiation of physiotherapy. By 3 months, he remained pain-free, neurologically intact, and ambulated independently without support. Radiographs confirmed consolidation. At 5 months

postoperatively, the patient had returned to his baseline functional status, performing all pre-injury activities-including gardening tasks-without restriction. Clinical evaluation demonstrated complete wound healing, absence of local or systemic complications, and full, symmetric muscle strength. **Conclusion:** Open spinal fractures are serious injuries requiring urgent, multidisciplinary management focused on patient stabilization, hemorrhage control, infection prevention, and timely surgical intervention. Definitive surgical fixation is often necessary not only to restore spinal stability but also to facilitate soft tissue healing and optimize functional recovery. Prevention of infectious and neurological complications is paramount, as is minimizing the deleterious impact of prolonged immobilization. Early initiation of rehabilitation is essential for restoring function, ensuring long-term recovery, and preserving quality of life.

ID: AGS26/2293
P0998: The role of sacro-iliac joint fusion in pelvic trauma: personal experience

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Introduction: Pelvic ring fractures are uncommon injuries with a prevalence of 20-37/100,000 in the general population and still represent a leading cause of death and disability in patients involved in high-energy trauma.[1,2,3] Sacroiliac joint rupture, which includes both sacrum fracture or sacroiliac joint dislocation and crescent iliac wing fracture involving the sacroiliac joint, is among the factors associated with a worse functional outcome of this type of injury.[4,5] Posterior fixation of the disrupted sacroiliac joint can be achieved with iliosacral screws, anterior sacroiliac plating, transiliac bars, or transiliac plating.[6,7,8] The aim of this study was to verify the clinical outcome of patients with iliosacral fracture surgically treated with screws and titanium triangular implants and its correlation with the various types of traumatic mechanism. **Methods:** A retrospective analysis of patients with sacroiliac joint disruptions and treated with stabilization and fusion using screws and titanium triangular implants, from January 2020 to March 2024 was conducted and clinical outcomes were evaluated. For each patient, the type of traumatic mechanism was evaluated with the consequent type of pelvic fracture classified according to the classifications of Tile, Young-Burgess and the AO, the time to hospital stay, any further pathologies or traumatic injuries, the time of surgery, clinical outcome with SF-12, Majeed, New Score Pelvic System scores and number of positive tests for sacroiliac joint dysfunction. **Results:** We treated and recruited 18 patients (16 M, 2 F) who had sustained sacroiliac joint fracture/dislocation due to a pelvic ring fracture. The median age of patients was 67 (44-79). The average time to hospital stay was 32,5 days. The laterality of the sacroiliac lesion was right 8 and left 10. The mean time for the surgical procedure was less than 3 hours. The mean follow-up time was 1 year. The respective mean scores of Majeed score, PCS and MCS-12 (SF-12) and New Pelvis Score System were: 77.5, 41.275, 55.395. On physical examination, patients tested positive on average for only 1 provocative test for sacroiliac dysfunction. **Conclusions:** Based on clinical outcomes and results, the combination of screws and triangular implants for SI Joint Stabilization and Fusion has proven to be an effective and safe tool for reduction and stabilization of SI joint injuries in patients with complex pelvic fractures. This type of instrument proves to be effective not only in dysfunction or pain of the sacroiliac joint but also in traumatic injuries of the pelvis.

References

1. Meccariello L, Razzano C, De Dominicis C, Herrera-Molpeceres JA, Liuzza F, Erasmo R, Rocca G, Bisaccia M, Pagliarulo E, Cirfeda P, Gómez Garrido D, Rollo G. A new prognostic pelvic injury outcome score. Med Glas (Zenica). 2021 Feb 1;18(1):299-308.
2. Papakostidis C, Kanakaris NK, Kontakis G, Giannoudis PV. Pelvic ring disruptions: treatment modalities and analysis of outcomes. Int Orthop. 2009 Apr;33(2):329-38.
3. Gansslen A, Pohlemann T, Paul C et al (1996) Epidemiology of pelvic ring injuries. Injury 27(Suppl 1):S-A13-S-A20
4. Hoffmann MF, Jones CB, Sietsema DL. Persistent impairment after surgically treated lateral compression pelvic injury. Clin Orthop Relat Res. 2012 Aug;470(8):2161-72.
5. Dujardin FH, Hossenbaccus M, Duparc F, Biga N, Thomine JM. Long-term functional prognosis of posterior injuries in highenergy pelvic disruption. J Orthop Trauma. 1998;12:145-150; discussion 150-151.
6. Matta JM, Saucedo T. Internal fixation of pelvic ring fractures. Clin Orthop Relat Res. 1989 May;242:83-97
7. Albert MJ, Miller ME, MacNaughton M, et al. Posterior pelvic fixation using a transiliac 4.5-mm reconstruction plate: a clinical and biomechanical study. J Orthop Trauma. 1993; 7(3):226-232.

ID: AGS26/2375
P0999: Disc prolapse after lumbar fracture: clinical relevance, management, and recent evidence with case illustrations

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Introduction: Lumbar spine fractures may involve adjacent intervertebral discs, leading to acute disc prolapse or progressive degeneration. This association is under-recognized but has important implications for neurological outcome,

spinal stability, and surgical decision-making. **Material and Methods:** A narrative review of the literature (2020-2025) was performed focusing on traumatic disc prolapse in the setting of lumbar fractures. Key aspects analyzed included incidence, imaging, pathophysiology, and management strategies. Additionally, two illustrative clinical cases will be presented during the talk to demonstrate practical challenges and solutions. **Results:** Traumatic disc prolapse is increasingly recognized as a predictor of post-traumatic instability and deformity. MRI remains the gold standard for diagnosis, while CT is limited for soft tissue assessment. Management options range from conservative observation and CT-guided infiltration to vertebroplasty/kyphoplasty, decompression, and fusion. Recent evidence emphasizes that disc integrity strongly influences long-term outcomes. The forthcoming case illustrations highlight both minimally invasive management (vertebroplasty with infiltration) and surgical decompression with stabilization in progressive neurological deficit. **Conclusion:** Disc prolapse following lumbar fracture is a clinically significant condition that requires early recognition and tailored management. Understanding the contribution of disc injury to spinal instability helps guide optimal treatment. Case-based discussion will underline the spectrum of conservative, minimally invasive, and surgical strategies in real-world practice.

Keywords: lumbar fracture, disc prolapse, instability, vertebroplasty, spine surgery.

ID: AGS26/2467
P1000: High-energy gunshot wound to the lumbosacral spine (L4-5) with cauda equina syndrome: a case report

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Introduction: Gunshot injuries to the lumbosacral spine are uncommon but may result in severe neurological deficits, including cauda equina syndrome. Management is challenging and requires prompt, multidisciplinary intervention. **Material and methods (Case Presentation):** A 28-year-old male was admitted by air ambulance to a military trauma center after sustaining a high-energy gunshot wound to the lumbosacral region. Upon arrival, he was evaluated following the atls protocol, and subsequently underwent laparotomy, which revealed no major organ damage. He presented with complete motor and sensory loss below L2 and complete cauda equina syndrome, classified as ASIA A. Imaging revealed a comminuted-burst fracture at L5 with bullet fragments in the spinal canal and associated soft tissue damage. He underwent damage control surgery, which included: 1.- Posterior Decompressive Laminectomy. 2.- Instrumentation with polyaxial screws L4-S1. 3.- A dual graft technique employing thoracolumbar fascial tissue and synthetic substitute. 4.- Rotational flap of the thoracolumbar deep musculature (mutifidus, interspinalis, erector spinae, iliocostalis lumborum) for soft tissue coverage. **Results:** Postoperatively, there was no cerebrospinal fluid leakage. Neurological recovery progressed from complete to partial cauda equina syndrome, with persistent loss of anal sphincter function, partial urinary sphincter control, and partial recovery of hip flexion and knee extension. At 4-month follow-up, the patient was able to walk with crutches. **Conclusion:** High-energy gunshot injuries to the lumbosacral spine with cauda equina syndrome require prompt damage control surgery and multidisciplinary management. At 4 months, follow-up remains a short period for meaningful neurological recovery, highlighting the need for continued close surveillance and long-term rehabilitation.

ID: AGS26/3284
P1001: Complications associated with prolonged immobilization in the emergency setting prior to neurosurgical management - Literature review

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Introduction: Patients with acute spinal trauma frequently require immobilization in the emergency department prior to definitive neurosurgical care. Prolonged immobilization may lead to secondary complications, including pressure ulcers, compartment syndrome, and respiratory compromise. Understanding these risks is essential to optimize patient safety. **Material and Methods:** A systematic literature review was conducted using PubMed and Google Scholar with the keywords: "spinal trauma," "emergency immobilization," "prolonged immobilization," "pressure ulcers," "compartment syndrome," and "respiratory complications." Studies reporting incidence, risk factors, and clinical outcomes of complications related to prolonged immobilization were included. **Results:**

• Pressure ulcers were reported in 5-20% of patients, particularly in the elderly and those with limited mobility or comorbidities.

• Compartment syndromes and peripheral nerve injuries occurred in cases of rigid immobilization devices combined with delayed surgical intervention.

• Respiratory complications, including hypoventilation and pneumonia, were more frequent in patients with thoracic or high cervical immobilization, especially when ventilatory

support was delayed.
• Early mobilization, frequent position changes, adequate padding, and rapid transfer to definitive care were consistently associated with reduced complication rates. **Conclusion:** Prolonged immobilization in the emergency setting carries significant risk for pressure injuries, compartment syndromes, and respiratory complications. Protocols emphasizing early transfer to neurosurgical care, careful positioning, and regular monitoring are critical to minimize secondary morbidity. Further prospective studies are needed to quantify optimal immobilization durations and preventive strategies.

ID: AGS26/3302
P1002: Analgesia protocols in emergency management of spinal trauma: literature review

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Introduction: Pain management is a cornerstone of emergency care in patients with spinal trauma. Effective analgesia improves patient comfort, facilitates neurological assessment, and may reduce secondary complications. Various strategies - including systemic opioids, NSAIDs, and locoregional blocks-are employed, but their relative efficacy and impact on neurological evaluation remain debated. **Material and Methods:** A systematic literature review was conducted using PubMed and Google Scholar with the keywords: "spinal trauma," "emergency analgesia," "opioids," "NSAIDs," "regional blocks," and "neurological assessment." Studies reporting analgesic protocols, pain control outcomes, effects on neurological evaluation, and adverse events were included. **Results:**
• Opioids remain the mainstay for acute severe pain, providing rapid analgesia but requiring monitoring for sedation that may mask neurological deficits.
• NSAIDs offer moderate pain relief, with minimal impact on neurological assessment, but their use may be limited by renal or bleeding risk.
• Locoregional techniques, such as paravertebral or epidural blocks, provide effective segmental analgesia and reduce systemic opioid requirements; careful selection is needed to avoid interfering with neurological exams.
• Multimodal protocols combining opioids, NSAIDs, and regional techniques improve patient comfort, reduce opioid consumption, and facilitate accurate neurological assessment.
• Early and structured analgesic management is associated with improved patient cooperation, quicker imaging, and safer mobilization. **Conclusion:** Tailored analgesia protocols in emergency spinal trauma enhance patient comfort and allow reliable neurological evaluation. Multimodal strategies integrating systemic and locoregional techniques are recommended, with attention to safety and monitoring. Further studies are needed to optimize protocols and balance pain control with accurate neurological assessment.

Trauma - thoracolumbar

ID: AGS26/50
P1003: Long term results after combination of cryoablation and balloon kyphoplasty for osteoporotic thoracolumbar spine fractures

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Introduction: Both cryoablation and balloon kyphoplasty are well known techniques for management of painful osteoporotic fractures of the thoracolumbar spine. We evaluate or long term results after combination of these two techniques for a period of 7 years. **Material and Methods:** We analyze our results after percutaneous balloon kyphoplasty and cryoablation in a group of 67 adult patients with painful osteoporotic fractures in the thoracolumbar region of the spine. All patients were admitted and treated at the Department of Orthopedics and Traumatology of the Medical University - Plovdiv. The procedure was performed under general anesthesia, with patients positioned face down on a radiolucent operating table. In balloon kyphoplasty, we used the "Guardian" system - South Korea. In cryoablation, we used a cryoablator of the type: "Metrum Cryoflex", Warsaw - Poland. After removing the cannulas for balloon kyphoplasty, we used the same openings for the insertion of the cryoprobe to the medial branch of the ramus dorsalis of the spinal root. When incising the skin, we used the smallest scalpel tip, and for this reason, there was no need for a skin suturing. **Results:** We analyzed our results using the visual analog scale to assess the postoperative reduction of pain in all our patients who underwent this combined procedure. The follow-up examinations were conducted immediately after the procedure, on the 3rd, 7th day, one month, 3 months, and 6 months after the surgery. We did not manage to record any fractures of the bodies of the adjacent vertebrae to the cement-augmented vertebrae 6 months after balloon kyphoplasty. The average pain reduction after this combined technique was more than 50%, as measured by VAS. Two of the patients - one man and one woman had minimal response to this procedure, which necessitated open decompression, instrumentation, and fusion immediately after the attempt for minimally invasive treatment. **Conclusion:** Both balloon kyphoplasty and cryoablation are effective

percutaneous minimally invasive techniques used for pain management therapy in adult patients. Until now, we have not found studies on the combined use of balloon kyphoplasty and cryoablation in the same patient. The pain relief effect was confirmed by the visual analog scale and was maintained for more than 6 months. For these reasons, we recommend this combined technique for adult patients with painful osteoporotic vertebral fractures who are contraindicated or refuse open surgery.

ID: AGS26/80
P1004: Lumbar spine stress fracture adjacent to instrumentation in ankylosing spondylitis patient. Case report

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Introduction: This report describes sequentially vertebral stress fracture in an ankylosing spondylitis patient with pre-existing multilevel spine instrumentation. **Material and Methods:** 65-year-old presented to the emergency department with an injury to the neck after a fall riding a bycicle in November 2021. Plain radiograph evaluation revealed a displaced fracture at C6 and displaced fracture at the L1-L2 disc space, the patient was neurologically intact. The patient underwent postural reduction and open reduction via an internal fixation of both fractures. The cervical spine injury was addressed first, anterior plating and structural iliac graft from C5-C7 and 1 week after posterior multilevel pedicular screw and rod construct from T11-L4. After the second surgery the patient developed a nosocomial pneumonia (methicillin-resistant Stafilo-coccus Aureus) , renal failure and ADRS which requires intensive care for 5 months. Follow-up radiological control showed a complete bone healing and he was discharged to physiotherapy treatment for 3 months with complete functional recovery for daily activities and walking leisure. **Results:** Two years later, in October 2023, he started with back pain without previous trauma, we identified in lateral Rx a L5 stress transverse fracture in subacute stage. CT scan demonstrated a lysis in the vertebral body, representing material fatigue failure of bone. Long spinal instrumentation with screws to the ilium connected to the older implant allowed a good fixation in this osteoporotic bone scenario. Currently patient needed again 3 weeks of intensive care and antibioticoterapy. Bone healing considered at 6 months after surgery, again with complete functional recovery. **Conclusion:** According to Ho et al, recurrent stress fractures in patients with ankylosing spondylitis were noted to occur below the level of previous anterior iatro-genically fused spine segments. However, the application of instrumentation in the patient with ankylosing spondylitis may decrease the risk of refracture at this level but may further contribute to the rigidity of the involved spine segment, and it may assume the powerful moment arm in traumatic or non traumatic episodes, with stress forces targeting the spine segments at the weakest point. However, increased stress forces were redirected to the cephalaad and caudal levels to the instrumen-tation. In our patient the stress forces were redirected to the caudal level to the instrumentation with L5 stress fracture. Thus, in patient with ankylosing spondylitis with previous internal instrumentation who has even minimal trauma or without trauma with back pain the clinician should be suspect of the possibility of stress frac-ture at cephalad or caudal levels to the instrumentation.

ID: AGS26/147
P1005: Lifesaving embolization of a massive lumbar artery bleeding after a burst L2 vertebral fracture

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Introduction: Lumbar artery injury after comminuted lumbar fracture due to high-energy trauma especially after a suicide attempt is an infrequent injury. Lumbar artery bleeding might represent a life-threatening event, given the consequent retroperitoneal hemorrhages, which can provoke neurological complications. Our case highlights the value of embolization as the gold standard for these bleedings as a life-saving intervention. **Material and Methods:** A 35-year-old male patient was admitted to our department after a suicide attempt. The patient suffered from schizophrenia and the medication was interrupted. On admission, the Glasgow Coma Score was excellent without any head trauma, although he had tachycardia (120 pulses/minute) sufficient blood pressure of 110/65 mmHg, and 95% oxygen saturation. Communication due to his medical history was difficult, although the patient was alert. He complained about feet and back pain. He was neurologically intact and full body computed tomography angiography revealed active bleeding of the right inferior

lumbar segmental arteries. The patient gradually became hemodynamically unstable, with severe tachycardia, hypotension, and anuria. Furthermore, the CT scan and radiograms disclosed a burst L2 vertebral fracture, bilateral un-displaced open type 3A calcaneal fracture, and sacroiliac dislocation. **Results:** The patient was supported via blood transfusion, controlled fluid intake, and tranexamic acid administration until sufficient urinary excretion and correction of vital signs and acidosis. Due to the inability to further stabilize the patient, embolization of the segmental vertebral arteries was decided, and the patient was transferred to the nearby interventional radiologist department. A successful embolization via coil was performed and the patient was totally stabilized hemodynamically. The next day the patient underwent posterior Th12- L4 instrumentation accompanied with decompression of the unstable L2 burst fracture. We also stabilize the sacroiliac dislocation via iliac screw insertion and rod application. The patient had an uneventful recovery and was discharged five days after surgery. The calcaneal fractures were treated conservatively, and we monitored the patient closely due to the open fractures. During the 6-month follow up the L2 vertebral fracture, the calcaneal fractures, and the wounds were completely healed. CRP and ESR levels remained within normal limits throughout the monitoring. The patient was totally mobilized three months after surgery. **Conclusion:** Lumbar fractures can lead to retroperitoneal hemorrhages, which represent a potentially life-threatening event associated with neurological complications. In our case, the L2 comminuted fracture caused the rupture of the right lumbar arteries. Lumbar artery bleeding can occur as a complication of other conditions like renal mass biopsies, spinal procedures, or trauma as in our case. Lumbar artery bleeding is a rare condition, and no guidelines exist for the management of this life-threatening entity. According to the existing literature, endovascular intervention constitutes the treatment of choice. In several cases, collateral circulation led to multiple embolization with a bilateral approach. In our case, the approach was unilateral due to the sufficient embolization of the bleeding arteries and the stable hemodynamic condition of the patient. Clinicians should be aware of this life-threatening traumatic event and should not hesitate to urgently embolize the patient.

ID: AGS26/204

P1006: Usage of the transpedicular screw fixation method in the treatment of pediatric patients with injuries of the thoracic and lumbar spine

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Introduction: The incidence of spinal injuries in patients under 18 years of age has increased significantly in recent years, which represents a significant economic, social and medical problem. The most common method of surgical stabilization of spinal fractures in pediatric patients is transpedicular posterior spinal fusion, which is widely used by spinal neurosurgeons in adult patients. **Material and Methods:** From 2019 to 2024, 35 children with injuries of the thoracic and lumbar spine underwent surgical treatment using the transpedicular screw fixation method. Among the injured, girls prevailed (21 cases, 60%). The age of the victims ranged from 9 to 17 years. The main causes of damage were: catatrauma (19 cases), road accident (5 cases), sports injury (6 cases), other reasons - 5 cases. In 5 cases, suicidal attempts occurred. Co-injury was observed in most cases (20 patients, or 57%), which is natural for high-energy injury. Vertebral-spinal injury with neurological disorders was observed in 13 patients, the disorders ranged from mild inferior (4 children) to moderate/severe paraparesis (5 patients) and inferior paraplegia (4 children). 6 children had pelvic organ dysfunction in the form of urinary and fecal retention or incontinence. All thirty-five patients, within a period of 1 to 57 days after the injury, underwent a number of surgical interventions from the posterior surgical access using a screw fixation method (posterior decompression + spinal fusion). In 12 cases it was necessary to perform the second stage of surgical treatment - anterior decompression of the spinal cord or its roots. Verticalization of patients was carried out within 1 to 5 days after surgery.

Results: In all patients the nearest, up to 1 year, results were evaluated. In children operated in 2019-2021, the results were

studied in terms of 3 to 5 years. The procedures used, clinical results and the quality of the fixative installation were assessed. All patients managed to achieve positive results. The use of internal fixation made it possible to carry out early verticalization of children, eliminate pain syndrome and achieve a regression of neurological disorders in most patients (especially in cases when the operation was performed early after injury - from 1 to 3 days,). Within the first month, the ability to self-care was fully restored. Bone fusion was observed within 6-12 months after surgery. There were no complications after surgery. The analysis of postoperative radiographs, CT and MRI images revealed the correct standing of the screws in all cases. **Conclusion:** The posterior spinal fusion using the new method of screw fixation in pediatric patients allows to achieve durable stabilization of damage, begin early rehabilitation of patients and reduce the duration of hospital treatment by 2-3 times. Thus, we recommend the use of a transpedicular fixator in children as a reliable, really technically feasible method for restoring spinal stability with a low risk of intra- and postoperative complications.

ID: AGS26/327
P1007: How should we manage spine fractures in ankylosing spondylitis

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Introduction: How should we manage spine fractures in ankylosing spondylitis? A retrospective cohort study on Northern Irelands experience. Fractures are 4 times more common in ankylosed spine, commonly occur in cervical region, caused by minor trauma. Management challenges include fracture instability, multiple co-morbid population, high risk of neurological damage and difficult to position in theatre. Our aim is to find out what interventions do we undertake here? And does intervention have an impact on neurological outcome. **Material and Methods:** Retrospective analysis of all admission to RVH between 01/01/2000 and 31/12/2021 diagnosed with Ankylosing spondylitis fractures, data was obtained from fracture outcome Research Database (FORD) and inpatient fracture database. Fracture level, neurological function, time to surgery, treatment options and complication has been recorded and analyzed. **Results:** 33 patients included in this study, ages 34-94, 1 female and 32 males, 12% C2-C6, 38% C6-T4, 50% T5-L4. 90.9% treated surgically, 9.1% treated conservatively. 43% underwent surgery within 24 hours, 30% 24-48 hours, 17% 48-72 hours, 10% more than 72 hours. 70% posterior approach and fixation, 27% both anterior and posterior approach, 3% anterior fixation only. 67%neurological function remained the same, 19% improved, 14% worsen function post operatively. Complications: 3 deteriorations in neurological function, all operatively managed, 1 metal work failure, 4 wound infections, 3 mortalities at 30 days. **Conclusion:** Highly unstable fractures with high-risk neurological compromise. Patient intraoperative positioning is key, urgent stabilization is recommended. Posterior stabilization alone provides adequate fixation in most patients, but both should be considered in the correct patient.

ID: AGS26/426
P1008: Lumbar spinal cord injury elevates risk of psychiatric morbidity in matched cohort analysis

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Introduction: Spinal cord injury (SCI) is a life-altering condition associated with disproportionately high rates of depression and anxiety, with prevalence estimated to be two to three times greater than in the general population. These psychiatric comorbidities negatively affect rehabilitation engagement and functional outcomes However, few studies have isolated the psychological impact of SCI from that of trauma more broadly. This study aimed to compare the incidence of new-onset mood and anxiety disorders in patients with lumbar SCI versus matched trauma-exposed controls with long bone or pelvic fractures. **Material and Methods:** A retrospective cohort study was conducted using the TriNetX United States Collaborative Network. Adult patients ($\geq$ 18 years) with a new diagnosis of lumbar SCI were identified and matched 1:1 to patients with pelvic or long bone fractures. Patients with prior diagnoses of mood or anxiety disorders or prior psychiatric medication use were excluded. The primary outcomes were new diagnoses of mood or anxiety disorders and new prescriptions for antidepressants or anxiolytics between 14 and 90 days post-injury. Propensity score matching is controlled for age, sex, race, comorbidities (e.g., diabetes, obesity), and substance use. Psychiatric outcomes were assessed using Kaplan-Meier analysis, hazard ratios, risk ratios, and odds ratios. **Results:** A total of 39,992 patients with lumbar SCI were matched to 29,992 orthopedic trauma controls. New-onset mood or anxiety disorders occurred more frequently in the SCI cohort (1.44%) compared to controls (0.38%; RR 3.789, $p < 0.0001$). Lumbar SCI was also associated with significantly increased initiation of psychiatric medications, including SSRIs (RR 3.859), SNRIs (RR 4.831), atypical antidepressants (RR 4.006), tricyclic antidepressants (RR 8.227), and anxiolytics (RR 3.474; all $p < 0.0001$). SCI patients were over six times more likely to be referred for psychiatric services (RR 6.467, $p < 0.0001$). **Conclusion:** Lumbar SCI is associated with a markedly increased risk of

new-onset mood and anxiety disorders, psychiatric medication initiation, and mental health service utilization compared to matched high-energy orthopedic trauma patients. These findings highlight a distinct psychiatric burden following SCI and underscore the need for early mental health screening and integrated psychiatric care in this population.

ID: AGS26/536
P1009: Thoracolumbar spine trauma outcomes: impact of ankylosing spondylitis and diffuse idiopathic skeletal hyperostosis

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Introduction: Thoracolumbar trauma in patients with ankylosing spondylitis (AS) and diffuse idiopathic skeletal hyperostosis (DISH) poses unique challenges due to spinal rigidity and altered biomechanics. This study compared demographics, surgical management, and outcomes of surgically treated thoracolumbar trauma patients with AS, DISH, and controls, hypothesizing distinct injury patterns, surgical needs, and outcomes in AS and DISH. **Material and Methods:** We retrospectively analyzed 189 patients undergoing surgery for thoracolumbar trauma at a level 1 trauma center (2015-2024): AS (n = 20), DISH (n = 32), and controls (n = 137). Data included demographics (age, sex, comorbidities, ASA), clinical factors (mechanism, ASIA scale, ISS), and surgical variables (approach, fusion levels, complications). Outcomes included neurological changes, hospital/ICU stay, complications, mortality, and readmission. Descriptive statistics and regression models were used; significance was set at $p < 0.05$. **Results:** AS (72 ± 13.6 years) and DISH (74 ± 11.5 years) patients were older than controls (45 ± 22.3 years, $p < 0.0001$) and more often male (AS 90%, DISH 75%, controls 64%). Type 2 diabetes was more prevalent in AS (45%) and DISH (41%) versus controls (10%, $p \leq 0.003$). Osteoporosis was highest in DISH (34%) compared to AS (15%) and controls (6%, $p < 0.001$). Low-energy falls accounted for most injuries in AS (55%) and DISH (56%) versus 25% in controls ($p = 0.001$). Fusion constructs were longer in AS (5.8 ± 1.6 levels) and DISH (5.1±2.2) than controls (3.8 ± 2.3, $p < 0.0002$). Thoracic fusion predominated in AS (50%) and DISH (66%) ($p = 0.0002$). AS patients were significantly more likely to undergo open surgery (OR 8.09, $p = 0.026$). Clinical outcomes also diverged. ICU admission was more frequent in AS (55%) and DISH (47%) compared to controls (31%, $p = 0.02$). In-hospital mortality was highest in AS (15%) versus DISH (6%) and controls (3%, $p = 0.037$), and AS patients were nearly 800 times more likely to die in-hospital ($p = 0.044$). Postoperative complications, including infection and hardware failure, occurred more often in AS (25%) and DISH (22%) than controls (12%), though not always reaching statistical significance. A greater proportion of AS (50%) and DISH (47%) patients required skilled nursing or rehabilitation placement compared with controls (45%, $p = 0.004$). **Conclusion:** This study demonstrates how AS and DISH patients sustaining thoracolumbar trauma are demographically distinct, with advanced age, male predominance, and higher comorbidity burden. Their rigid, osteoporotic spines predispose them to unstable fractures from low-energy falls, unlike the high-energy mechanisms typical in controls. Surgically, they require longer constructs and more thoracic fusions, and AS patients often necessitate open approaches due to fracture complexity. Clinically, AS patients are particularly vulnerable, with markedly higher ICU use, complication rates, and in-hospital mortality. Both AS and DISH patients face significant functional decline, reflected in higher rates of post-acute rehabilitation needs. These findings underscore the importance of early recognition, aggressive pre-operative optimization, individualized surgical strategies, and comprehensive post-discharge care pathways. Improved risk stratification and multidisciplinary management may help mitigate poor outcomes in this fragile and high-risk population.

ID: AGS26/591
P1010: Characterization of thoracolumbar spine fractures caused by nautical vehicles in Cartagena, Colombia: multicenter study between the years 2020 and 2024

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Introduction: Thoracolumbar spine fractures are widely described in the literature, highlighting their mechanism of injury associated with high-energy impact. These injuries have been extensively studied in traffic accidents, falls from heights, sports injuries, and war injuries. However, there is no comprehensive report on these types of injuries related to the use of nautical vehicles. Furthermore, there are no clear reports on the frequency, type, and consequences of these injuries in our setting. Therefore, the objective of this study is to identify the prevalence and characterize thoracolumbar fractures due to the use of nautical vehicles in two hospitals in Cartagena, Colombia. **Material and Methods:** A cross-sectional, descriptive, and retrospective study was conducted, evaluating patients over 18 years of age who were admitted to the Medihelp Clinic and the Bocagrande Hospital in Cartagena, Colombia, between January 1, 2020, and December 31, 2024,

with a diagnosis of thoracolumbar spine fractures while using nautical vehicles. The study included a description of sociodemographic, clinical, and imaging factors, as well as the mechanism of trauma, complications, and functional outcomes. **Results:** Preliminary results were obtained from a total of 53 patients with thoracolumbar fractures during the study period, with an average of 12.5 patients per year. Most of the cases were foreigners (tourists), with young adults (35 to 40 years) being the most affected age group, and women were the predominant sex. Axial compression was identified as the primary mechanism of trauma. **Conclusion:** The characterization of these types of fractures associated with the use of these vehicles provides guidance on the risk factors and complications to which these patients are exposed. It also highlights the importance of having medical teams trained to manage these types of injuries early, especially in coastal and tourist cities, as well as the development of preventive and safety programs by local authorities.

ID: AGS26/689
P1011: Mortality risk factors in patients with osteoporotic vertebral fractures treated conservatively: a regional hospital cohort study

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Introduction: With population aging, the number of patients with osteoporotic vertebral fractures (OVF) has been increasing. However, evidence on mortality risk factors following conservative treatment remains scarce. OVF, like hip fractures, is a serious condition directly linked to survival in the elderly. This study aimed to identify risk factors for all-cause mortality in OVF patients treated conservatively at Morimachi Hospital, the only acute-care hospital in the region. **Material and Methods:** We retrospectively analyzed 613 OVF patients who underwent conservative treatment at our hospital between 2016 and 2024. All-cause mortality (in-hospital and post-discharge) was set as the primary outcome. Clinical variables included age, sex, height, weight, body mass index (BMI), prognostic nutritional index (PNI), and comorbidities. Survival and mortality groups were compared using univariate analyses (t-tests or chi-square tests). Variables with $p < 0.10$ were entered into multivariate logistic regression, and odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to identify independent predictors. **Results:** During the observation period, there were 125 deaths (20.4%). Compared with survivors, the mortality group was older, had lower BMI and PNI, and had higher proportions of male patients and collagen diseases. Multivariate analysis identified the following independent predictors of mortality: age (OR 1.082, 95% CI 1.048-1.117, $p < 0.001$), male sex (OR 1.898, 95% CI 1.237-2.912, $p = 0.003$), low BMI (OR 0.845, 95% CI 0.792-0.902, $p < 0.001$), low PNI (OR 0.894, 95% CI 0.859-0.930, $p < 0.001$), and collagen disease (OR 3.050, 95% CI 1.364-6.820, $p = 0.007$). ROC analysis revealed cutoff values of PNI 36 (sensitivity 42%, specificity 84%, AUC 0.66) and BMI 20 (sensitivity 80%, specificity 46%, AUC 0.66). **Conclusion:** In 613 OVF patients treated conservatively, advanced age, male sex, low BMI, low PNI, and collagen disease were independent risk factors for mortality. PNI, which can be easily calculated from routine blood tests, is a practical prognostic marker, and PNI < 36 may serve as a threshold for identifying high-risk patients. A unique strength of this study is that, being conducted in the region's sole acute-care hospital, nearly complete follow-up of all deaths was achieved, overcoming the common limitation of missing mortality data. These findings underscore the importance of nutritional assessment, lifestyle guidance, and targeted intervention for high-risk patients, and provide new evidence for prognostic management in OVF care.

ID: AGS26/735
P1012: Complex management of bilateral L5 pedicle fractures in a young adult: from pseudomeningocele to circumferential fusion

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Introduction: Bilateral pedicle fractures of L5 are exceedingly rare, particularly in young patients. Their management can be further complicated by concomitant traumatic injuries and postoperative sequelae. We present a unique case highlighting multiple unusual aspects, including delayed fixation due to abdominal trauma, pseudomeningocele formation, instrumentation failure, and the need for a combined circumferential approach. **Material and Methods:** A 23-year-old male sustained a high-energy motor vehicle accident resulting in bilateral L5 pedicle fractures. Surgery was initially postponed due to concurrent sigmoid rupture requiring urgent laparotomy and colostomy. During follow-up, MRI revealed a large lumbar pseudomeningocele. He underwent posterior L4-S1 fixation with neuronavigation, L5 laminectomy, pseudomeningocele drainage, and dural repair. Postoperatively, neurological function improved, although complicated by urinary tract infection and partial wound dehiscence, treated conservatively. At 24 years of age, he developed worsening back pain and radiculopathy. Imaging demonstrated progressive instrumentation failure, with bilateral S1 screw fractures. A revision surgery was performed in three sequential stages within the same operative session: (1) posterior removal

and replacement of fractured screws; (2) anterior transperitoneal L5-S1 discectomy and interbody fusion with cage (Synfix, DePuy Synthes) and bone morphogenetic protein; (3) final posterior fixation with rods between L5 and S1. The postoperative course was uneventful, with significant pain relief and neurological stability. **Results:** This case illustrates several uncommon features: bilateral L5 pedicle fractures, development of a large pseudomeningocele, contraindication to initial anterior fusion due to abdominal trauma, and subsequent bilateral screw fractures. The feasibility of combining anterior and posterior approaches sequentially within the same operative session ultimately enabled durable circumferential stabilization. **Conclusion:** Complex L5 pedicle fractures in young patients may require individualized, multi-step surgical strategies. When complicated by pseudomeningocele and hardware failure, circumferential fusion performed in a single operative session can provide definitive stabilization and favorable clinical outcomes.

ID: AGS26/800
P1013: Association of a FRAX-guided clinical pathway with reduced refracture risk in osteoporotic vertebral fractures: a retrospective cohort study in LMICs

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Introduction: Osteoporotic vertebral fractures in low- and middle-income countries (LMICs) are associated with high refracture rates (68% at 3 years) and limited access to dual-energy X-ray absorptiometry (DXA), necessitating cost-effective alternatives to guideline-recommended care. To evaluate whether a FRAX-guided perioperative pathway reduces refracture risk in patients undergoing percutaneous vertebroplasty/kyphoplasty (PVP/PKP). **Material and Methods:** This retrospective cohort study compared 400 patients managed under a FRAX-guided pathway (January 2022-January 2024) with 400 historical controls (January 2019-December 2021) at a single center in county China. After applying inclusion/exclusion criteria and propensity score matching (1:1 ratio, caliper = 0.1), 200 matched pairs (400 patients) were included in the final analysis. Inclusion criteria: age ≥ 50 years, radiologically confirmed osteoporotic fractures, and complete 12-month follow-up. A 4-phase pathway: (1) preoperative FRAX-based risk stratification (cutoff ≥ 15%), (2) intraoperative cement volume restriction (≤ 4.0 mL/vertebra), (3) algorithm-guided antiresorptive therapy, and (4) SMS-based adherence monitoring. **Results:** Primary outcome: 12-month radiographic refracture incidence. Secondary outcomes: bone health metrics (DXA T-score, FRAX reduction), functional recovery (Oswestry Disability Index), and cost-effectiveness. The FRAX-guided group (n = 200 matched pairs) had a 52% lower 12-month refracture incidence (12.7% vs. 26.1%; RR = 0.48, 95% CI 0.29-0.81) and a 49% reduction in cement leakage (9.2% vs. 18.3%). Functional improvement (ODI Δ = 10.8) and cost-effectiveness (ICER = $1,980/QALY) were significant. **Conclusions:** A FRAX-guided perioperative pathway significantly reduced refracture rates and costs in a resource-limited setting, providing a scalable, DXA-independent model for LMICs. This study supports task-shifting and low-tech strategies to improve osteoporosis care where guidelines are currently impractical.

Keywords: Osteoporotic vertebral fracture; FRAX tool; LMICs; Refracture prevention; Cost-effectiveness; Task-shifting

ID: AGS26/803
P1014: mFRAX-CL: a resource-efficient preoperative risk score for osteoporotic fractures in low- and middle-income countries (LMICs)

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Introduction: Osteoporotic fractures (OPFs) in low-resource settings lack accessible risk stratification tools. A simplified, cost-effective tool is urgently needed to guide anti-osteoporosis interventions and reduce refracture rates. To develop and validate the mFRAX-CL score, a preoperative risk score for OPF patients without bone mineral density (BMD) testing. **Material and Methods:** This retrospective diagnostic accuracy study followed TRIPOD guidelines and analyzed data from 800 patients undergoing percutaneous vertebroplasty or kyphoplasty for osteoporotic vertebral compression fractures at a district hospital in Chongqing, China (January 2020-December 2022). The 2020-2022 cohort (n = 720) was used for model development, while the 2023 cohort (n = 80) served as a temporal validation set. Exposure: mFRAX-CL score (height loss ≥ 3 cm, prior fractures, age, sex, BMI, smoking). **Results:** Among 720 included patients (mean [SD] age, 68.4 [8.2] years; 562 [78%] female), 152 (21.1%) developed refractures. Primary outcome was 1-year postoperative refracture (vertebral/non-vertebral). Model performance was assessed via area under the receiver operating characteristic curve (AUC), sensitivity, calibration (Hosmer-Lemeshow test), and decision curve analysis (DCA). The mFRAX-CL score showed significantly higher discrimination than FRAX without BMD (AUC = 0.87 vs. 0.71; ΔAUC = 0.16, $p < .001$). Sensitivity and specificity were 91% and 76% at a threshold of 8 points. Calibration showed minimal deviation (slope = 0.95, intercept = -0.05; Hosmer-Lemeshow p = .21). DCA indicated net clinical benefit at threshold probabilities of 10% to 35%. After adjusting for

confounding via propensity score weighting, high-risk patients (score ≥ 8) who received zoledronic acid had a significantly lower refracture rate than those who did not (12% vs 35%; adjusted odds ratio = 0.30; 95% CI, 0.15-0.60; p < .001). Screening cost was $1 per case (incremental cost-effectiveness ratio = $120 per quality-adjusted life-year). **Conclusions and Relevance:** The mFRAX-CL score, which omits BMD, demonstrated superior discrimination and cost-effectiveness, offering a scalable tool for LMICs to reduce refracture-related morbidity and mortality. The observed association with zoledronic acid benefit warrants confirmation in a randomized trial.

ID: AGS26/805
P1015: Feasibility and safety of a 23-hour discharge protocol after percutaneous kyphoplasty in county-level hospitals: a dual-cohort study

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Introduction: Short-stay protocols following percutaneous kyphoplasty (PKP) are increasingly adopted in high-resource settings, yet their feasibility and safety in county-level hospitals remain underexplored. This study evaluates a 23-hour discharge pathway for PKP patients in a Chinese rural healthcare context. **Material and Methods:** A dual-cohort design was employed:

• Retrospective cohort: 600 eligible PKP cases were selected from a database of 1000 procedures (2019-2024) across Chongqing county hospitals. Patients were stratified into short-stay (< 24 hours) and conventional-stay (> 48 hours) groups.

• Prospective validation cohort: 100 consecutive patients will be enrolled from October 2025 using a structured 23-hour discharge criteria (cement volume < 5 mL, no cement leakage, VAS improvement > 50%, independent ambulation). Data collected included cement volume, leakage rate (classified per Nieuwenhuijse), preoperative ODI/VAS, complications, 30-day readmission, 90-day refracture rate, hospitalization costs, EQ-5D satisfaction, and family caregiver competency (10-item scale). Economic analysis incorporated both direct medical costs and indirect costs (caregiver lost wages, transportation). Statistical analyses included propensity score matching (1:1, caliper 0.2) for retrospective data and sample size estimation (n = 100, 80% power, α = 0.05) for prospective comparison. **Results:** Preliminary retrospective analysis (n = 600) showed:

• Cement leakage rate: 8.3% (Type B: 5.2%, Type C: 2.1%, Type D: 1.0%).

• Median VAS improvement: 5 points (IQR: 4-6).

• 30-day readmission rate: 2.5% in short-stay vs. 3.8% in conventional-stay (p = 0.28).

• Refracture rate at 90 days: 1.7% vs. 2.1% (p = 0.65). Prospective outcomes will be reported upon completion. **Conclusion:** A 23-hour discharge protocol after PKP is feasible and safe in county-level hospitals, with no significant increase in short-term complications or readmissions. The protocol supports resource-efficient care without compromising patient outcomes, suitable for broader implementation in grassroots healthcare settings.

Keywords: Percutaneous kyphoplasty, short-stay surgery, discharge protocol, county hospital, cement leakage, health economics

ID: AGS26/957
P1016: Is indirect decompression & stabilaization enough for patients MIS fixation for thoraco-lumbar burst fracture with incomplete neurology, 2 years follow up

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Introduction: Open spinal fixation and posterior decompression remains the corner stone for treating thoraco-lumbar burst fracture with neuro deficit. Many surgeons have also tried anterior approach to direct decompress and reconstruct the spine with equally good or better results. Although both approaches have given good results in terms of stabilization and neural decompression but these approaches causes severe morbidity in peri and post op periods. Wound dehiscence, infection, blood loss , prolong hospitalizations are some of them. We introduce a MIS technique that allow stable fixation of these fracture using MIS pedicle screw fixation spanning the fracture and indirectly decompressing the neural elements by rod distraction technique causing the fracture to reduce. A vertebroplasty / Kyphoplasty is done at the fractures level for anterior support and preventing collapse of the vertebra. **Material and Methods:** This is a prospective observational study of 32 patients who had undergone this procedure. All the patients were assessed clinically & radiologically. Patient with TL burst fracture with motor power in lower limb ≥ 3 and without bowel and bladder involvement were chosen in the study. Assessment of all patients were done using VAS score, wedging angle of the vertebra and MRC grading of the lower limb muscles. **Results:** 32 patients underwent MIS pedicular fixation with/ without fenestrated screw with vertebroplasty / kyphoplasty at the fractured vertebral level after indirect decompression at the compression level and after restoring significant height of fractured vertebra using rod distraction technique and or positioning of the patient (extension). There were significant improvement (p < 0.05) `VAS scores in the immediate and late post operative periods. In addition there was significant improvements in motor power of lower limb muscles (MRC grade) in of the patients who had neuro deficits

in immediate and early post operative period which was maintained till late follow up (2 years). 30 out of 32 patients were self ambulatory by first week post op without any assistance and rest 2 were ambulatory by 3 week of surgery. **Conclusion:** MIS pedicle screw stabilization with vertebroplasty / kyphoplasty after indirect decompression using rod distraction technique is safe and rewarding procedure and avoid morbidity of decompression laminectomy in these subset of patient with power in lower limbs not less than MRC grading 3 and without bowel/ bladder involvement

ID: AGS26/966
P1017: Spinal chronic subdural hematoma: a case report

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Introduction: Spinal hematomas are rare conditions that can cause spinal cord compression, radicular pain, and irreversible neurological deficits. Spinal subdural hematomas (spinal SDH) represent 4.1% of all spinal hematomas. Risk factors include coagulopathies, blood dyscrasias, lumbar puncture, spinal surgery, trauma, and vascular malformations. Spinal SDH can be classified as traumatic, iatrogenic, or spontaneous. Traumatic spinal SDH, first described in 1826, has only 58 documented cases and accounts for 9.7% of all spinal SDH incidents. **Material and Methods: Case presentation:** An 86-year-old male undergoing anticoagulation therapy for atrial fibrillation experienced severe pain after a spinal sprain while cycling on 20/08/2024. An MRI of the lumbar spine to T11 showed no abnormalities. The pain worsened, and on 02/01/2025, the patient developed progressive paresis of the left leg and sensory loss below T10 on the left side. **Clinical Findings:** The patient showed fluctuating proximal left-sided leg weakness (M2-3), sensory deficit below T10 on the left side, pronounced ataxia, inability to walk and urinary and fecal retention. **Investigations:** Emergency MRI revealed an intradural extramedullary mass at T11 level, emphasizing the left side. A thoracic spine MRI identified an intradural extramedullary hematoma. **Intervention:** The patient underwent microsurgical laminectomy at T10 and T11 levels, evacuation of subarachnoid extramedullary hematoma, and septal resection with left-side neurolysis. **Results:** The patient was evaluated at 6 weeks and 6 months postoperatively with resumed anticoagulation therapy. At 6 months, patient was pain-free, showed only minimal atactic gait with walking sticks. Neurological evaluation showed mild left hip flexor weakness (M4-M5), with restored tactile sensitivity. Patellar and Achilles reflexes were symmetrically reduced, with negative Babinski sign. The left knee-heel test remained dysmetric but improved. Bowel function improved, while micturation remained limited with Suprapubic catheter. **Conclusion:** Spinal chronic subdural hematoma are extremely rare and can manifest with rapid neurological symptoms, with MRI being the diagnostic tool of choice. Anticoagulated Patients with trauma history and progressive back pain should be assessed for spinal SDH. For small lesions without cord compression, conservative management is appropriate. However, spinal SDH above conus medullaris with neurological deficits requires urgent surgery due to ischemic necrosis risk.

ID: AGS26/1030
P1018: Aseptic vertebral necrosis in thoracolumbar trauma

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Introduction: Instability of traumatic spinal injuries is a major indication for urgent stabilization surgery to prevent neurological decline and progressive deformity. In military and resource-limited conditions, however, staged evacuation often delays surgery. This has revealed rare but clinically important complications, among them post-traumatic aseptic vertebral body necrosis (AVN), which differs from Kümmell's disease and requires further analysis. The aim was to describe and analyze clinical cases of aseptic vertebral necrosis following unstable thoracolumbar injuries. **Materials and Methods:** A retrospective study was conducted at the Romodanov Neurosurgery Institute (Kyiv, Ukraine) from 2021 to 2024, supplemented by teleconsultations from Kyiv hospitals. Inclusion required unstable thoracolumbar injury without stabilization in the first two weeks. Exclusion criteria were penetrating trauma, septic spondylitis/discitis, or prior spinal injury/surgery. Clinical data included demographics, trauma mechanism, neurological status (ASIA), AO Spine TLSICS classification, TLICS score, and radiological findings. **Results:** Nineteen patients met the inclusion criteria. Among them, six (31.6%) developed post-traumatic aseptic necrosis of the vertebral body. The median age was 40 years (range 18-61), and two-thirds of patients were male. Mechanisms of trauma included falls from height, ground-level falls, and traffic accidents, with the thoracolumbar junction being the most frequent site of injury. According to AO Spine classification, the majority of injuries were type B2 or type C. Neurological status on admission ranged widely: most patients presented with complete deficits (ASIA A), some with partial deficits

(ASIA B), and others without neurological impairment (ASIA E). In patients with AVN, imaging demonstrated progressive lysis of the anterior vertebral body, in some cases extending to the adjacent endplates, and in severe cases resulting in near-total destruction of the vertebra. Importantly, laboratory markers such as white blood cell count and C-reactive protein remained within normal limits, and intraoperative cultures were consistently negative, confirming the aseptic nature of the process. The presence of chronic septic foci was not associated with the development of necrosis. All patients with verified necrosis underwent stabilization surgery, which included decompression, corpectomy with cage implantation, and posterior pedicle screw fixation. In every case, surgical intervention arrested further bone lysis. Follow-up CT scans obtained two to six months after surgery confirmed the integrity of the implants and demonstrated no further progression of destructive changes. **Conclusions:** Post-traumatic aseptic vertebral necrosis is a rare but significant complication of delayed stabilization in unstable thoracolumbar injuries. The process is non-infectious and most likely ischemic in origin, aggravated by pathological mobility of the injured segment. Early surgical stabilization should be regarded not only as a preventive measure against neurological deterioration but also as essential for avoiding destructive changes of the vertebral body. These findings underline the importance of timely stabilization, especially in wartime or delayed-care scenarios.

ID: AGS26/1041
P1019: Casting or bracing? Long-term clinical and radiological outcomes of two conservative modalities in thoracolumbar vertebral fractures

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Introduction: To evaluate and compare the long-term clinical and radiological outcomes of hyperextension casting versus Jewett bracing in the conservative management of thoracolumbar vertebral compression fractures. **Material and Methods:** Thirty-five patients with stable compression fractures between T10 and L2 treated from 2002 to 2012 were retrospectively reviewed (Brace: n = 18, Cast: n = 17). Outcomes included Visual Analog Scale (VAS), Oswestry Disability Index (ODI), kyphotic angle (Cobb method), bone mineral density (BMD) index, and hospital stay. Median values were used; Mann–Whitney U and Chi-square tests were applied. **Results:** There were no significant differences in age, sex, or follow-up duration ($p > 0.05$). However, the brace group had significantly higher BMD Index (27.3 [26.8–28.1] vs. 26.3 [25.3–26.9]; $p = 0.005$*) and shorter hospital stay (1.0 [1.0–1.0] vs. 2.0 [2.0–2.0] days; $p < 0.001$*). Functional outcomes (ODI, VAS) were better in the brace group ($p < 0.001$*), while kyphotic progression was more limited in the cast group ($p = 0.042$). **Conclusion:** While the Jewett brace may offer an advantage in terms of early mobilization and functional recovery, hyperextension casting appears to be more effective in limiting kyphotic progression over time.

ID: AGS26/1114
P1020: Spinal injuries in professional football players: a media-based study

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Introduction: Football is the most popular sport in the world and is associated with a wide range of injuries. Although lower limb injuries are the most prevalent, spine injuries can be highly debilitating in professional athletes, leading to prolonged recovery periods and chronic pain. The lumbar spine is particularly relevant, as it is the most frequent site of complaints among elite athletes, typically presenting as lower back pain. Our aim is to analyze the most common spinal injuries associated with lower back pain in professional football players, examining their distribution by playing position, tier, and world region, as well as assessing their impact in terms of time lost due to injury, injury recurrence over a two-year period, and match participation time before and after the spinal injury. **Material and Methods:** Average match participation time 2 seasons before the injury (Year -2), 1 season preceding the injury (Year -1), season of the injury (Year 0) and 1 season after injury (Year 1), time lost due to injury and injury recurrence, along with players' characteristics, leagues, tiers, teams, and playing position data were collected from Transfermarkt.com through a customized web scraping framework. Additional data on spine injuries were manually gathered from reliable online sources. The statistical analysis was performed using IBM SPSS Statistics with statistical significance set at $p < 0.05$. **Results:** Among 407 professional football players, herniated disc was the most reported specific spinal injury (14.7%) followed by lumbar fracture (13.5%). Injury distribution differed significantly by severity levels ($p < 0.001$), tiers ($p < 0.001$), and world regions ($p = 0.007$), although the last findings may reflect sample bias due to overrepresentation of the first tier and European players. No significant association was found with playing position.

Severe injuries accounted for the highest proportion (44.2%), mainly herniated discs. Injury recurrence occurred in 9.3% of players, most commonly in disc herniation (11.7%), without significant associations. Match participation declined between the season preceding injury and season of the injury and remained reduced one season post-injury. In the season preceding the injury, significant differences were observed between injury types and the match participation ($p = 0.04$), with players with lumbar fractures (52.5 minutes) showing the highest average. **Conclusion:** This study provides a comprehensive analysis of spinal injuries in professional football players using media-based data. Herniated discs and lumbar fractures were the most reported injuries, with severity levels differing significantly across injury types. Match participation declined between the season preceding injury and season of the injury and remained reduced one season post-injury. These findings underscore the impact of spinal injuries on recovery and match participation. Our study also highlights the value of media-based data as a complementary tool for injury surveillance in sports injury, while acknowledging of limitations related to diagnostic precision and possible sample biases.

ID: AGS26/1215

P1021: Mechanical instability after civilian thoracolumbar gunshot injuries: a systematic review to support classification development

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Introduction: Although spinal gunshot wounds are often viewed as inherently stable, a clear consensus on the definition or classification of unstable fracture patterns is lacking. We aim to identify risk factors for mechanical instability in thoracolumbar gunshot wounds to develop a new classification system. **Material and Methods:** A systematic review following PRISMA 2020 guidelines was conducted across multiple databases from January 1, 1990, to September 12, 2024 (PROSPERO: CRD42023458804). **Results:** Of 2,400 records, 33 studies (3,195 patients) met inclusion criteria, mostly retrospective and single-center with varying definitions of instability. Direct comparison was limited due to clinical heterogeneity. Only 12 studies defined mechanical instability, mainly using the Denis three-column theory. Instability was reported in less than 10% of cases, except for one higher-rate outlier. The main markers included vertebral body comminution and potential ligamentous injury. Management was mainly conservative, with a low fixation rate (1.5-9.7%). Imaging relied on CT and static X-rays, with some studies advocating for dynamic radiographs. **Conclusion:** There is a lack of standardized definitions for mechanical instability in civilian thoracolumbar gunshot injuries. Four recurrent unstable patterns were detected, with vertebral body comminution as the most consistent marker. The need for a standardized classification system and further prospective studies is evident.

ID: AGS26/1246

P1022: Does age influence the clinical and radiological outcomes of surgical treatment for thoracolumbar junction fractures?

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Introduction: Thoracolumbar junction fractures represent a frequent cause of spinal trauma. Surgical management aims to restore spinal alignment, ensure stability, and improve functional and clinical results. However, age-related differences in bone quality, bone healing and comorbidities may significantly affect outcomes. Understanding the impact of age on both functional and radiological parameters is crucial for optimizing surgical strategies. The aim of this study was to evaluate the influence of patient age on postoperative results after posterior surgical fixation of thoracolumbar junction fractures. **Material and Methods:** It is a retrospective study

including 120 patients surgically treated for thoracolumbar fractures between January 2010 and January 2020. All patients underwent posterior pedicle screw fixation, with variable assembly (long, mixed and short)**.** Our populations are divided into two age groups: **Group A:** patients younger than 60 years and **Group B:** patients aged 60 years and older. Functional outcomes were assessed using the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), and Dallas Pain Questionnaire. Radiological outcomes were evaluated by measuring regional kyphosis (RK), vertebral kyphosis (VK), traumatic regional angulation (TRA), and Beck index at postoperative and the last follow-up. The evaluation of the results was done by calculating the loss of correction of radiological parameters between the postoperative radiographs and the last follow-up radiographs as well as at final follow-up. Complications including infection, hardware failure, nonunion, and material removal were also analyzed. **Results:** Group A included 72 patients with a mean follow-up of 58.7 months, while Group B included 48 patients with a mean follow-up of 55.1 months. Functional outcomes were significantly better in younger patients: mean VAS (1.82 vs 3.37, $p = 0.03$), ODI (17.2 vs 34.77, $p < 0.001$), and Dallas score (10.1 vs 24.68, $p < 0.001$). Radiological analysis showed a greater loss of correction in elderly patients for CR (2.14° vs 0.75°, $p = 0.03$), VK (1.89° vs 0.62°, $p = 0.001$), and ART (2.17° vs 0.77°, $p = 0.03$). Postoperative kyphotic angles were also significantly higher in Group B (RK 14.17° vs 11.71°, $p = 0.02$; CV 15.17° vs 11.74°, $p = 0.03$). However, we didn't find a statistically significant difference in Beck index ($p = 0.31$). Complications were more frequent in elderly patients, with higher rates of hardware failure (16.7% vs 4.2%, $p = 0.06$) and nonunion (8.3% vs 0%, $p = 0.04$). Material removal was more common in younger patients (34.7% vs 19.4%, $p = 0.01$). However, no significant differences were noted in surgical site infection (5.6% vs 8.3%, $p = 0.06$). **Conclusion:** Age has a significant impact on functional and radiological outcomes after surgical treatment of thoracolumbar junction fractures. Patients under 60 years of age achieved superior pain relief, functional recovery, and maintenance of correction, while older patients had higher rates of loss of correction, hardware failure, and nonunion. This may be explained by the significant mechanical stresses exerted on the hinge between a less mobile thoracic spine and a mobile lumbar spine, as well as osteoporosis. These results confirm the role of age as a prognostic factor to be taken into account when planning surgical management.

ID: AGS26/1253
P1023: Impact of Body Mass Index on functional clinical and radiological outcomes after posterior surgical treatment of thoracolumbar junction fractures

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Introduction: Obesity is an increasingly common health issue worldwide and is associated with higher perioperative risks in spine surgery. Its impact on functional recovery, radiological correction, and complication rates following thoracolumbar fracture surgery remains controversial. The aim of this study was to assess the influence of body mass index (BMI) on postoperative outcomes after posterior fixation of thoracolumbar junction fractures. **Material and Methods:** We conducted a retrospective study including 120 patients operated on our department for thoracolumbar junction fractures between January 2010 and January 2020. All patients underwent posterior fusion assembly. Patients were divided into two groups according to BMI:

• **Group A:** normal weight/overweight (mean BMI 25.8 kg/m^2).

• **Group B:** obese (mean BMI 32.7 kg/m^2). Clinical outcomes were assessed using the Visual Analogue Scale (VAS), the Oswestry Disability Index (ODI), and the Dallas Pain Questionnaire (Dallas score). Radiological parameters included vertebral kyphosis (VK), regional kyphosis (RK), traumatic regional angulation (TRA), and Beck index, evaluated at last follow-up. Complications such as infection, hardware failure, nonunion, and implant removal were also recorded. **Results:** Group A included 66 patients with a mean follow-up of 59.5 months, while Group B included 34 patients with a mean follow-up of 49 months. Functional outcomes were poorer in obese patients: mean VAS (2.97 vs 2.06, $p = 0.03$) and Dallas score (20.29 vs 12.12, $p = 0.001$). No significant difference was found for ODI (30.76 vs 19.09, $p = 0.14$). Radiological analysis showed slightly higher

postoperative kyphotic angles in obese patients (RK 14.39° vs 11.65°, p = 0.05), while differences in VK, TRA, and Beck index were not statistically significant. Infection occurred more frequently in obese patients (4.8% vs 2.5%, p = 0.08), while rates of hardware failure (8.8% vs 7.6%), nonunion (5.9% vs 3%), and implant removal (29.4% vs 28.8%) were comparable between groups. **Conclusion:** Obesity has a negative impact in clinical and radiological outcomes after thoracolumbar junction fracture surgery, with higher pain levels, worse Dallas scores, and greater postoperative kyphosis. Although complication rates did not increase significantly, the upward trend in infection rates suggests the need for optimized perioperative management in obese patients. These findings highlight the importance of BMI as a relevant prognostic factor to be considered in surgical planning and post-operative care.

ID: AGS26/1312
P1024: Risk factor analysis for predicting vertebral body re-collapse after posterior instrumented fusion of thoracolumbar junction burst fractures

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Introduction: The thoracolumbar junction (T12-L1) represents a transitional zone between the rigid thoracic spine and the mobile lumbar spine, making it particularly vulnerable to fractures. Among these, burst fractures are the most common and often require posterior instrumented fusion. While initial correction is usually obtained, postoperative re-collapse of the vertebral body remains a major complication that can compromise both functional and radiological outcomes. The aim of our study is to evaluate risk factors and predictors for postoperative re-collapse in thoracolumbar burst fractures. **Material and Methods:** It is a retrospective study including 61 patients who underwent posterior instrumented fusion for thoracolumbar junction burst fractures between 2010 and 2023. The surgical procedure consisted in short, long or combined segment fusion. The population was divided into two groups: well maintained (G1) and re-collapse (G2) group. Patients were assigned to the re-collapse group if their vertebral body height loss was greater than 20% at any follow-up compared with immediate postoperative results. **Results:** The mean age was 49.38 years (range from 24 to 74 years), with male predominance (57.4% of cases). The mean BMI was 28.65 kg/m2. Diabetes was reported in 19.7% of cases. Fracture locations were T12 in 29 cases (39.3%) and L1 in 36 cases (59%). Short fixation was performed in 11 patients (18%), mixed fixation in 21 (34.4%), and long fixation in 29 (47.5%). Laminectomy was performed in 3 cases (4.9%). The mean follow-up was 41 months. Re-collapse occurred in 18 of 61 patients (29.5%). We didn't find any significant difference between the two groups for age, gender, BMI, diabetes, neurological deficit, posterior wall recession, intra-canal fragment and pedicle and articular fractures. Multivariate logistic regression analysis identified three independent risk factors short segment fixation (p = 0.0001; Ratio odds = 20; 95% CI [3.67-108.84]), surgical site infection (p = 0.3; Ratio odds = 3.47; 95% CI [2.32-5.18]) and nonunion (p = 0.006; Ratio odds = 4; 95% CI [2.54-6.29]). The long segment fixation is a protector factor for re-collapse (p = 0.008; Ratio odds = 0.19; 95% CI [0.05-0.69]). Laminectomy and bone grafting were not risk factors for re-collapse. **Conclusion:** The occurrence of re-collapse remains possible but unpredictable no matter the surgical technique used. The type of segment fixation is a crucial parameter to consider. Careful surgical planning and long-term follow-up are recommended, particularly in patients treated with short fixation at the thoracolumbar junction.

ID: AGS26/1373
P1025: Thoracolumbar fractures. arthrodesis or not?

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Introduction: The aim of this paper is to describe the results obtained in 91 patients, all between 18 and 70 years, operated in the last 6 years with thoracolumbar vertebral fractures post traumatic. In all cases we used the same technique, which consists of fixing two levels above and two levels below the fractured vertebrae including it in the osteosynthesis system getting full or partial reduction of the fracture without arthrodesis. After the fracture consolidation we proceed to the removal of the implant between 6 to 10 months so all patients recover the capacity of flexo extension of their thoracolumbar spine. Most of the fractures are produced by falls from their own height either standing or seated, secondly traffic accidents and finally by osteoporosis, which is a low energy mechanism that is not included in this work. **Material and Methods:** 91 patients were evaluated, 58 men and 33 women. The complaint was for post traumatic back or low back pain by falling from their own height standing or sitting, in the 64% of cases, with no more than 48 hours of evolution that did not get better with rest and got worse with mobilization. The rest of the cases were traffic accidents. All patients were studied by MRI and X-rays. All fractures were treated by the same surgeon within the first 72 hours of making the diagnosis. Fractures were divided as follows: T9 (1), T10 (7), T11 (20), T12 (26), L1 (21), L2 (12), L3 (2) and L4 (2). 77% of cases were type A fractures according to the AO classification, and

the remaining 23% were type B, which were associated with rupture of the posterior wall and invasion of the spinal canal. Only 3 fractures had neurological and motor compromise C, according to Frenkel classification. The rest of the fractures were Frenkel E. **Results:** All patients returned to their usual activities. It took them 42 days on average to return to work and from 6 to 9 months to their sports activities with the exception of the 3 Frenkel C. As postoperative complications patients had scar hygromas that were cured with puncture and compressive bandage. Everyone referred complete or partial improvement of their symptoms. In 1 case we had a postoperative complication which was the rupture of one of the lower transpedicular screws of the system at 3 months; but when we removed the implant the pain disappeared without complications. **Conclusion:** This method is usually used in our department to treat thoracolumbar fractures. In our experience this type of fractures are one of the most common, it is a severe pathology that should be diagnosed and treated early. We always consider surgical treatment (temporary fixation without arthrodesis) because patients are able to move quickly without getting risks of more complex injuries during the process of consolidating. Patients had no important complications and in all cases there was a complete remission of symptoms and return to normal activity. They were followed for around two years after surgery.

ID: AGS26/1801
P1027: Nail gun-induced penetrating thoracic spinal cord injury: case report and surgical approach

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Introduction: Non-missile penetrating spinal cord injuries (NMPSCI) are rare, accounting for less than 1.5% of penetrating spinal injuries. Surgical management is technically demanding, as improper handling may exacerbate neurological deficits. A tailored operative strategy is essential to ensure safe extraction of the foreign body and preservation of cord function. **Material and Methods:** We report a 23-year-old male who sustained an accidental nail gun injury to the thoracic spine at work. He presented with left lower limb monoparesis (MRC grade 3) and sensory loss below T6, with intact sphincter function. CT revealed a metallic nail traversing the posterior thoracic region with its tip embedded in the spinal cord at T5. Emergency surgery was performed with the following key steps:

• **Precise intraoperative localization** using fluoroscopy.
• **Microsurgical nail extraction under direct vision** to minimize secondary cord injury.
• **Nail removal prior to laminectomy** to prevent cord vibration during bone work.
• **Adequate laminectomy** for decompression in case of cord edema and for optimal dural exposure.
• **Watertight dural repair** to prevent CSF leakage.
• **Intraoperative ultrasonography** to inspect the cord, avoiding unnecessary durotomy or myelotomy.
• **Continuous neurophysiological monitoring** to safeguard neural integrity. **Results:** Postoperatively, neurological function was preserved without deterioration. Motor power improved to MRC grade 4, though residual sensory deficit persisted below T6. MRI showed minimal cord edema, no hematoma, and no residual compression. The patient mobilized with assistance and was discharged well one week later. **Conclusion:** Successful management of NMPSCI requires a structured surgical strategy. Critical principles include controlled foreign body extraction, adequate exposure, meticulous dural repair, and the adjunctive use of ultrasonography and neuromonitoring. **Learning point:** A stepwise microsurgical approach with careful intraoperative decision-making allows safe removal of intramedullary foreign bodies while maximizing neurological recovery.

ID: AGS26/2292
P1028: What is the most accurate and reliable method for measuring interspinous widening in CT?

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Introduction: Interspinous widening (ISW) showed varying accuracy in detecting posterior ligamentous complex (PLC) injury on magnetic resonance imaging (MRI) due to the lack of standardized methods of measurement. The aim of this study is to compare the accuracy of various methods to measure ISW on computed tomography (CT) in detecting PLC injuries on for thoracolumbar fractures (TLFs). **Material and Methods:** We retrospectively reviewed 215 consecutive patients with acute TLFs (T10-L2). Three reviewers evaluated MRI and CT images. We massed 4 ISW measurements:1) supraspinous distance (SSD): distance between the most posterior aspect of the two spinous processes; 2) midspinous distance (MSD): between the midpoints of the spinous processes; 3) interlaminar distance (ILD): between the most anterior aspect of lamina; 4) interspinous angle (ISA): the angle between the 2 spinous processes**.** For SSD, MSD, and ILD, four different measurements were calculated according to the reference, either the average of upper and lower adjacent levels or whether a ratio or absolute value was used. We compared the diagnostic accuracy of various methods of ISW measurement in detecting black stripe discontinuity on MRI using the area under the receiver operator curve (AUC) and interobserver

reliability using interclass correlation (ICC). **Results:** All ISW methods showed low accuracy as denoted by AUC < 0.70 (range 0.51-0.65). At the optimum threshold, there was a trend for higher specificity and lower sensitivity. The ICC was poor for 2 measurements, moderate for 5 measurements, and good for 5 measurements. **Conclusion:** This study shows the limited accuracy of ISW methods in detecting PLC injury on MRI. However, ILD showed a trend toward better accuracy; there was no statistically significant difference between all methods. The study indicates that ISW, especially when isolated, should be interpreted with caution as an indicator for PLC injury.

ID: AGS26/2314
P1029: First reported posterolateral lumbar fusion using trabecular allograft from a bone bank in Chile: clinical feasibility and public health impact

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Introduction: Autologous iliac crest graft remains the standard for lumbar fusion but is associated with donor-site morbidity, increased operative time, and limited availability. Biologic allografts from accredited bone banks offers a cost-effective and safe alternative, particularly in healthcare systems where resources are constrained. In Chile, bone banks are rare, and no previous cases of posterolateral lumbar fusion using trabecular allograft have been documented. We present the first reported Chilean case, emphasizing not only clinical feasibility but also the broader public-health implications of this practice in a public hospital setting. **Material and Methods:** A 20-year-old male patient with an unstable lumbar fracture at L2 underwent posterior instrumentation and posterolateral fusion at Hospital Regional de Copiapó. Trabecular bone allograft, processed and provided by the institutional tissue bank, was placed bilaterally in the posterolateral gutters. The patient was followed clinically and radiographically at 3 and 6 months. Outcomes included pain relief (VAS), functional recovery (ODI), and radiological fusion assessed by CT and Bridwell criteria. A comparative cost analysis with conventional strategies (autologous iliac crest harvest and synthetic substitutes) was performed using institutional procurement data. **Results:** Surgery was uneventful, with reduced operative time due to avoidance of iliac crest harvesting. The patient experienced significant improvement in pain (VAS reduced from 5 to 0) and disability (ODI improved from 26% to 4%) at 6 months. CT confirmed progressive trabecular incorporation and solid posterolateral fusion by 6 months. No graft-related complications, infections, or hardware failures were observed. Cost analysis revealed a reduction of approximately 30% in implant-related expenses compared to synthetic substitutes, while eliminating donor-site morbidity associated with autograft harvest. **Conclusion:** This case represents the first reported posterolateral lumbar fusion using trabecular allograft from a bone bank in Chile. Beyond the successful clinical outcome, the use of biologic allografts in a public hospital provides a safe, effective, and economically advantageous strategy. This approach has the potential to improve access to spinal fusion surgery, reduce health-system costs, and serve as a model for other low- and middle-income settings.

ID: AGS26/2566
P1030: Relationship between MRI poor prognostic factors and serum cytokine levels in osteoporotic vertebral fractures

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Introduction: Osteoporotic vertebral fractures (OVF) commonly affect the elderly and carry a poor prognosis. Although publications like the New England Journal of Medicine do not include percutaneous vertebroplasty (BKP) in standard treatment, it may improve the quality of life (QOL) for OVF patients. However, identifying prognostic factors for OVF remains challenging. In a previous study, we demonstrated that elevated IL-6 levels in bone marrow fluid correlated with poor prognosis in OVF patients requiring emergency hospitalization due to mobility impairment. This study aims to confirm the correlation between IL-6 concentrations in bone marrow fluid and serum in OVF patients, clarify that serum IL-6 levels can predict poor prognosis in OVF, and identify suitable candidates for early BKP. **Material and Methods:** Several studies have identified two MRI-based poor prognostic factors for OVF. This study analyzed the correlation between serum and intraoperatively obtained bone marrow IL-6 concentrations in forty OVF patients undergoing BKP. We also examined the relationship between MRI findings and serum IL-6 concentrations. **Results:** In OVF patients undergoing BKP, serum and bone marrow IL-6 concentrations correlated. The MRI poor prognosis group also showed significantly higher serum IL-6 concentration. **Conclusion:** We previously reported a correlation between MRI poor prognostic factors and bone marrow IL-6 concentration. This study further demonstrated a correlation between serum IL-6 concentration and bone marrow IL-6 concentration. Serum IL-6 is easier to collect and less expensive to test. The clinical significance of using serum IL-6 concentration to predict poor

OVF prognosis is substantial. Based on serum IL-6 levels, this study may suggest effective treatment strategies for OVF, such as recommending early BKP for considered to have a poor prognosis.

ID: AGS26/2597
P1031: Risk factors of new vertebral fracture after vertebroplasty for osteoporotic vertebral compression fracture

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Introduction: To determine the natural course of new vertebral fractures after vertebroplasty for osteoporotic vertebral compression fracture and to analyze risk factors for understanding the incidence of adjacent vertebral fracture and remote vertebral fracture. **Material and Methods:** The study subjects included 190 patients who received vertebroplasty for osteoporotic vertebral compression fracture. Age, body mass index, bone density, cement leakage, location of fracture, sagittal imbalance, segmental kyphosis were checked to detect risk factor for new vertebral fracture after vertebroplasty. During the follow-up, any new developed vertebral fractures were identified. We analyzed the time of occurrence differed between adjacent vertebral fracture and remote vertebral fracture by calculating survival analysis and each risk factors separately. **Results:** New vertebral fractures occurred in 44 patients (23%) after vertebroplasty. Adjacent vertebral fracture occurred 19 patients (10%), and remote vertebral fracture occurred 25 patients (13%). The onset time of adjacent vertebral fracture was about 6.2 ± 1.8 months after vertebroplasty, showing a significant difference from that of remote vertebral fracture which was 15.2 ± 1.8 months ($p < 0.001$). In multivariate analysis, risk factors of adjacent vertebral fracture included osteoporosis, vertebroplasty in thoracolumbar junction, sagittal imbalance, segmental kyphosis ($p < 0.005$). Risk factors of remote vertebral fracture included osteoporosis, sagittal imbalance ($p < 0.005$). **Conclusion:** After vertebroplasty for osteoporotic vertebral compression fracture, a significant difference in the meantime of occurrence between adjacent vertebral fracture and remote vertebral fracture was found. Osteoporosis and sagittal imbalance were important for new vertebral fracture after vertebroplasty, even in both adjacent and remote vertebral fracture.

ID: AGS26/2631
P1032: Pedicle morphological changes in thoracolumbar vertebral fractures: implications for safe intermediate screw insertion

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Introduction: The use of intermediate screws at the fracture level has been increasingly adopted in thoracolumbar fracture fixation. However, canal violation or screw malposition may occur due to pedicle morphological changes. This study investigated pedicle morphological changes, including pedicle angle and lateralization, in thoracolumbar fractures. **Material and Methods:** We retrospectively reviewed patients with thoracolumbar fractures (including AO typeA, B1 and B2) treated in our institutions between 2017 and 2024. Radiographic measurements, including pedicle angle, lateralization, were obtained on CT. Pedicle lateral deviation and the distance from the pedicle center to the lateral vertebral wall were assessed on plain radiographs. In addition, patient demographics (age, sex, and mechanism of injury categorized as high- or low-energy trauma) and Thoracolumbar Injury Classification and Severity Score (TLICS) and Load Sharing Classification (LSC) were included. Multivariable regression analysis was performed to identify predictors of pedicle morphological changes. **Results:** A total of 105 patients were included with a mean age of 55 years. Fractured vertebrae demonstrated significantly smaller pedicle angles and greater lateralization compared with adjacent levels. Across all fractures, the mean pedicle angle change was 1.7° and the mean lateralization was 0.7 mm. These changes were most pronounced in type A4 fractures. Multivariable analysis identified high-energy trauma and greater comminution as predictors of pedicle morphological changes. **Conclusion:** In thoracolumbar burst fractures, particularly AO A4 fractures and high-energy

injuries, pedicle morphological changes were pronounced. Surgeons should carefully evaluate pedicle morphology on preoperative CT to reduce the risk of canal violation during intermediate screw insertion.

ID: AGS26/2676

P1033: Lumbopelvic fixation for spinopelvic dissociation and complex sacral and pelvic ring injuries at a level 1 trauma center

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Introduction: Spinopelvic dissociation, unstable sacrum fractures, and complex sacral and pelvic ring injuries are commonly a result of high-energy trauma, often associated with polytraumatized patients. Treatment options include open reduction internal fixation (ORIF), percutaneous fixation, and lumbopelvic fixation. Lumbopelvic fixation creates a stable construct allowing for immediate postoperative mobilization. We hypothesize that the use of single or dual S1/S2 Alar-Iliac (SAI) screws is a durable option in the setting of unstable sacral fractures and complex pelvic ring injuries. **Material and Methods:** We retrospectively reviewed records from a single Level 1 Trauma center for all patients treated with lumbopelvic fixation for spinopelvic dissociation or sacral/pelvic ring injuries from September 2021 to November 2023. We collected clinical data, including patient demographics, intraoperative complications, surgical site infection (SSI), and postoperative complications. **Results:** 18 patients were included, with a mean follow-up of 313 days (range 64-459). Diagnoses included 9 spinopelvic dissociations, 5 Young and Burgess anteroposterior compression III injuries, 3 Denis Zone 3 vertical shear sacrum fractures, and 1 Young and Burgess lateral compression II nonunion. All patients were allowed immediate weight bearing as tolerated. Average preoperative sacral kyphosis was 29.1 degrees, and postoperative sacral kyphosis was 18.8 degrees. Preoperative sacral shortening was 8.6 mm, and postoperative shortening was 4.6 mm. There were a total of 53 SAI screws placed. 6 patients underwent anterior pelvic ring ORIF and 1 underwent acetabulum ORIF. Perioperative complications included 4 SSIs requiring return to the operating room and 1 early failure of fixation requiring revision. Long-term complications included 1 bilateral rod fracture and 3 painful hardware requiring implant removal. There were no neurologic complications. **Conclusion:** Lumbopelvic fixation is an effective technique for stabilizing complex spinopelvic, sacrum, and pelvic injuries. Depending on the fracture pattern, it can be used in isolation or in combination with various fracture fixation techniques. LP fixation allows improvement of segmental sacral kyphosis and stable construct allowing immediate weight-bearing.

ID: AGS26/2759

P1034: Beyond survival: functional status and health related quality of life following traumatic spinal injury in Tanzania

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Introduction: Traumatic spinal injury (TSI) is a major cause of disability and mortality worldwide, occurring more frequently in low- and middle- income countries (LMICs). TSI impacts a patient's functional status and health quality, including both physical and psychological domains of life. Understanding how spine trauma and its management impact patients' quality of life is essential to provision of optimal spine care. This study aims to assess spine trauma patients' functional outcomes over time utilizing standardized measures of impairment and health related quality of life (HRQOL). **Material and Methods:** All spine trauma patients presenting to a single tertiary referral center in Tanzania between July 2024 and August 2025 were included in this analysis.

Demographic information, injury characteristics, and HRQOL measures were recorded at 2-, 6-, 13-, 26-, and 52- weeks following spine trauma. AO PROST questionnaire responses were used as a measure of patient reported HRQOL. Mean PROST scores were calculated, then stratified by ASIA grade at each timepoint. **Results:** A total of 149 patients were included in this study. At time of analysis, 81.5% of eligible patients reached 2-week follow-up, and nearly 75% of eligible patients completed 6 month follow-up evaluation. A decline in overall PROST scores was observed at the 2-week follow-up (41.2 ± 34.2), followed by improvement (54.3 ± 31.6) at 6 months. The greatest increase in PROST scores occurred between the 6-week and 3-month follow-up points. Across all time points, patients with ASIA grade E had the highest average PROST scores, followed by ASIA grade D. By contrast, ASIA grade A patients consistently had the lowest PROST scores. Average PROST scores improved across all ASIA grade groups between 2 weeks and 6 months. **Conclusion:** In this study, conducted at a hospital located in Tanzania, follow-up rates have consistently exceeded 70%, demonstrating strong engagement from enrolled patients. The overall high follow-up rate demonstrates the feasibility of collecting data relevant to spine trauma in an LMIC in Africa. Overall, AO Spine PROST scores show an improving average trend following trauma, and higher grades of spinal injury correlate to better long-term patient-reported functional outcomes. Despite these findings aligning with those of studies conducted in high income countries, LMICs have insufficient capacity to provide optimal spinal trauma care for all their patients. This study offers unique insights via employing standardized

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P1035: Mid-term outcomes of vertebral body stenting for osteoporotic vertebral fractures and the validity of MRI-based indications

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Introduction: Vertebral body stenting (VBS) has emerged as a novel device for osteoporotic vertebral fractures (OVF), comparable to balloon kyphoplasty (BKP), and was approved for clinical use under the Japanese national health insurance system in 2021. At our institution, VBS has been performed since June 2021, with 118 cases (118 vertebrae) treated by December 2023. This study evaluated one-year clinical outcomes and compared the efficacy of VBS between patients with and without poor prognostic MRI findings, which are associated with non-union. **Material and Methods:** Among 118 cases, 87 patients were retrospectively analyzed after excluding those who required additional fixation due to severe vertebral damage or in whom stent deployment was unsuccessful. Clinical outcomes included numerical rating scale (NRS) for pain, perioperative complications, adjacent vertebral fractures, and progression to non-union or delayed vertebral collapse. Radiological parameters included anterior vertebral height (AVH), middle vertebral height (MVH), posterior vertebral height (PVH), and vertebral angle (VA), measured at four time points: preoperatively, postoperative day 1 (POD1), postoperative month 6 (POM6), and POM12. Furthermore, differences in AVH, MVH, PVH, and VA were compared between patients with and without poor prognostic MRI findings, defined as high-intensity or diffuse low-intensity changes on T2-weighted imaging. **Results:** The mean age and operative time were 79.2 years and 27.2 minutes, respectively. NRS scores significantly improved from 6.2 preoperatively to 2.8 postoperatively. Cement leakage occurred in 16% of patients but was asymptomatic in all cases. No non-union was observed; delayed vertebral collapse occurred in 3 cases, all asymptomatic. Radiological improvements in AVH, MVH, PVH, and VA were significant at POD1 and were maintained through POM12 compared with preoperative values. Patients with poor prognostic MRI findings demonstrated significantly greater improvements in AVH, MVH, and VA at both POD1 and POM12. **Conclusion:** VBS was effective in maintaining vertebral height and preventing progression to non-union or delayed vertebral collapse during the observation period. Moreover, patients with poor prognostic MRI findings benefited more from VBS, suggesting the validity of MRI-based treatment selection.

ID: AGS26/2911
P1036: Enhancing the Thoracolumbar Injury Classification System to Guide Surgical Decision-Making for Burst Fractures

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Introduction: The Thoracolumbar Injury Classification and Severity Score (TLICS) is widely used to guide management of thoracolumbar spine trauma. However, its applicability to burst fractures remains debated, particularly given the uniform assignment of 2 points for morphology regardless of fracture complexity. The objective of this study is to evaluate the diagnostic performance of TLICS in predicting surgical management for thoracolumbar burst fractures and to determine whether incorporating radiographic modifiers into the morphology domain improves predictive accuracy. **Material and Methods:** A retrospective analysis was performed on patients with confirmed burst fractures treated from 2018 to 2023 using a statewide institutional database linked to a Level 1 Trauma Center. Patients were divided into surgical and non-surgical cohorts. Original TLICS scores were calculated retrospectively. Modified TLICS (mTLICS) scores were generated by assigning additional morphology points for radiographic thresholds: AP canal diameter < 9.7 mm, retropulsion ≥ 5 mm, anterior vertebral height loss ≥ 8.2%, and kyphotic angle ≥ 15°. Diagnostic performance was assessed using ROC analysis and comparison of sensitivity and specificity at a surgical threshold of > 4 points. **Results:** A total of 185 patients with thoracolumbar burst fractures were included in the final analysis. Of this sample, 65 patients (35.1%) underwent surgical intervention, while 120 patients (64.9%) were managed non-operatively. Among surgically treated patients, 68% had a TLICS score ≤ 4, suggesting underestimation of surgical need. The original TLICS score demonstrated limited discriminative ability (AUC = 0.654). At a threshold of > 4, specificity was 90.8%, sensitivity was 2.3%, with a PPV of 65.6% and NPV of 71.2%. The best-performing mTLICS model was mTLICS-7, which incorporates all four radiographic modifiers. This modified score assigned 2 points for AP canal narrowing, 1 point each for retropulsion, vertebral height loss, and kyphotic angle. ROC analysis of mTLICS-7 yielded an AUC of 0.828 with sensitivity of 83.1%, specificity of 70.0%, PPV of 63.3%, and NPV of 87.4%, representing marked improvement over the unmodified scoring system. **Conclusion:** The TLICS scoring system demonstrates limited sensitivity in identifying surgical candidates among patients with thoracolumbar burst fractures, in part due to fixed morphology scores that fail to reflect the heterogeneity of fracture severity. While TLICS remains a valuable decision-support tool, our findings highlight the importance of refining its morphology component. Incorporating radiographic modifiers such as canal compromise, retropulsion, anterior vertebral height loss, and kyphotic angle can significantly enhance its predictive accuracy.

ID: AGS26/2931
P1037: Comparative outcomes of percutaneous and conventional open pedicle screw fixation for thoracolumbar burst junction fractures without neurologic deficit

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Introduction: Thoracolumbar Burst fractures requiring surgical intervention can be treated with either open or percutaneous stabilization, each with some distinct risks and benefits. There is insufficient evidence available to support one approach as superior. The aim of our study is to compare the functional clinical and radiological outcomes of percutaneous versus conventional open posterior fixation for thoracolumbar burst junction fractures. **Material and Methods:** We conducted a retrospective study of 61 patients who underwent posterior fixation for thoracolumbar burst fractures. Patients were divided into two groups according to the surgical approach:

• Group A included 35 patients treated using the conventional open posterior fixations.

• Group B included 26 patients treated using the percutaneous posterior fixation. Functional and clinical outcomes were assessed using Visual Analogue Scale (VAS), Oswestry and Dallas scores and return-to-work time. The evaluation of results was done by calculating the variation of radiological parameters between pre-operative radiographs, postoperative radiographs and last follow-up radiographs. The gain is the preoperative value minus the postoperative value. The loss of correction is the value at the last follow-up minus the post-operative value. **Results:** In group A, the mean age 49.89 years. The mean BMI was 28.71 kg/m^2. We noted a male predominance (26 males and 31 females). The most frequent fracture vertebra was L1 (37 cases). The mean follow-up was 53.82 months. In group B, the mean age was 46.88 years with female predominance (10 males and 16 females). The mean BMI was 26.42 kg/m^2. L1 vertebra was the most frequent (18 cases). The mean follow-up was 49.04 months. Percutaneous fixation was associated with better clinical outcomes, including earlier verticalization ($p = 0.007$), shorter return-to-work time ($p = 0.03$), lower post-operative VAS (1.58 vs 2.42 $p = 0.003$), and improved Oswestry (13.08 vs 23.07) and Dallas scores (8.26 vs 15.45) ($p = 0.002$ and $p = 0.001$, respectively). Regarding radiological

parameters, the gain in regional kyphosis was 10.09° for group A and 8.04° for group B (p = 0.3). The gain in vertebral kyphosis was 8.29° and 8.85° for group A and B respectively (p = 0.22). At the last follow-up of group A, the loss in regional kyphosis (RK) was 1.64°, the loss in vertebral kyphosis (VK) was 1.18 and the loss of traumatic regional angulation (TRA) was 1.64. At the last follow-up of group B, the loss in RK was 0.38°, the loss in VK was 0.42° and the TRA loss was 0.46. At this stage, there was a significant difference between the two groups for VK (p = 0.009) and TRA (p = 0.01). Regarding the complications, conventional open pedicle screw fixation was linked to higher complication rates, including hardware failure (p = 0.011), while other complications such as nonunion (p = 0.44) and sepsis (p = 0.32) did not reach statistical significance. **Conclusion:** Percutaneous posterior fixation for thoracolumbar burst fractures provides superior clinical recovery and better radiological outcomes compared with open fixation, without increasing complication rates. These findings support the use of percutaneous techniques to optimize patient recovery, kyphosis correction, and maintenance of spinal alignment.

ID: AGS26/2968
P1038: A one-year report on the current burden of spine trauma at a tertiary referral hospital in Tanzania

Chellandra Samuels [1], Mariam Mzingi[2], Elochukwu Ibekwe[3], Chibuikem Ikwuegbuenyi[3], Romani R. Sabas[2,3], Sheryne Zeitoun[1], Halinder Mangat[3], Hamisi Shabani[2], David Shearer[1], Ashraf El Naga[1], Roger Härtl[3], David Gendelberg[1], African Spine Trauma Network, SIGN Spine[4]

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Introduction: Traumatic spinal injury is a significant cause of high morbidity and mortality worldwide. A major spine trauma care gap is the lack of data, specifically in lower- and middle-income countries (LMICs). The number of trauma registries are limited, secondary to the costs associated implementing and managing the database. Understanding the current state of spine trauma in LMICs will provide valuable information, guiding future interventions. This study aims to describe spine trauma patient demographic, injury, and management characteristics amongst the cohort. **Material and Methods:** This study is a prospective observational cohort study enrolling adult patients with spine trauma at a tertiary referral hospital in Tanzania since July 2024. At enrollment, patients' demographics, socioeconomic details, injury characteristics, hospitalization data, and management details were entered into REDCap. Patients are followed up at the following time points : 2 weeks, 6 weeks, 3 months, 6 months and 12 months. **Results:** Between July 2024 - August 2025, 150 spine trauma patients have been enrolled. The average age of enrolled spine trauma patients was 38.05 years (SD = 13.20). Majority of patients were male (129, 86.0%). Most patients were uninsured (121, 80.7%) and working (125, 90.0%) at time of injury. Prevalent mechanisms of injury for enrolled patients include motor vehicle accident (71, 47.3%) and fall (46, 30.7%). Neurologic deficits were present for 111 (75.0%) patients. Thoracolumbar levels (95, 71.4%), were the most common injury level. Out of the 149 enrolled patients, 118 patients were determined to be surgical candidates, and of these, 105 surgeries were performed. Delays to surgery were experienced in 77 cases (72.6%), most commonly caused by inability to pay. Nonsurgical management included orthosis (15,48.4%), immobilization (3, 9.7%), and pain management (25, 80.6%). Instrumentation was performed in 103 (98.1%) surgeries, and of these, 63 (61. 2%) cases utilized donated instruments. Most commonly instrumented levels were thoracolumbar levels, specifically, T11 (38, 36.9%), T12 (47, 45.6%), L1 (49, 47.6%), L2 (52, 50.5%), L3 (27, 26.2%). Of the entire cohort, 110, 98, 70, and 6 patients have been evaluated for 6 week, 3-, 6-, and 12- month follow-up, respectively. Follow-up rate at 6 months is 74%. **Conclusion:** Data collection of spine trauma patients at this medical center in Tanzania has provided detailed information on patient demographic, injury, and management characteristics. Data collection is needed for greater understanding of spine trauma in lower resourced settings and development of interventions aimed at providing optimal spine trauma care.

ID: AGS26/3020
P1039: Pneumorrhachis following a subscapular stab wound: a case report and literature review

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Introduction: Pneumorrhachis is a condition characterized by the presence of air in the spinal canal. It is most often discovered incidentally, associated with a variety of underlying conditions. However, chest trauma associated with pneumorrhachis is a rare occurrence. The mechanism by which free air becomes trapped in the spinal canal following chest injury remains unclear. **Material and Methods:** We present the case of a 17-year-old adolescent who was the victim of a stab wound with a left suprascapular injury. Upon admission, imaging revealed a massive left pneumothorax, extensive pneumomediastinum, and diffuse pneumorrhachis. Despite the severity of the injuries, the patient exhibited no neurological deficits. **Results:** The management included chest drainage for the pneumothorax, along with close clinical and radiological monitoring for the pneumorrhachis. The patient's condition improved progressively, with gradual resolution of the pneumorrachis. **Conclusion:** Pneumorrhachis is often found incidentally, associated with a variety of underlying conditions, particularly in cases of traumatic pneumothorax and skull base fractures. Pneumorrhachis is typically managed conservatively and should be carefully considered in the presence of neurological deficits.

ID: AGS26/3047
P1040: Treatment of high energy traumatic thoracolumbar burst fractures with armed kyphoplasty

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Introduction: Management of complete (AO A4) and incomplete (AO A3) high energy traumatic thoraco-lumbar burst fractures is still controversial. The aim of this study was to compare intravertebral fracture reduction using armed SpineJack® Kyphoplasty (SJ) and compare it with conventional minimal invasive posterior percutaneous instrumentation (PPI) techniques. **Material and Methods:** Retrospective single centre analysis of surgically treated traumatic thoracolumbar burst fractures (AO A3 and A4) with SJ, PPI, or a combination of both (SJ & PPI) from January 2018 to March 2022. The primary endpoint was the 30-day morbidity. Secondary endpoints were operation time, length of hospital stay, reoperation rates and postoperative radiographic fracture reduction. **Results:** A total of 64 patients were included in the study. 14 patients were treated with SJ, 40 patients received PPI and 10 patients received a combination of both (SJ & PPI). 26 were suffering from a polytrauma (ISS $\geq$ 15). A total of 16 (25%) patients had complications in the 30 days post index surgery: The complications were mild in 9 (4 patients grade 1a, 5 patients 1b) and moderate (2b) in 7 patients; there was no difference between treatment groups. Rehospitalization within 30 days after surgery was necessary in two patients, one in the PPI and one in the SJ & PPI group. The mean surgery time in the SJ group was 48 $\pm$ 51minutes, 139 $\pm$ 62 minutes in the PPI group, and 135 $\pm$ 75 minutes in the SJ & PPI group ($p < 0.05$). There were no significant differences for radiographic parameters between groups. **Conclusion:** SJ is a viable and safe treatment option for traumatic incomplete or complete burst fractures, either as a standalone procedure or in combination with short dorsal instrumentation. It has similar radiographic fracture reduction capabilities when compared with dorsal instrumentation techniques, but has the advantage of shorter operative times especially when used as a standalone treatment device.

ID: AGS26/3079
P1041: A rare case of open thoracolumbar fracture: a case report

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Introduction: Open spinal fractures are rare and often associated with high-energy trauma, severe wound contamination, and neurological deficits. They pose significant management challenges due to the risk of infection, dural involvement, and spinal instability. Early surgical intervention and appropriate antimicrobial therapy are essential to optimize outcomes. We present a case of an open thoracolumbar fracture with severe contamination successfully managed with early debridement, stabilization, and prolonged follow-up. **Case presentation:** A 24-year-old male estate worker sustained an occupational injury when his safety harness became entangled in a conveyor machine, pulling him against the machinery. He developed a deep laceration over the lumbar spine with exposed muscle and spinous processes. On examination, the wound was grossly contaminated with sand and metallic particles. Neurological assessment revealed incomplete cord injury (ASIA B). He was hemodynamically stable. Imaging findings on CT noted L1 chance fracture and L2 comminuted posterior element fracture. MRI showed L1 chance fracture with widened L1/L2 bilateral neuroforamina due to facet joint dissociation. Visualization of L2-

L3 was limited due to metallic foreign body artifact. In the emergency department, intravenous cefuroxime and metronidazole were administered, and the wound was irrigated with normal saline. On day 2 post-trauma, the patient underwent wound debridement, posterior spinal instrumentation and fusion from T11 to L4, and L1-L2 laminectomy. Prophylactic gentamicin was given in addition to cefuroxime and metronidazole prior to incision. Intraoperatively, extensive contamination with sand and metallic debris was noted, extending down to the dura. The dura was exposed but intact without cerebrospinal fluid leakage. Debridement of superficial and deep muscle was performed. Estimated blood loss was 1 Liter, requiring transfusion of 2 pints of packed red blood cells. Antibiotics were continued for 5 days postoperatively. The patient was discharged in good condition with no wound complications. At 1-year follow-up, the wound had healed completely. Neurological recovery was limited but improved from grade 0 to grade 1 power in both lower limbs, with intact sensation. **Discussion:** Open thoracolumbar fractures are extremely rare and most often result from high-energy trauma. They are associated with a high risk of infection, neurological deterioration, and poor functional outcomes. The management principles include immediate antibiotic therapy, meticulous debridement, and spinal stabilization. In this case, the presence of gross contamination with soil and metallic foreign bodies raised significant concern for deep infection. However, timely debridement, broad-spectrum antibiotics, and rigid stabilization prevented septic complications. Neurological recovery remained limited, reflecting the severity of the initial spinal cord injury. This case supports previous reports emphasizing early multidisciplinary management in achieving satisfactory wound healing and long-term spinal stability despite severe contamination. **Conclusion:** Open thoracolumbar fractures are rare but serious injuries requiring urgent multidisciplinary management. Early broad-spectrum antibiotics, thorough surgical debridement, and spinal stabilization are crucial to reduce complications. Although neurological recovery may be limited, satisfactory wound healing and stable spinal reconstruction can be achieved, as demonstrated in this case.

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P1042: Cement-augmented minimally invasive fixation for a U-shaped sacral insufficiency fracture: a case report

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Introduction: Sacral insufficiency fractures are an increasingly recognized cause of severe low back and pelvic pain in elderly patients, most often related to osteoporosis. These injuries are frequently underdiagnosed due to their nonspecific presentation and the limited sensitivity of plain radiographs. While many sacral insufficiency fractures are stable and can be managed conservatively, the U-shaped configuration is a severe and biomechanical unstable subtype, resulting in spinopelvic dissociation and a risk of progressive kyphosis. In these cases, surgical fixation is often required to restore stability, relieve pain, and allow early mobilization. **Material and Methods:** We present the case of a 60 year old female patient with osteoporosis who was admited with acute severe low back and radicular pain, gait inability, and functional impairment. CT imaging demonstrated a U-shaped sacral insufficiency fracture involving both sacral alae and the S1 body. The patient underwent minimally invasive lumbopelvic percutaneous fixation with fenestrated pedicle screws at L4-L5 and iliac screws, augmented with polymethylmethacrylate (PMMA) cement. **Results:** The procedure was uneventful, with no intraoperative complications. Postoperatively, the patient experienced significant pain relief, was mobilized with partial weight-bearing, and discharged the following day. At one-month follow-up, she reported marked functional improvement, with radiographs confirming stable fixation and no loss of alignment. **Conclusion:** This case highlights the importance of recognizing U-shaped sacral insufficiency fractures as an unstable entity requiring surgical management. Cement-augmented minimally invasive lumbopelvic fixation proved to be a safe and effective technique, providing immediate stabilization, rapid pain relief, and early mobilization in an osteoporotic patient with spinopelvic dissociation.

ID: AGS26/3139
P1043: Impact of loss of correction on functional and clinical outcomes after posterior surgical treatment of thoracolumbar junction fractures

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Introduction: Thoracolumbar fractures, a prevalent type of spinal fracture, typically occur at the thoracolumbar junction. This region, where thoracic kyphosis transitions into lumbar lordosis, has complex anatomical structures and experiences significant biomechanical stress. Loss of vertebral alignment after posterior stabilization of these injuries may compromise long-term functional recovery. This study aimed to evaluate the impact of loss of correction on functional and clinical outcomes in patients treated surgically. **Material and**

Methods: We conducted a retrospective study including 60 patients treated for thoracolumbar junction fractures with posterior fixation. The loss of correction was defined as a ≥ 20% decrease in vertebral height, Cobb angle, or vertebral kyphosis from the immediate postoperative measurement Patients were divided into two groups: Group A included 18 patients with significant loss of correction and Group B included 42 patients without significant loss. Functional outcomes were assessed using the Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Dallas Score, return to work, work reassignment, and duration of work absence. **Results:** The mean age of Group A was 49.78 years and 49.33 years for Group B. The mean BMI was 28.75 in Group A and 28.60 in Group B. Group A included 8 women and 10 men, whereas Group B included 17 women and 25 men. Diabetes was present in 5 patients in Group A and 7 in Group B. Initial neurological deficit was observed in 1 patient in Group A and 3 patients in Group B. The mean follow-up was 61 months for Group A and 50.21 months for Group B. Among the 60 patients included, 18 patients experienced significant loss of correction (Group A), while 42 patients maintained vertebral alignment (Group B). Functional evaluation showed that patients with loss of correction had slightly higher pain scores on the Visual Analogue Scale (mean 2.78 vs 2.32; $p = 0.33$) and Oswestry Disability Index scores (mean 26.72 vs 22.59; $p = 0.40$), although these differences were not statistically significant. However, the Dallas Score was significantly higher in Group A compared to Group B (21.94 vs 13.31; $p = 0.007$), indicating worse functional outcomes in patients with loss of correction. Return to work rates were similar between groups, with 8 patients resuming work in Group A and 19 in Group B ($p = 0.79$), while work reassignment occurred in 3 patients in Group A and 6 patients in Group B ($p = 0.79$). The average duration of work absence was also comparable (150 days in Group A vs 158.75 days in Group B; $p = 0.62$). **Conclusion:** Postoperative loss of vertebral correction in thoracolumbar junction fractures is associated with poorer functional outcomes as measured by the Dallas Score. The factors responsible for this loss of correction should be investigated in future studies to better prevent this complication and improve long-term recovery.

ID: AGS26/3232
P1044: Isolated unstable L5 burst fractures presenting as cauda equina syndrome

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Introduction: Burst fractures of the fifth lumbar vertebra (L5) are rare injuries that usually result from high-energy axial compressive loads. Their distinct anatomy and biomechanical features set them apart from other lumbar spine injuries. To our knowledge, the treatment approaches for L5 burst fractures have not been comprehensively outlined. Reported treatment options include prolonged immobilisation and surgical stabilisation, most commonly involving an instrumented fusion from L4 to the sacrum. **Material and Methods:** We present two cases of L5 Burst fractures with cauda equina syndrome. The patient sustained injury due to a fall from a height. On admission, the evaluation of radiographs and neurological status was done. The measurements of the angle between the L4 lower and the S1 upper-end plates, the angle between the upper and lower-end plates of L5 and the height of the anterior and posterior rims of the L5 vertebral body were done. CT scans were assessed for a relative narrowing of the spinal canal. The fractures of L5 were stabilised with a short-segment L4-S1 fixation in combination with canal and posterolateral fusion (PLF) decompression and transpedicular bone grafting. **Results:** Radiographs, neurological findings and subjective complaints were assessed at 3, 6, and 12 months of follow-up. Both patients were satisfied with the improved symptoms. It was recommended that they discontinue medication and TLSO wearing after six weeks. **Conclusion:** The posterior instrumented spinal fusion of L5 alone is sufficient for treating most L5 burst fractures. Despite worsening spinal alignment parameters, the functional outcomes are good at the recent follow-up. Often, good clinical outcomes are in contradiction with radiological findings.

ID: AGS26/3236
P1045: Multi-level contiguous isolated lumbar spinous process fractures with intact neurology in a young adult

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Introduction: Contiguous multiple spinous process fractures localized to the lumbar vertebra are rare. We report a case of multilevel (L1-L4) continuous lumbar spinous process fractures, with the entire injury confined to the posterior column only. It was an isolated posterior column injury involving the complete lumbar spine. **Material and Methods:** A 24-year-old man presented to the emergency department with a lower back injury due to a fall from 10 feet height. There were no significant fractures visible on X-rays of the cervical and thoracic spine, but posterior element injuries to the lumbar spine X-rays. CT scan of the whole spine was done as further workup, which revealed the following injuries: spinous process fractures on L1-L4, L5-S1 facet joint fracture on the right side, and transverse process fracture on the L1-L5 right side. The patient was treated conservatively. He was advised bed rest till the pain subsided, then mobilised with a thoracolumbosacral corset (TLSO) for four weeks. **Results:** The patient was satisfied with the improved symptoms. He was recommended to discontinue medication and TLSO wearing after six weeks. **Conclusion:** In the literature, continuous lumbar spinous process fractures without any injury to the

anterior and middle column are extremely rare; all can be treated conservatively with good outcomes.

ID: AGS26/3239
P1046: Remodeling of thoracolumbar junction fractures: balloon kyphoplasty alone or with posterior percutaneous spinal instrumentation?

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Introduction: Traumatic spine fractures commonly occur at the thoracolumbar junction (T10-L2), most often at Th12-L1. Balloon kyphoplasty is an effective minimally invasive option for pain relief and vertebral height restoration, though its role in cases with spinal canal compromise remains debated. Various surgical strategies, including kyphoplasty alone or in combination with posterior percutaneous spinal instrumentation (PPSI), have been proposed to improve outcomes in these fractures. **Material and Methods:** Between October 2022 and March 2025, patients with thoracolumbar fractures who underwent balloon kyphoplasty (Group A, n = 31) or kyphoplasty combined with PPSI (Group B, n = 29) were retrospectively reviewed. All patients were neurologically intact (Frankel grade E). Inclusion criteria were traumatic fractures between T10 and L2 treated within 60 days of injury; pathological fractures due to malignancy were excluded. Demographic and radiological data were collected, including age, sex, fracture level, and fracture type based on the AO classification. Measurements comprised anterior (AVB) and posterior vertebral body (PVB) heights, spinal canal area, and local kyphotic angle, assessed preoperatively and postoperatively, with kyphotic angle also evaluated at 6-month-follow-up. All procedures were performed via a posterior approach. In Group B, pedicle screw-related implants allowed short-segment. The mean cement volume was 4.5-6 cc, and balloon expansion volume 15-20 cc. **Results:** A total of 60 patients were analyzed (Group A: 31, Group B: 29). Group A patients were older (71.1 vs. 59.4 years; $p = 0.003$) and predominantly female (24/31 vs. 15/29; $p = 0.037$). Fractures were most frequent at L1 (n = 32), followed by T12 (n = 17), L2 (n = 8), T11 (n = 2), and T10 (n = 1). By AO classification, A1 fractures were the most common in both groups (~45%). Group B showed more A2 fractures (31.0%), whereas Group A had more A3 (35.5%) and A4 (12.9%) fractures. Preoperative PVB height showed a significant difference between the two groups ($p = 0.002$), and this difference remained significant postoperatively ($p = 0.008$). The mean preoperative spinal canal area was significantly larger in Group B (279.2 mm^2) compared with Group A (204.9 mm^2; $p < 0.001$). In the overall cohort, AVB and PVB heights improved significantly postoperatively compared with preoperative values (anterior $p < 0.001$; posterior $p = 0.018$). The local kyphotic angle also improved after surgery ($p < 0.001$), decreasing from 12.8° to 10.1° in Group B and from 12.4° to 9.4° in Group A. However, the degree of kyphotic angle correction did not differ significantly between the groups ($p = 0.715$). Kyphotic angle correction was significant from preoperative to postoperative 6-month-follow-up ($p < 0.001$), but not between postoperative and 6-month-follow-up measurements ($p = 0.117$). In the subgroup of L1 fractures, a trend toward significance was observed for age differences between Group A and Group B ($p = 0.052$).For L1 fractures, repeated measures ANOVA revealed a significant increase in spinal canal area over time(preoperative-vs.-postoperative; $p = 0.004$),while no significant interaction between time and treatment type was observed ($p=0.252$),indicating comparable improvements in both groups. **Conclusion:** Both balloon kyphoplasty and kyphoplasty with PPSI improved radiological outcomes in thoracolumbar fractures. While stabilization was linked to greater spinal canal area, overall improvements were similar, suggesting both methods are effective, with added stability from the combined approach in selected cases.

ID: AGS26/3240
P1047: Percutaneous transpedicular fixation for thoracolumbar extension-distraction fractures in patients with ankylosing spinal disorders

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Introduction: Typical traumatic thoracolumbar (TL) fracture in patients with ankylosing spinal disorders (ASD) is a hyperextension injury involving all three spinal columns, which is associated with unfavorable outcomes. Although a consensus on the management of these highly unstable injuries is missing, minimally invasive surgery (MIS) has been progressively accepted as a treatment option, since it is related to lower morbidity and mortality rates. This study aimed to evaluate clinical and radiological outcomes after percutaneous instrumentation for hyperextension TL fractures in patients with ASD at a single institution. **Material and Methods:** retrospective analysis of prospectively collected data from

2013 to 2022 from Level I trauma center, 88 cases of thoracic and lumbar spinal fractures in patients with ASD treated with a PTPF. Back pain was assessed at preoperative, postoperative, and final follow-up visits using the visual analog scale (VAS). Patient-reported outcomes via the Oswestry Disability Index (ODI) were obtained to assess disability and mobility during follow-up. Union rate and implant failure. Intra- and postoperative complications were recorded. **Results:** A total of 29 patients with AS, 41 with DISH, 18 with advanced spondylosis. The mean patient age was 71.2 ± 6.8 years. The VAS score for back pain significantly improved over the follow-up period (from 8.4 ± 1.1 to 2.8 ± 0.8, $p < 0.001$). At the last follow-up, all patients had minor disability (mean ODI score 23.4 ± 5.1, $p = 0.002$). The Cobb angle (5.2° ± 2.9° preoperatively to 4.4° ± 3.3° at follow-up) and SI (7.9° ± 4.2° to 8.8° ± 5.1°) were maintained at follow-up, showing no loss of segmental kyphosis. Bone union was observed in all patients. The overall complication rate was 10%, while the reoperation rate for implant failure was 4%. **Conclusion:** Percutaneous instrumentation for traumatic hyperextension TL fractures in ASD demonstrated good clinical and radiological outcomes, along with a high bone union level and low reoperation rate. Accordingly, MIS reduced the complication rate in the management of these injuries of the ankylosed spine.

ID: AGS26/3272
P1048: Initial management of thoracolumbar fractures in the emergency setting: impact of transfer delay on neurological outcome - Literature review

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Introduction: Thoracolumbar fractures, particularly those associated with neurological deficits, require timely assessment and management to optimize outcomes. Delays between emergency department presentation, imaging, and neurosurgical transfer may influence neurological recovery. This review examines the relationship between early management and functional outcomes. **Material and Methods:** A systematic literature search of PubMed and Google Scholar was performed using the keywords: "thoracolumbar fracture," "emergency management," "transfer delay," "neurological outcome," and "spinal trauma." Studies reporting timing of initial assessment, imaging, transfer to definitive care, and subsequent neurological recovery were included. Data regarding study design, patient population, fracture type, and reported outcomes were extracted. **Results:**

• Early imaging and rapid transfer to specialized spinal units are consistently associated with improved neurological outcomes.
• Delays in assessment or transfer, particularly >12-24 hours, correlate with increased rates of persistent motor or sensory deficits.
• Factors contributing to delays include initial triage, access to advanced imaging (CT/MRI), and inter-hospital transfers.
• Protocolized trauma pathways, including early recognition and expedited transfer, reduce delay and may improve functional recovery. **Conclusion:** Timely initial management of thoracolumbar fractures, including rapid imaging and prompt neurosurgical referral, is critical for optimizing neurological outcomes. Standardized emergency protocols and early coordination with spinal units are recommended to minimize delays. Further prospective studies are warranted to quantify the impact of specific time thresholds on long-term recovery.

ID: AGS26/3293
P1049: Non-surgical management of stable thoracolumbar fractures in the emergency setting: outcomes and comparison with delayed surgical intervention - Literature review

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Introduction: Stable thoracolumbar fractures are common in trauma patients and may be managed conservatively in the emergency setting. Non-surgical management, including bracing, analgesia, and activity modification, aims to prevent neurological deterioration while promoting early mobilization. The effectiveness and outcomes compared with delayed surgical intervention remain under discussion. **Material and Methods:** A systematic review of PubMed and Google Scholar was performed using keywords: "thoracolumbar fracture," "stable fracture," "non-surgical management," "orthopedic treatment," "brace," and "conservative treatment." Studies reporting outcomes of conservative treatment, complications, and comparisons with secondary surgical intervention were included. **Results:**

• Conservative treatment with rigid or dynamic bracing, analgesia, and early mobilization resulted in satisfactory pain control and maintenance of spinal alignment in most patients.
• Neurological deterioration was rare when appropriate fracture stability criteria were applied.
• Comparative studies indicate that outcomes of delayed surgery following failed conservative management were generally favorable, though initial conservative management

did not increase complication rates.
• Patient compliance, fracture morphology, and regular follow-up imaging were key factors influencing treatment success.
• Early mobilization and structured outpatient follow-up reduced the incidence of complications such as chronic pain and postural deformities. **Conclusion:** Non-surgical management is effective for stable thoracolumbar fractures in the emergency setting, providing good functional and radiological outcomes. Delayed surgical intervention remains a viable option in cases of pain persistence, deformity progression, or neurological compromise. Careful patient selection and close follow-up are essential to optimize outcomes.

ID: AGS26/3301
P1050: Comparative outcomes of short-segment versus long-segment fixation in thoracolumbar burst fractures

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Introduction: Whether short-segment (SS) or long-segment (LS) posterior fixation yields superior outcomes in thoracolumbar burst fractures remains debated. Prior meta-analyses and contemporary series suggest SS preserves motion segments and reduces perioperative burden, while LS may better maintain sagittal correction and lower implant failure in select patterns (osteoporosis, comminution). This study compares radiological and clinical outcomes of SS versus LS fixation in AO type A3/A4 fractures and contextualizes findings against recent evidence. **Material and Methods:** A retrospective cohort of **157** consecutive patients with thoracolumbar burst fractures (AO A3/A4) operated between **2020-2024** was analyzed. Group A received SS fixation (one level above/below), Group B LS fixation (two above/two below). Outcomes included kyphosis correction (Cobb angle) and loss of correction at last follow-up (≥12 months), neurological recovery (Frankel), functional scores (VAS, ODI), perioperative metrics, and complications (implant failure, reoperation). Subgroup exploration considered bone quality and fracture comminution. **Results:** Both strategies achieved comparable immediate deformity correction. At 12 months, **loss of correction averaged 4-6° in SS vs 1-2° in LS**, aligning with pooled literature showing greater durability of alignment after LS in selected cases. Implant failure occurred more often after SS (**~7%**) than LS (**~3%**), consistent with reports identifying higher SS failure in osteoporotic or highly comminuted patterns and the mitigating role of fracture-level screws/bone grafting. Neurological recovery (Frankel) and patient-reported outcomes (VAS, ODI) were **similar between groups**, while SS demonstrated **shorter operative time and lower blood loss**. **Conclusion:** In AO A3/A4 thoracolumbar burst fractures, **SS and LS are both effective**. SS confers perioperative advantages and segment preservation but shows greater risk of correction loss/implant failure in specific morphologies; LS provides **superior radiographic durability** where bone quality is poor or comminution is substantial. Findings mirror contemporary meta-analyses and series supporting **individualized selection** (fracture pattern, bone quality) and the potential value of adjuncts (fracture-level pedicle screws, transpedicular grafting) to enhance SS stability.

ID: AGS26/3322
P1051: Pediatric chronic wound caused by a penetrating foreign body

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Introduction: Chronic wounds are wounds that do not heal in the expected timeframe usually required for healing, thus remaining in the inflammatory stage for too long. They often become a suitable habitat for germs, and infections set in further complicating treatment. It is a health problem often present in old patients with multiple chronic pathologies such as diabetes. In this case report, the presence of such wound in a young patient was found out to be secondary to a penetrating foreign object (plant needle) embedded deep within the wound. **Case Report:** We discuss the case of a 9-year-old patient, who consulted our emergency room with complaints of a fever and a purulent content leaking from a 1 cm wound at the lumbar region. The patient's family reported that the wound has been resistant to all treatment and wouldn't heal despite multiple consultations to the emergency room. Upon examination, the patient exhibited severe pain at the mobilisation of the lumbar spine, he had no motor deficit. He however had an

inflammatory mass at the level of the wound, with pus leaking through the wound. Further imaging revealed a purulent collection. The patient was operated on via a posterior approach, per-operatively, a 4 cm plant-needle was discovered that has perforated the dura. No CSF leak was present upon removal. **Discussion:** Chronic wounds in the paediatric population represent a rare occurrence that should always raise a red flag, especially in a post-traumatic context. In such scenarios, persistent inflammation and failure to respond to conventional treatment should prompt further investigation, including surgical exploration, even when imaging findings are inconclusive. Early identification and removal of the offending agent are critical to resolving infection, preventing complications, and facilitating complete wound healing. **Conclusion:** This case underscores the importance of considering retained foreign bodies as a potential etiology in pediatric patients presenting with chronic, non-healing wounds, particularly in the absence of underlying systemic.

ID: AGS26/3339
P1052: Thoracic duct injury in spine surgery: a systematic review of presentation, management, and clinical outcomes

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Introduction: Thoracic duct injury (TDI) is a rare yet a serious complication in spine surgery that requires prompt identification and management. TDI can occur in the setting of spinal trauma or as an iatrogenic damage during spine surgery. Given the rarity of this complication and the paucity of literature on the subject, we conducted a systematic review to summarize all reported cases of TDI related to spine surgery. We aim to provide an up-to-date understanding of the presentation, diagnosis, management, and outcomes of this condition. **Material and Methods:** We conducted a systematic search to identify articles related to TDI in spine surgery. We included all observational reports that discussed spine surgery-related TDI. Two independent reviewers screened the articles for inclusion. Data were extracted on patient demographics, surgical details, clinical presentation, management strategies, and outcomes. **Results:** We included 64 studies, involving a total of 70 patients with a mean age of 39 years. Two major groups were included for analysis, TDI secondary to spine trauma (28 patients, 40%) and TDI secondary to an iatrogenic injury (42 patients, 60%). In the traumatic group, injuries were mostly at the thoracolumbar level, with dislocation/translation fractures being the most common type (31%). In the iatrogenic group, the primary surgical indication was spinal deformity (54%) followed by degenerative spine disease (24%). Anterior cervical approaches were the cause of the TDI in 8 patients (19.05%). Patients presented with a median of 3 days after the initial etiological event. Chylothorax was the most frequent clinical diagnosis in both groups (70%). The most common therapeutic intervention was percutaneous drainage 80%, and most of the patients had complete resolution (96%). Two patients died due to complications. **Conclusion:** This review offers an updated overview of this challenging complication and help to guide the diagnosis and management of this condition.

ID: AGS26/3342
P1053: Stability of the lumbar spine in traumatic paraplegia following fracture dislocation

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Introduction: More than half of all spinal trauma cases involve a thoracolumbar fracture, making it the most frequent spinal injury. However, thoracolumbar fracture-dislocations are rare and account for less than 3% of these injuries. A combination of shear, rotation, and flexion-extension forces can cause trauma to both static and dynamic stabilizing elements, including the vertebral bodies, discs, facets, and ligaments, resulting in vertebral fracture-dislocations that disrupt the entire spinal column. Subsequent paraplegia is more common in cases of thoracolumbar spine dislocation. Here, we report a case of complete fracture-dislocation of L2 through L1 vertebrae with paraplegia. **Material and Methods:** A 43-year-old man presented with acute back pain secondary to a fall. He was immediately transferred to the emergency department, complaining of severe back pain and having complete paraplegia and anesthesia of his lower extremities. The physical examination at admission revealed stable vital signs and several small abrasions on the lower back. Bilateral lower extremity strength was 1/5 with complaints of urinary and fecal incontinence. Radiographs and computed tomography (CT) showed fracture dislocation at the L1-L2 level, more than 50% anterolisthesis at L1-L2 with anterior wedging of L2. and an initial magnetic resonance imaging (MRI) revealed complete ligamentous disruption through the disc space and disruption of the posterior ligamentous complex (PLC) with subluxation of the vertebral bodies, classified as AO L1/2 type C, L2 type A1. The patient underwent emergent open decompression at L1-2 and pedicle screw fixation at T12-L4. The displaced segment was carefully reduced using rod distraction, and a cross-connector was applied. In addition, decortication of the posterior elements and autologous bone grafting were performed before drainage and wound closure. The patient was placed in a thoracolumbosacral orthosis

(TLSO). The TLSO was continued for about 3 months. At the end of the 3-month follow-up, the patient was able to mobilize without support, but urinary and fecal incontinence still continued. **Results:** Since the spine is unstable as a result of fracture-dislocation and insufficiency of the 3 columns, it requires surgical intervention that includes decompression of the neurological elements, reduction of abnormal alignment, and stabilization with spinal fusion. Surgical treatment for individuals with spinal cord injuries is now recognized as an initial component of the intricate rehabilitation process for these patients. The most important results after the procedure were the beneficial psychological effect of early mobilisation and the adjustment to a new way of living with their disability. **Conclusion:** Traumatic thoracolumbar fractures (TLF) are common injuries that occur after trauma. Burst fractures compromise the most commonly encountered TLF. Thoracolumbar spine fracture-dislocation, which usually occurs as a result of high-energy trauma, is frequently associated with spinal cord injury, and severe spinal fractures leading to dislocation can lead to complete neurological dysfunction. Patients with fracture-dislocation spinal injuries and spinal cord transections experienced the most severe outcomes, whereas individuals with wedge compression fractures and cord edema had more favorable results. In order to provide a stable environment for neurological and musculoskeletal repair, the spine should be stabilized as soon as possible.

ID: AGS26/3355
P1054: Radiological and functional outcomes of thoracolumbar burst fractures screw fixation: open vs percutaneous pedicle instrumentation

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Introduction: Burst fractures of the spine, particularly at the thoracolumbar junction, constitute a significant public health issue. The optimal surgical strategy, particularly for Magerl type A3 fractures, remains a matter of ongoing debate. This study aimed to compare the functional and radiological outcomes of percutaneous versus open osteosynthesis for thoracolumbar vertebral fractures. **Material and Methods:** We conducted a comparative study in the Department of Orthopedic Surgery at Mongi Slim Hospital, involving 32 patients with Magerl type A3 fractures of the thoracolumbar junction (T12-L2) over 7 years from January 1, 2015, to December 31, 2022, with a mean follow-up of 45.75 months. For each group, we evaluated epidemiological parameters, functional outcomes (Visual Analog Scale [VAS], Oswestry Disability Index [ODI])and radiological parameters (vertebral kyphosis, regional kyphosis, traumatic regional angulation, Load Sharing Score [LSS], Beck's index). **Results:** The study population was predominantly male (sex ratio 1.67) with a mean age of 46.2 years. The most common causes of injury were domestic trauma, followed by occupational accidents, with 76% of cases being isolated injuries. Compared with conventional surgery, percutaneous instrumentation was associated with significantly reduced operative time, hospital stay, postoperative recovery, and perioperative blood loss. Functionally, patients treated percutaneously had lower postoperative pain (VAS) and disability (ODI) scores ($p < 0.001$), as well as faster mobilization and return to prior activities, indicating quicker overall recovery. Radiological outcomes, including vertebral and regional kyphosis and Beck's index, were similar between the two groups. However, the percutaneous technique resulted in significantly higher exposure to radiation. **Conclusion:** Percutaneous thoracolumbar osteosynthesis is a safe and effective approach, offering reduced perioperative morbidity, faster functional recovery, and satisfactory radiological results. It is particularly recommended for fractures without neurological deficits or associated ligamentous injuries.

ID: AGS26/3396
P1055: Surgical management of spinal fractures in ankylosing spondylitis: a retrospective study of 30 cases

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Introduction: Spinal fractures in ankylosing spondylitis are unstable lesions associated with high morbidity and mortality. Surgical management is often required, but outcomes remain debated. This study aimed to evaluate the surgical results of spinal fractures in ankylosing spondylitis patients. **Material and Methods:** We conducted a retrospective review of 30 patients treated surgically for spinal fractures between 2015 and 2024. Demographic data, fracture location, neurological status, surgical approach, and postoperative outcomes were analyzed. **Results:** The mean age was 58 years, with a male predominance (85%). Cervical fractures were most common (60%), followed by thoracolumbar lesions (40%). Neurological deficits were present in 50% of cases. Posterior instrumentation was performed in 80% of patients. At final follow-up, 70% showed neurological improvement, with a complication rate of 20%. **Conclusion:** Surgical stabilization of spinal fractures in ankylosing spondylitis provides favorable functional outcomes despite high complication rates. Early diagnosis and appropriate surgical strategy are essential to reduce morbidity.

ID: AGS26/3413
P1056: Conservative management of unstable thoracolumbar fractures: a case series in medically fragile patients

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Introduction: Thoracolumbar fractures account for a significant proportion of spinal injuries, with management guided by fracture stability and neurological status. Surgical stabilisation is generally recommended for Type B2/B3 and considered mandatory for Type C injuries due to their high instability. However, surgery may be contraindicated in patients with severe comorbidities or polytrauma. **Material and Methods:** We report a case series of four patients (mean age 71 years; range 54-89) with unstable thoracolumbar fractures (two Type B, two Type C) managed conservatively. Three patients had ankylosing spondylitis. Non-operative management was chosen in three cases due to medical unsuitability for surgery and in one case by patient preference. Treatment included spinal precautions, gradual postural fracture reduction, mobilisation in a thoracolumbosacral orthosis (TLSO), and close radiological monitoring. **Results:** All patients achieved fracture healing with maintained alignment and no requirement for delayed surgical intervention. TLSO bracing was discontinued after confirmed healing, and no major complications were observed during inpatient care or follow-up. **Conclusion:** This case series demonstrates that a structured conservative protocol can provide satisfactory outcomes in selected patients with unstable thoracolumbar fractures who are unsuitable for surgery. These findings support the role of individualised, multidisciplinary decision-making, though larger studies are needed to validate this approach.

ID: AGS26/3445
P1057: Efficacy, safety, and reliability of a single posterior approach for unstable thoracolumbar burst fractures treated with anterior reconstruction and posterior instrumentation

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Introduction: The optimal management of unstable thoracolumbar burst fractures remains debated. While combined anterior-posterior instrumentation provides robust stability, it is associated with increased morbidity. A single posterior approach that enables anterior column reconstruction and posterior fixation may achieve decompression, deformity correction, and stabilization with reduced surgical burden. **Methods:** Between January 2017 and June 2025, 27 patients (18 males, 9 females; mean age 39.8 ± 11.9 years, range 16-60) with acute unstable thoracolumbar burst fractures (T11-L4) and neurological deficits were treated using a single posterior approach with anterior reconstruction and posterior instrumentation. Inclusion criteria were McCormack's load-sharing score ≥ 6 and thoracolumbar injury severity score (TLISS) ≥ 5. Outcomes assessed included neurological recovery (ASIA scale), pain (Visual Analogue Scale, VAS), radiological correction (kyphotic angle, Cobb's method), and operative parameters (duration, blood loss). **Results:** The mean operative time was 248 ± 36 minutes (range: 200-320), with an average blood loss of 465 ± 110 mL (range: 320-680). Neurological recovery showed a mean ASIA grade improvement of 1.6 ± 0.5 in patients with incomplete spinal cord injuries, while those with complete injuries remained unchanged at final follow-up. Radiologically, the mean kyphotic angle improved from 24.7° ± 5.9 (range: 17-38) preoperatively to 5.6° ± 2.4 (range: 2-10) postoperatively. Pain scores improved significantly, with VAS decreasing from 6.0 ± 1.1 (range: 4-8) preoperatively to 1.8 ± 0.7 (range: 1-3) at final follow-up. The mean follow-up duration was 44.2 ± 19.1 months (range: 12-96). **Conclusion:** The single posterior approach is a safe, reliable, and cost-effective surgical option for unstable thoracolumbar burst fractures provides effective decompression, deformity correction, and stabilization in unstable thoracolumbar burst fractures. Compared with combined anterior-posterior surgery, It allows reconstruction of all spinal columns with reduced morbidity and satisfactory neurological, radiological, and functional results.

Tumors

ID: AGS26/56
P1058: Patient-specific 3D-printed PEEK implants for vertebral body replacement in spinal tumor surgery

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Introduction: Anterior column reconstruction after spinal tumor resection remains a complex challenge. Traditional options - autografts, allografts, and implants from titanium or other materials - have inherent limitations, especially regarding imaging artifacts and biomechanical compatibility. Polyetheretherketone (PEEK) is increasingly favored due to its radiolucency, biocompatibility, and mechanical properties similar to bone. The advent of 3D printing enables the creation of patient-specific PEEK implants (PSI), potentially

improving anatomical fit and surgical outcomes. This study evaluates the feasibility, integration, and clinical results of 3D-printed PEEK PSI for vertebral body replacement (VBR) in patients with spinal tumors over a 12-month follow-up. **Material and Methods:** This retrospective single-center case series included five patients (three males, two females, mean age 51.2 years) who underwent VBR with 3D-printed PEEK PSI following tumor resection between April 2022 and June 2023. Inclusion criteria were thoracic or lumbar spinal tumors (benign, primary malignant, or solitary metastatic), PEEK 3D VBR reconstruction, and follow-up exceeding 12 months. Implants were designed from CT data using BonaPlanner software and manufactured via fused filament fabrication from medical-grade PEEK. Surgical approaches and fixation methods were tailored to each case. Outcomes assessed included radiological evidence of bony fusion (Brantigan-Steffee classification), local angle and segment height stability, and complications. Descriptive statistics were performed using R software. **Results:** The mean follow-up was 19.2 months (range: 12-28 months). All patients survived the follow-up period; one experienced local recurrence. Three patients received postoperative radiotherapy. Postoperative imaging demonstrated a decrease in local angle without significant progression during follow-up. Segment heights remained stable; no implant subsidence or hardware failure occurred. All patients achieved at least probable radiographic fusion, with three demonstrating solid fusion. No adverse tissue reactions or infection were observed. **Conclusion:** Patient-specific 3D-printed PEEK implants for vertebral body replacement in spinal tumor surgery are feasible and demonstrate promising clinical outcomes, including stable integration, minimal complications, and clear postoperative imaging. The technology offers significant advantages for surgical planning and postoperative management, particularly in oncological settings requiring radiotherapy. However, customization is resource-intensive, and intraoperative adaptability remains a challenge. Larger, prospective studies are warranted to confirm these results and further define the role of PEEK PSI in complex spinal reconstruction.

ID: AGS26/94
P1059: Initial experience with painvision for the evaluation of pain due to spinal cord tumors

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Introduction: PainVision[R] was introduced in 2007; however, reports on its application in the field of spine surgery are limited. Our department adopted PainVision[R] for spinal surgery cases starting in April 2024. Since spinal tumors often present with radicular neuropathic pain, we evaluated the degree of neuropathic pain before and after tumor resection using Pain Vision™ and report our findings. **Material and Methods:** We analyzed 16 spinal tumor surgeries performed in our department from April 2024 onward (10 schwannomas, 4 meningiomas, 1 choroid plexus papilloma, and 1 Pleomorphic xanthoastrocytoma), including 8 male and 6 female patients. Neuropathic pain caused by spinal tumors was assessed using both the Visual Analog Scale (VAS) and PainVision[R] pain intensity values. Pain improvement rates were calculated based on these measurements. **Results:** The mean patient age was 54 years. Postoperative pain evaluations were conducted on average 6.8 days after surgery. Surgical treatment significantly improved VAS scores from 45 to 5 ($p < 0.001$) and PainVision[R] pain intensity from 199.9 to 35.3 ($p < 0.001$). The improvement rates were 70.4% for VAS and 73.6% for PainVision[R], with no significant difference between the two improvement rates ($p = 0.84$). The correlation between the two evaluation items was moderately strong ($r = 0.514$, $p = 0.042$). Surgical resection significantly improved neuropathic pain both subjectively (VAS) and objectively (PainVision[R]). No significant difference was observed between the improvement rates measured by the two methods, suggesting that PainVision[R] is a useful objective tool for evaluating neuropathic pain associated with spinal tumors. **Conclusion:** For surgeons, PainVision[R] provides a valuable objective measure to assess the efficacy of surgical treatment beyond imaging studies like MRI, by quantifying neuropathic pain. This tool may therefore aid in clinical decision-making and outcome evaluation in spinal tumor surgery.

ID: AGS26/113
P1060: Total excision of upper thoracic eden type 3 dumbell tumor by posterior approach alone: a case report

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Introduction: Schwannomas of the neural elements of the spine account for approximately 25% of all spinal tumors. Most commonly in thoracic spine followed by cervical and lumbar regions. Dumbbell tumor is a conceptual definition where a tumor connects two or more separate regions such as intradural space, epidural space, and locations outside the paravertebral space. Schwannoma sometimes extend into the root through the foramen and then extend into the paravertebral space thus forming a dumbbell tumor. Surgical strategies for treating these tumors is dependent on Eden's classification. A combined posterior and thoracotomy approach in two stages is the usual surgical option. If the extraforaminal tumor component is large, a combined posterolateral approach which includes a costotranversectomy

and thoracotomy is used with a multispecialty team. We would like to present a case of a giant Schwannoma of the upper thoracic spine, where complete resection was achieved with a single stage, posterior surgery only. **Material and Methods:** 52-Year-old male presented with upper back ache and numbness of both lower limbs of 3 months with unsteadiness of gait. Neurological examination revealed upper motor neuron signs in the lower limb sparing the upper limbs. MRI revealed a Lobulated intraspinal , extradural lesion with left neural foraminal and extraspinal extension (Dumbell shaped appearance) at T5-T6 and CT revealed smooth scalloping and widening of left neural foramen of the T5 vertebra by dumbbell shaped lesion with Intra-thoracic extension posterior to aorta with thinning and erosion of left T5 pedicle, transverse process and lamina of the T5 vertebra .He was diagnosed to have T5-T6 extradural dumbbell tumor (Eden type 3) with Nurick grade II Thoracic compressive myelopathy. He underwent T5-T6 decompression, tumor excision and biopsy, T4-T7 posterior instrumented stabilisation & posterolateral fusion. A single posterior midline incision with Laminectomy of T5 and T6 and Partial laminectomy of T4 and a left sided T5 and T6 Costotransversectomy was done to expose the tumor in its entirety. The tumor was arising from the T5 nerve root which had to be sacrificed to excise the tumor in total measuring 4.0x3.7x2.0 cm. Care was taken to avoid any pleural or aortic injury by using blunt instrumentation to free the tumor margins. Posterior Instrumentation was done from T4-T7 for stability. Haemostatsis was achieved and routine closure was done. **Results:** Postoperatively left T5 dermatome paraesthesia was seen with no additional major complications. Incentive spirometry was started on post operative day 1, started walking on post operative day 2 with drain removed on the same day. Postoperative chest x ray showed no signs of haemothorax, pneumothorax or atelectasis. He was discharged on postoperative day 3. Histopathology confirmed Schwannoma as diagnosis without malignancy. Followup at 1 and 6 months showed recovery of upper motor neuron signs and gait improvement. No radiological signs of recurrence were seen. **Conclusion:** Our novel approach of single-stage surgery with laminectomy and costotransversectomy may be a useful approach in excising thoracic dumbbell tumors especially in thoracic spine thus potentially avoiding major thoracic surgery and its complications.

ID: AGS26/136
P1061: Epidural lumbar spinal Schwannoma: case report and literature discussion

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Introduction: Nerve sheath tumors are the most common spinal neoplasms and make up for 40% of extramedullary tumors of the spinal column. Majority of these lesions are purely intradural (50-80%) or associated to an extradural extension (10-20%). Purely extradural schwannomas account for 1-10% of all spinal schwannomas and are more often seen in the cervical region. Lumbar extradural schwannomas account for 2.4-3.2% of all nerve sheath tumors. This report presents the case of a 53 year old patient with chronic back pain and bilateral crural pain. **Material and Methods:** A 53-year-old man with no medical history complained of back and crural pain associated to progressive paresthesia in both legs for 1 year. Neurological examination was normal except for mild hypoesthesia in both lower limbs, without particular systematization. Among other negative signs, the patient had neither sphincter disorders, nor signs in favor of neurofibromatosis. Computed tomography (Figure 1) showed a left giant lumbar L1-L2tumor associated to a scalloping of the L1-L2 left intervertebral foramen. Magnetic resonance imaging (Figure 2 and 3) disclosed at a voluminous, circular lesion at the level of left L1-L2 foramina. This tumor was hypointense on T1-weighted images, hyperintense on T2-weighted images, with intensive enhancement after Gadolinium injection. On axial sections, the terminal cone was deflected to the opposite side of the lesion. Initially, a scan guided biopsy was performed. Pathological examination concluded to a schwannoma. **Results:** Nerve sheath tumors are the most common spinal neoplasms, and represent up to 40% of extramedullary tumors of the spinal column. The majority of these lesions are purely intradural (50-80%) or intradural associated to extradural extension (10-20%). Purely extradural schwannomas only account for 1-10% of all spinal schwannomas, and are more often found in the cervical region. Lumbar extradural schwannomas account for 2.4-3.2% of all nerve sheath tumors. In the literature, extradural schwannomas have not been the focus of investigation among the series of spinal nerve sheath tumors, and have been the subject of relatively little study in general. Most of the studies that discusses this dumbbell shaped tumor presented more often as a single case report or small series. Clinical manifestations of lumbar epidural schwannomas are not specific. They are usually shortened to chronic back pain associated to crural pain and limb numbness. In some cases cauda equina syndrome can been seen. MRI is the gold standard in matter of diagnosis for spinal tumors, and schwannomas in all different locations in general (8). Epidural schwannomas are usually hypointense on T1-weigted images, hyperintense on T2-weighted images, and show intense contrast enhancement. The enhancement is probably due to the opening of gap junctions, that freely

communicating with a relatively large extracellular space. The aim of surgical treatment of spinal schwannomas is to get a total removal of the tumor, and to optimize functional outcome through conservation of the pathological nerve root. Different strategies for surgical management have been discussed by several authors. Giant dumb-bell tumors are effectively managed by a combined posterior and anterolateral approach or a single stage lateral extracavitary approach. Tumors with a large foraminal and paraspinal component limited to one segmental level can be managed by hemi-laminectomy, unilateral facetectomy and intertransverse approach. In our experience, we reached the tumor through a facetectomy that made it possible to remove the tumor in its totality. Purely paraspinal nerve sheath tumours have been traditionally approached through posterior midline incision with muscle dissection lateral to the facet and tip of transverse. **Conclusion:** Purely extradural lumbar schwannomas are uncommon. They are rarely described as an individualized entity. Clinical manifestations are not specific and the MRI is the most useful method for diagnosis. Classic surgical approaches are progressively regressing in the benefits of minimal invasive ones, which allow resection of the tumors without compromising spinal balance, and even for giant forms.

ID: AGS26/143
P1062: Extraventricular neurocytoma of the medullar conus: an exceptional pathologic diagnosis

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Introduction: Central neurocytoma is currently recognized as a distinct class of central nervous system (CNS) tumors. It is classically defined as a typically benign supratentorial mass located in the lateral ventricles or the third ventricle. Extraventricular localizations are very rare, in particular those in the spinal cord, reported only in sporadic cases. We report a new case of medullar neurocytoma. **Material and Methods:** We present the case of a patient operated for an intramedullar tumor which was thought to be an ependymoma on imaging. Only pathologic exam redressed the diagnosis by revealing an extraventricular neurocytoma. **Results:** We report the case of a 12-year-old girl, with no notable pathological history, who presented for the progressive onset of a weakness of the lower limbs since 6 months, associated with a sphincteric dysfunction since 1 year. She also complains of chronic low back pain. Neurological examination revealed flaccid paraplegia, lower extremity areflexia with a right Babinski sign and L1 sensory level. Magnetic resonance imaging showed an intramedullary intradural tumor at the level of lower thoracic spine, with extensive syringohydromyelia. The tumor was in iso-T1 and slightly in hyper-T2. Homogeneous enhancement is observed after injection of Gadolinium. The diagnosis of ependymoma was initially suspected. The decision was to operate the patient. A laminectomy from D10 to D12 was performed, followed by complete resection of a haemorrhagic, friable, grayish intramedullary tumor surrounded by a thin white capsule. Postoperative, the patient developed transient constipation, and no motor improvement was observed until discharge. Pathological exam with immunohistochemistry redressed the diagnosis towards a grade II extraventricular neurocytoma. No adjuvant treatment was undertaken. 5 months after the surgery, the patient could walk with crutches, and the sphincter disorders have regressed. **Conclusion:** Central medullary neurocytoma is a rare entity with only sporadic cases reported in the literature. Surgical resection is the reference treatment and the diagnosis is based on an immunohistochemical study.

ID: AGS26/144
P1063: Primary cervical localization of myxoid liposarcoma: case report and review of the litterature

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Introduction: Liposarcoma is the most common soft tissue sarcoma in adults. The myxoid subtype is the second most frequency lesion, accounting for 30% to 40% of cases. Extrapulmonary metastatic locations are often found especially in the skeleton, with a propensity to the spine. However, primary spinal involvement is rare, since only five cases have been identified so far. Hereby, we present a case of primary liposarcoma of the cervical spine. **Material and Methods:** We report the case of an 80-year-old patient, suffering from arterial hypertension, who presented for the onset of a motor deficit in the 4 limbs since 15 days. Physical examination found a spastic quadriplegia. MRI revealed a spinal cord compression by an extensive epiduritis ranging from C3 to C7, with adjacent intramedullar hyperintensity. Facing this presentation, the diagnosis of infectious spondyliscitis was considered at first. The patient was operated for medullar decompression. Pathological examination concluded to a grade 2 myxoid liposarcoma. **Results:** Liposarcoma is the

most common soft tissue tumor. It accounts for about 20% of all malignant mesenchymal tumors. Five histological types are described: well differentiated, dedifferentiated, myxoid, round cells and pleomorphic. Myxoid liposarcomas are usually found in the extremities, especially the thighs. Unlike other types of liposarcoma which typically metastasize to the lungs, myxoid liposarcomas tend to spread to extrapulmonary sites, such as retroperitoneum, mediastinum, chest wall, peritoneum, and heart. This predilection can be explained by the abundance of adipose tissue at these locations. Complete surgical resection combined to radiotherapy is usually sufficient for local control. Chemotherapy may be indicated in case of metastases. Nevertheless, prognosis remains reserved. **Conclusion:** Liposarcoma is the most common soft tissue tumor in adults. However, primary spinal involvement is very rare. Despite of its rarity, our case demonstrates that liposarcoma should be discussed as a differential diagnosis of cervical tumors.

ID: AGS26/264
P1064: Clinical outcomes after spine surgery for patients with potentially unstable metastatic spinal disease (Spine Instability Neoplastic Score 7-12): a systematic review

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Introduction: While the surgical management of metastatic spinal disease has wide consensus for "stable" (Spine Instability Neoplastic Score [SINS] 0-6) and "unstable" (SINS 13-18) disease, there is currently limited consensus regarding spine surgery for patients with "potentially unstable" (SINS 7-12) metastatic disease. However, in the literature, few robust systematic reviews have examined this topic. The purpose of this study is to examine the clinical outcomes for patients with potentially unstable metastatic spinal disease who underwent spine surgery. **Material and Methods:** This systematic review examined articles from PubMed, CINAHL, MEDLINE, and Web of Science from database inception until December 18th, 2024. Inclusion criteria were studies that examined clinical outcomes in patients with SINS 7-12 who underwent spine surgery. **Results:** Among 111 articles, 10 observational studies were included. Of 1,546 patients, 942 with SINS 7-12 underwent spine surgery for metastases. Average postoperative survival ranged from 10-14 months, with an 80% six-month survival and 59% one-year survival. One article found a statistically significant survival benefit with surgery over radiation, while two did not. Patients with SINS 10-12 were more likely to receive instrumentation than SINS 7-9. Surgery may be more effective than radiation for patient-reported outcomes. Rates of subsequent spine surgery after non-surgical treatments ranged from 2.3%-25.5%. Risk factors for instrumentation may include osteolytic lesions and > 50% vertebral body collapse. Cutoff scores of SINS 9 or 10 were associated with instrumentation. **Conclusion:** Average postoperative survival in patients with SINS 7-12 after spine surgery ranged from 10-14 months with an 80% six month survival and a 59-76% one year survival, with a trend towards no difference in postoperative survival in patients treated with spine surgery with or without radiation versus radiation alone. Spine surgery for patients with SINS 7-12 may have benefit for both neurological status and patient reported outcome measures, although benefits are unclear in comparison to radiation alone. Subgroups of spine instability within SINS 7-12 may exist, as patients with SINS 7-9 were less likely to receive instrumentation as compared to patients with SINS 10-12 with SINS 9 or 10 representing a cut off for instrumentation. Rates of subsequent spine surgery in patients with SINS 7-12 after non-surgical treatment failure ranged from 4.0-25.5%, suggesting caution should be exercised when choosing non-surgical treatment options. No individual component of the SINS criteria was a clear risk factor for spine surgery in patients with SINS 7-12. This study represents the first systematic review and largest study examining clinical outcomes after spine surgery for patients with SINS 7-12 with data based on ten moderate quality observational studies. The results and conclusions of this study should be taken with caution, given the high study heterogeneity and very low certainty of evidence. Future randomized studies should examine SINS 7-12 as well as subgroups with SINS 7-12 to further enhance decision-making.

ID: AGS26/306
P1065: Different treatment strategies for primary spinal aneurysmal bone cyst: a mean 5-year follow-up study from a single spinal center

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Introduction: There are few reports on primary spinal aneurysmal bone cysts due to its extremely low incidence. The aim of this study is to investigate the efficacy of different

treatment strategies for primary spinal aneurysmal bone cyst. **Material and Methods:** Patients with primary spinal aneurysmal bone cyst treated between November 2015 and November 2022 in our hospital were retrospectively analyzed. Patients' basic information, preoperative spinal cord function score, lesion location, treatment strategies, and postoperative remission were collected. **Results:** A total of 12 patients were included in this study, including 7 males and 5 females aged from 16 to 56 years old. The average follow-up period was 5 years. Among the 12 patients, 8 patients presented with local pain, 4 patients presented with local pain and neurologic symptoms of extremities, of which 3 were classified as ASIC D, 1 was ASIC C. The cyst arose in the cervical spine in one patient, in the thoracic spine in 3 patients and in the lumbar spine in 6 patients. Only spinal posterior column was involved in 2 patients, and both anterior and posterior columns were involved in 8 patients. Seven patients received open surgery, among whom 6 patients had symptom relief and 5 patients had no recurrence in long-term follow- up. Two patients received minimally invasive arterial embolization, and clinical symptoms were significantly relieved, the lesions were reduced and ossified in long-term follow-up. One patient was treated with denosumab, and the symptoms were relieved, the lesions were reduced and ossified in the last follow-up. **Conclusion:** The tumor size and severity of spinal aneurysmal bone cyst are varied in patients. Personalized operation scheme is helpful to relieve pain and nerve compression, maintain spinal stability, reconstruct bone structure, reduce postoperative recurrence and increase the benefit of patients.

ID: AGS26/334
P1066: 3D-printed vertebral body improves reconstruction after C2 tumor resection: a comparative study

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Introduction: C2 vertebral tumors pose major surgical challenges due to the complex anatomy of the upper cervical spine, proximity to the vertebral artery, and the need for stable reconstruction following resection. Conventional titanium mesh constructs have historically been used for anterior column reconstruction but are associated with hardware complications. The advent of personalized 3D-printed artificial vertebral bodies (AVBs) offers the potential for improved stability and osseointegration. This study compared surgical outcomes between titanium mesh and 3D-printed AVBs after C2 tumor resection. **Materials and Methods:** We retrospectively reviewed 31 consecutive patients with C2 vertebral tumors treated between 2009 and 2020 at a single tertiary spine center. All underwent staged posterior fixation and anterior resection via retropharyngeal, transoral, or transmandibular approaches. Patients were divided into two groups according to reconstruction material: titanium mesh (n = 13) or personalized 3D-printed AVB (n = 18). Clinical data, surgical variables, complications, and fixation status were analyzed. The primary endpoint was implant stability during follow-up. **Results:** The cohort included 14 chordomas, 11 giant cell tumors, and six other histologies. Gross total resection was achieved in 90.3% of patients, and en bloc resection in 9.7%. The overall perioperative complication rate was 45.2%, with mortality of 6.5%. Patients reconstructed with titanium mesh had a higher complication rate than those with AVBs (69.2% vs. 27.8%, p = 0.022). Approach selection influenced outcomes: retropharyngeal procedures had fewer complications compared with transoral or transmandibular approaches (30.0% vs. 72.7%, p = 0.022). During follow-up, hardware failure occurred in 4/13 titanium mesh patients (30.8%) compared with 1/18 AVB patients (5.6%, p = 0.060). Titanium mesh complications included implant migration, loosening, and rod breakage. In contrast, AVBs demonstrated reliable fixation, reduced halo vest dependence (16.7% vs. 76.9%, p = 0.003), and better conformity to anatomical defects. **Conclusion:** C2 tumor resection remains technically demanding and carries substantial risk, but reconstruction using 3D-printed AVBs provides superior implant stability and fewer approach-related complications compared with titanium mesh. Personalized AVBs not only reduce the incidence of hardware failure but also minimize the need for external immobilization. Our findings support the use of 3D-printed AVBs as a safer and more effective reconstructive option in upper cervical surgery, though further refinement of prosthesis design is warranted.

ID: AGS26/368
P1067: A case series describing operative interventions for spinal metastatic disease undertaken In Oxford, UK, from 2020-2022

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Introduction: Metastatic or secondary bone tumours are known to be associated with skeletal-related events, such as pathological fractures, spinal cord compression, or hypercalcemia. These deposits are often highly painful and cause

significant functional impairment and harm to quality of life. Between January 2020 and December 2022 the Oxford Spine Unit undertook operative intervention on 88 cases of metastatic spinal disease. This case series will look to explore the patterns of activity seen in those cases including surgical outcomes, complication rates and mortality. **Material and Methods:** A retrospective audit of surgical cases was undertaken using the electronic patient recorded based on coding for spinal surgical intervention and metastatic cancer affecting the bony skeleton. Data was extracted by a team of clinicians using a pre-agreed data capture template with key measures drawn from the literature including prognostic scores such as Tomita and Tokuhashi, functional scores including the Spinal Metastatic Staging System and FRANKEL and complication categorisation SAVES. **Results:** 88 patients underwent operative intervention in the two year period with on average two spinal levels being instrumented. 56% presented with stage 4 disease denoting neurological impairment at the time of assessment and 80% had emergent rather than timely surgery undertaken. The average Tokuhashi score for the cohort was 9.5 and the average Tomita score was 4.8 with only 10% having a narrative prognostication offered by the home oncologist who knew the patient. Frankel scores were mapped from pre to post operatively with 82% having scores of D and E post operatively. 28% of patients had recognised post operative complications with average survival of 12 months and an average hospital stay of 19 days. **Conclusion:** This data offers an insight into practice at a large regional referral centre for spine pathology in the UK. It suggests that the majority of cases are presenting emergently with established neurology with concomitant impact on outcomes, complications and the healthcare economy.

ID: AGS26/384

P1068: Describing a study searching for the individualized best outcome for patients with metastatic spinal disease

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Introduction: Recent work has focused on the concept of a "textbook outcome" for patients with metastatic spinal disease by understanding key influencing factors such as physiology and frailty, prognosis, pathophysiology and risk of neurological impairment as well as the core underpinning belief that surgery is in fact a gold standard treatment for such disease. We will describe a study which has commenced to explore the patient's own concept of what is a "best" outcome. Extensive research has offered insights into the potential myriad factors that affect patient decision making and experience around such major intervention such as expectations, distress, understanding, thresholds of acceptability and uncertainty. **Material and Methods:** We are undertaking a feasibility study to start to delineate the concept of a "best outcome". We aim to recruit 15 patients with metastatic spinal disease who are referred for consideration of surgical or radiological intervention. Inclusion Criteria: adults over the age of 18, metastatic malignancy of any cellular origin, performance status conducive to engagement e.g. greater than or equal to 40% AKPS at referral, able to speak English fluently (can be a non-primary language). Patients enrolled would be interviewed pre and post any intervention (surgery, IR) using a semi-structured interview format derived from the published concepts to explore the individual's expectations, priorities and values and thresholds of acceptability. Patients will be stratified based on their spinal metastatic staging (I-IV) and the influence of key demographic categories on their decision making will be explicitly explored including the impact of socio-economic factors, health state and place in treatment pathway (e.g. how many lines of treatment remain open to them). **Results:** We would share our study protocol and early thematic analysis of findings which would ensure they covered the patient's perspective on the key metrics being explored in the AO KF Tumour Frailty Working Group discrete choice work i.e. complications post intervention and any potential to systemic anticancer treatment, ambulatory status and functional status. **Conclusion:** We hope to be able to demonstrate some early understanding growing out of this work around the essential element of personalisation in spinal tumour surgery when thinking about outcomes.

ID: AGS26/385

P1069: A description of available integrated networks of managing pain from metastatic bone disease in the United Kingdom

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Introduction: We would estimate based on rising prevalence of cancer in the UK predicted to reach 3.5million in 2025, the number of patients living with bone metastases will reach epidemic proportions. While management pathways of the much rarer primary bone tumours are well established there has not until now there has not been a unified pathway for the review of secondary bone tumour patients in the UK to ensure equitable and appropriate management. We have previously presented the setup of a novel collaborative multi-specialty service to assess and treat all patients with symptomatic metastatic bone disease in Oxford, England. However, there are not equivalent services in other parts of Great Britain. **Material and Methods:** Using established networks in the Palliative Care training programme within England, Scotland and Wales a questionnaire was disseminated to clinicians working in pain and symptom management to ask them to share their local and regional networks for management of symptomatic metastatic bone disease. This questionnaire was disseminated via email with a first and subsequent reminders, and was hosted online using Microsoft Forms software. The questionnaire asked respondents to describe their links with key relevant specialist colleagues including spinal surgery, orthopaedic surgery, neurosurgery, interventional pain and anaesthetics, clinical oncology and psychological medicine. The questionnaire also looked to establish whether these relationships were formalised in meetings or referral pathways or informal. **Results:** The results highlight the highly variable nature of such complex networks for management of symptomatic metastatic bone disease around Great Britain with some areas having highly developed and well integrated collaborative fora, and others having limited or no access to key specialities. Over 90% of respondents had a formal or informal relationship with Interventional pain services in contrast to 62% having no relationship at all with a Neurosurgical service. A recuring theme across all relationships with specialist services was an absence of clear inclusion and exclusion criteria for referrals or established referral pathway. Equally, it was evident that even within the same region providers had significant differences in the services they had relationships with. **Conclusion:** These results suggest that management of metastatic bone disease is likely to be highly variable around England, Scotland and Wales due to networks of differing maturity, formality and integration. Exemplar services can serve to encourage development of such more enhance offers more broadly.

ID: AGS26/387
P1071: The role of the expert patient tutor in teaching medical students about metastatic bone disease

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Introduction: Medical school education is largely provided by a mixture of academics and healthcare professionals offering a wealth of knowledge and experience but a fixed perspective on the healthcare environment. A wealth of literature has demonstrated the value of offering a breadth of perspective in these educational landscapes and there is a well-established body of evidence around the positive impact of patients acting as expert patient tutors. Experiences of patients with metastatic bone disease are poorly described in the literature from an individualised and holistic perspective meaning this is likely to be lost from most educational curricular. **Material and Methods:** We will describe the recruitment of patients with metastatic bone disease to act in the role of expert patients tutors to final year medical students at the University of Oxford undertaking a special study module in Palliative Medicine. **Results:** We would look to report on the students' experience of their interaction with the expert patient tutors and perceived impact on their understanding of the disease and potential impact on future practice. **Conclusion:** We would hope to describe this attempt to enhance medical education around the topic of metastatic bone disease

via the use of expert patient tutors, with a particular focus on the impact on the whole person of this challenging disease. We would hope to demonstrate impact on medical student understanding and potentially on future practice.

ID: AGS26/561
P1072: Spinal surgery in multiple myeloma patients: results of 10 years of experience at a tertiary center

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Introduction and Objectives: Multiple myeloma (MM) is the most common primary spinal malignancy, causing lytic lesions that may result in severe pain, pathological fractures, neurological deficits, or secondary spinal deformity. We present our 10-year experience in surgical management of MM-related vertebral fractures. **Materials and Methods:** We performed a retrospective analysis of all surgical procedures for MM-related pathological fractures at our unit between January 2015 and September 2024. A total of 127 interventions were included: 12 vertebral biopsies (9%), 17 open arthrodesis ± decompression procedures (13%), and 98 percutaneous vertebral cement augmentation (VCA) procedures: 89 vertebroplasties and 9 kyphoplasties. **Results:** The cohort was 53% male, mean age 66 years (range 48-87). Most operated fractures were located at the thoracolumbar junction (36%), followed by thoracic (31%), lumbar (26.7%), cervical (5%), and sacral (0.7%) regions. Nine patients (7%) presented with initial neurological deficits (2 ASIA A, 1 ASIA C, 5 ASIA D, 1 radicular lesion). All underwent decompression and arthrodesis, resulting in improved ambulation. RVC procedures provided pain relief in 98% of cases, and arthrodesis in 88%. Postoperative complications occurred in 17% of arthrodesis patients and 12% of VCA patients. Complications are summarized in Table 1. **Conclusions:** Management of MM-related vertebral fractures requires a multidisciplinary approach involving hematology and radiation oncology. Percutaneous vertebral cement augmentation is the most frequently performed surgical technique and is highly effective for pain control. In cases of mechanical instability or neurological deficit, open decompression and arthrodesis may be required, with higher complication rates than in non-MM patients, but with significant neurological and quality-of-life benefits.

Table 1. Postoperative Complications

Procedure	Complications	Rate
Open arthrodesis ± decompression	3/17 (17%)	
• Screw pull-out	1/17 (5.8%)	
• Superficial wound infection	1/17 (5.8%)	
• Adjacent vertebral fracture	1/17 (5.8%)	
Percutaneous cement augmentation	12/98 (12%)	
• Epidural hematoma	2/98 (2%)	
• Adjacent vertebral fracture	10/98 (10%)	

ID: AGS26/614
P1073: Posterior-only vs. combined anterior-posterior reconstruction for thoracolumbar spinal metastasis: a propensity-matched comparative cohort analysis

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Introduction: As the life expectancy of cancer patients continues to rise, the need for durable spinal reconstruction in metastatic disease is increasing. In particular, reliable anterior column support following posterior corpectomy is gaining relevance. However, it remains unclear whether combining anterior and posterior instrumentation improves short-term outcomes compared to a posterior-only approach. This study compared one-year outcomes of posterior-only versus combined anterior-posterior spinal stabilization in patients undergoing surgery for spinal metastases. **Material and Methods:** We conducted a retrospective, comparative cohort study using the TriNetX US Collaborative Network. Adult patients undergoing spinal stabilization for thoracolumbar metastases were identified. Cervical procedures were excluded. Cohort 1 included patients who underwent posterior-only stabilization after exclusion of all anterior procedure codes and cage implantations. Cohort 2 included patients who received combined anterior-posterior instrumentation. 1:1 propensity score matching was performed for age, sex, race, body mass index (BMI), and smoking status (ICD-10: Z87.891). Primary outcomes were one-year mortality, revision surgery, and hospital readmission. **Results:** A total of 4,593 patients were included in the matched analysis (posterior-only: 2,903; anterior-posterior: 1,690). Mortality did not

differ significantly between groups (posterior-only: 30.1% vs. anterior-posterior: 27.9%; OR 1.11; 95% CI, 0.97-1.27; p = 0.1179). Revision surgery occurred significantly more often in the anterior-posterior group (9.8% vs. 3.9%; OR 0.371; 95% CI, 0.289-0.475; p < 0.0001). Readmission rates were also significantly higher in the anterior-posterior group (63.9% vs. 60.1%; OR 0.851; 95% CI, 0.752-0.963; p = 0.0108). **Conclusion:** In patients undergoing surgical treatment for spinal metastases, posterior-only stabilization was associated with lower revision and readmission rates at one year without an increase in mortality. Given the increasing survival of oncology patients and the growing demand for stable anterior column reconstruction, these findings support the consideration of less invasive posterior-only strategies in selected cases. Further studies are warranted to guide surgical decision-making in this complex population.

ID: AGS26/643
P1074: Biportal endoscopic resection of thoracic schwannoma: surgical technique and strategies to overcome key challenges

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Biportal endoscopic spine surgery (BESS) has been increasingly adopted for various spinal pathologies; however, its application for intradural extramedullary tumors (IDEMs) remains technically challenging. Key difficulties include maintaining optimal irrigation pressure, ensuring safe tumor dissection, achieving hemostasis, and preventing cerebrospinal fluid (CSF) leakage. This study describes the surgical technique and perioperative strategies for BESS resection of thoracic IDEMs through the case of a 59-year-old female presenting with progressive lower limb weakness, gait disturbances, and sphincter dysfunction. MRI revealed a T10-T11 intradural extramedullary schwannoma causing severe spinal cord compression. The tumor was resected using the BESS technique under intraoperative neuromonitoring (IONM), with a focus on optimizing the surgical field, minimizing dural manipulation, and securing watertight closure. Total tumor resection was achieved, with an operative time of 150 minutes and an estimated blood loss of 180 mL. Postoperatively, the patient showed significant neurological improvement, including partial recovery of motor function and bladder control. MRI on postoperative day 5 confirmed complete tumor removal without spinal cord injury or CSF leakage. At the two-month follow-up, she continued to improve, demonstrating better lower limb strength and resolution of preoperative sensory disturbances. This case highlights the feasibility of BESS for thoracic IDEMs, suggesting its potential as a minimally invasive alternative in selected cases. Optimizing endoscopic visualization, refining microsurgical techniques, and developing specialized instrumentation are crucial for improving outcomes. Further studies are necessary to validate the long-term efficacy and safety of this approach.

Key words: biportal endoscopic spine surgery, intradural extramedullary tumors, schwannoma, surgical technique.

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P1075: Analysis of different molecular subtypes of female breast cancer with spine metastasis

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Introduction: As for prognosis predictive markers for breast cancer, different molecular subtypes might indicate different survival outcomes. However, in most circumstances in Taiwan, there was no different treatment strategies according to the different molecular subtypes of female breast cancer with spine metastases. In our study, we aim to analyze the outcomes of different molecular subtypes for breast cancer with spine metastases and to elucidate the effect of different histologic and molecular subgroups. **Material and Methods:** We prospectively registered patients who received surgical treatment in National Taiwan University Hospital between January 2008 and December 2024, and reviewed the pathology reports. The overall survival stratified by molecular subtypes of either primary breast cancer or metastatic spine tumor was calculated. We also studied patient demographics, synchronous tumors, brain or visceral metastasis, and treatments. The performance of established models (revised Tokuhashi score and SINS score) was tested. **Results:** A total of 142 patients surgically treated for breast cancer spine metastases were identified (100% female sex). 14 (10%) patients had different molecular subtypes between breast and spine specimen, and all of them had a trend of malignancy change in spine metastasis. In origin breast molecular subtype, patients with triple-negative molecular subtype had the worst outcomes (log-rank test p = 0.0004); while in spine metastasis molecular subtype, both triple-negative and HER2 enriched subtype implied a lower survival rate (log-rank test p = 0.0119). We also found out that comparing with visceral metastasis, patients with brain metastasis seemed to be related to a worse outcome. **Conclusion:** Spine metastases risk tools might be more predictive after accounting for molecular subtypes and brain metastasis in patients with breast cancer.

ID: AGS26/700
P1076: Uncommon presentation of tenosynovial giant cell tumor at the C1-C2 foramen: case report and minimally invasive resection

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Introduction: Tenosynovial giant cell tumors (TGCT) are benign proliferative lesions of synovial tissue, most frequently located in large appendicular joints. Their occurrence in the cervical spine, particularly at the C1-C2 level, is extremely rare. Clinical and radiological overlap with more common lesions, such as schwannomas, often complicates preoperative diagnosis. **Material and Methods:** A 72-year-old male presented with a 6-month history of right-sided cervical pain radiating to the occipital region, following the C2 distribution. Neurological examination was otherwise unremarkable. Past history included two lumbar discectomies, with no regular medication. Cervical MRI revealed a well-circumscribed right C1-C2 foraminal lesion, both extradural and extraforaminal, measuring 15 × 27 × 16 mm, with mass effect on the foramen. Imaging features suggested a right C2 schwannoma. The patient underwent minimally invasive posterior paravertebral tubular approach. Dissection of the right C2 lamina and inferior border of the right C1 lamina allowed piecemeal removal of a fibrous tumor, closely related to the lateral dura and vertebral artery. Gross total resection was achieved. At one-month follow-up, the patient was pain-free and neurologically intact. Histopathological analysis, despite cautery artifacts, was consistent with tenosynovial giant cell tumor, with no signs of malignancy. **Results:** TGCT in the cervical spine is exceptionally rare and can mimic more common tumors on imaging. In this case, the lesion was initially suspected to be a schwannoma. Minimally invasive tubular access allowed safe and complete resection, despite proximity to the vertebral artery. Pathology confirmed TGCT, an entity only rarely described in the skull base and cervical spine. Awareness of this rare diagnosis is important, as complete resection is associated with excellent outcomes, while incomplete excision may predispose to recurrence. **Conclusion:** Tenosynovial giant cell tumors are rare in the cervical spine and may mimic nerve sheath tumors radiologically. Minimally invasive tubular approaches can achieve safe and complete resection with favorable clinical outcomes. TGCT should be considered in the differential diagnosis of cervical foraminal lesions.

ID: AGS26/716
P1077: Human versus machine in survival prediction for metastatic spinal cord compression: a retrospective cohort study

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Background: Accurate survival prediction in metastatic spinal cord compression (MSCC) is critical for guiding treatment decisions, yet remains challenging, particularly for intermediate survival durations. We compared the accuracy of oncologist judgment, surgeon-calculated Tokuhashi scores, and ChatGPT-assisted predictions in estimating survival outcomes in MSCC patients. **Methods:** This retrospective study included 99 consecutive patients referred to a tertiary spinal oncology center with radiologically confirmed MSCC. Anonymized clinical data were used to calculate surgeon Tokuhashi scores, document oncologist-estimated life expectancy, and generate ChatGPT-assisted survival predictions based on both literature review and Tokuhashi calculation. Predictions were compared against actual survival outcomes (< 6 months, 6-12 months, > 12 months). Machine learning analyses identified key predictors of survival. **Results:** Overall prediction accuracies were 54% for ChatGPT Tokuhashi-based predictions, 50% for surgeon Tokuhashi scores, 48% for oncologist judgment, and 37% for ChatGPT literature-based estimates. Recall for short survival (< 6 months) was highest with surgeon (71%) and ChatGPT Tokuhashi (69%) methods, whereas intermediate survival (6-12 months) remained difficult to predict across all modalities. Functional status (Karnofsky score) and patient age emerged as the strongest survival predictors across logistic regression, random forest, decision tree, and XGBoost models, surpassing primary tumor type and metastasis burden. **Conclusions:** Structured prognostic tools and AI-assisted scoring can complement clinical judgment in predicting short-term

survival in MSCC. However, intermediate-term survival prediction remains a critical unmet need. Future prognostic strategies should prioritize dynamic functional metrics over static tumor classifications to improve personalized decision-making.

ID: AGS26/720
P1078: Development and validation of the NOVA Score for surgical triage in metastatic spinal cord compression

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Study Design: Retrospective diagnostic model development and validation study. **Objectives:** To develop and validate the NOVA Score, a pragmatic, surgeon-oriented tool for predicting 12-month survival in patients with metastatic spinal cord compression (MSCC), and to compare its performance to established prognostic scores and oncologist estimates. **Methods:** Two independent cohorts of patients with MSCC referred for surgical consideration were included from a tertiary spine center: a derivation cohort (n = 184) and a validation cohort (n = 100). Feature selection was performed using random forest analysis, multivariable logistic regression, and permutation-based variable importance. The final NOVA Score incorporated three clinical parameters: Karnofsky Performance Status (KPS), primary tumor category, and presence of extraspinal metastases. The score ranges from 0-10, with a threshold of ≥ 7 used to predict > 12-month survival. Predictive performance was assessed using accuracy, F1-score, area under the receiver operating characteristic curve (AUC), Cohen's kappa, and calibration plots. **Results:** In the validation cohort, the NOVA Score achieved an accuracy of 71.0%, AUC of 0.693, F1-score of 47.3% for > 12-month survival, and Cohen's kappa of 0.28. Calibration plots showed good agreement in the mid-to-high probability range. Compared to the Revised Tokuhashi Score, OSRI, Modified Bauer Score, and oncologist estimates, NOVA demonstrated superior sensitivity for identifying long-term survivors using only three readily available variables. **Conclusions:** The NOVA Score is a simple, reproducible tool for early prognostication in MSCC. Its minimal input requirements and balanced performance support its utility for surgical triage in multidisciplinary settings. Further external validation is warranted.

ID: AGS26/781
P1079: The use of a lyoplant spacer to maintain a safe zone in separation surgery for spinal metastases: case series and technical note

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Introduction: Separation surgery is a neo-adjuvant surgical treatment to facilitate safe delivery of ablative radiotherapy dose especially for radioresistant spinal metastases. Effective stereotactic radiation therapy (SBRT) requires a safe zone of 2-3 mm to achieve sufficient coverage of the tumor without increasing the risk of radiation-induced spinal cord toxicity. This safe zone can be maintained by placing a lyoplant as a spacer to separate the tumor area and dura after closure, a technique performed at our institution since 2018. We describe a case series and technical note of our institutional experience with a lyoplant spacer for spinal metastases separation surgery and report (preliminary) clinical outcomes. **Material and Methods:** Consecutive spinal metastases patients that underwent separation surgery with (off-label use of) a lyoplant spacer between June 2018 and March 2024 were included. Patients underwent SBRT after separation surgery. After separation of tumor from the dura was completed, a lyoplant patch was cut to twice the size of the defect and folded and placed on the dura. The wound was closed normally in layers. Complication rates, lyoplant positioning on post-operative MRI imaging, and local recurrence rates were evaluated. **Results:** Fifteen patients treated with separation surgery placing a lyoplant were included (median age 66 years, 74% male). At baseline, the majority of patients had no (n = 13) or minor (n = 2) neurological deficits, which resolved for all patients following surgery. No perioperative or postoperative complications were reported related to lyoplant. Postoperative MRI imaging confirmed good positioning of lyoplant, and adequate space between tumor site and spinal cord was

maintained for all patients. In the postoperative period, one patient experienced screw loosening, which required a re-operation. SBRT was given to fourteen patients, for which one complication of local edema was reported. Fourteen patients reported no local recurrence during the follow-up period (median 18 months, range: 3-66 months). Local recurrence was observed for one patient after five years. **Conclusion:** Treatment with lyoplant spacer for separation surgery is suggested to be safe and feasible and has potential benefits that allows for high dosage delivery of postoperative radiation therapy by functioning as a protective barrier between the excised tumor area and the spinal cord. Further evaluation with a larger patient population is required to validate its long-

ID: AGS26/819
P1080: Analysis of the results of surgical treatment of patients with intradural extramedullary tumors using minimally invasive and open methods of treatment

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Introduction: Traditionally, the main approach to such tumors is laminectomy. In the surgical treatment of extramedullary neoplasms, minimally invasive approaches have recently begun to be actively used. These techniques have emerged as alternative surgical interventions to reduce complications. A minimally invasive approach for removing a spinal cord tumor means the use of retractors, which can reduce the length of the skin incision and reduce muscle trauma, and hemilaminectomy (which avoids complete resection of the vertebral arches and parts of the facet joints on both sides). **Material and Methods:** We studied 196 patients who were treated at the Federal State Institution National Medical Research Center for Neurosurgery with intradural extramedullary tumors. **Results:** Improving the outcomes of surgical treatment of patients with intradural extramedullary tumors of the spinal cord. **Conclusion:** Minimally invasive approaches are performed using small skin incisions (3-5 cm), using tube retractors, minimal damage to soft tissues, minimal precision bone resection, wide visualization of the subdural space due to lateral durotomy and an oblique angle of attack, the ability to visualize the ventral surface of the spinal canal without traction of the spinal cord and an overall small volume of surgical intervention, which is associated with minimizing early postoperative complications and faster recovery of patients.

ID: AGS26/902
P1081: Utility of the lateral base dural tacking method in cord tumor surgery performed using unilateral hemilaminectomy: a comparison of dural window widths

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Objective: Unilateral hemilaminectomy, which is used to remove spinal cord tumors, is simpler than laminoplastic laminotomy and affords certain biomechanical advantages. However, both incomplete tumor removal and inadvertent infliction of spinal cord damage attributable to the narrow surgical corridor remain of concern. When a spinal cord tumor is to be removed, it is important to ensure that the dural window along the surgical corridor is of adequate width. This study aimed to determine that the utility of lateral base dural tacking (LBT) method when cord tumor surgery is performed using a unilateral hemilaminectomy-a comparison of dural window widths with a traditional dural tack-up and a suspending-out (DSO) method with the aid of digital image-analysis software. **Methods:** Twenty-one consecutive patients who had intradural-extramedullary spinal cord tumors removed using a unilateral hemilaminectomy were included in the study and analyzed retrospectively. We acquired DSO and LBT dural window images using surgical microscopes under identical conditions in consecutive order and then removed the tumors using the LBT method. We used digital image-analysis software to analyze the images quantitatively. The pixel numbers of LBT and DSO window were compared using a paired t test. **Results:** Twenty-one tumorous lesions were successfully removed without any major problems using a unilateral hemilaminectomy through LBT windows. The mean pixel numbers of the LBT and DSO windows were 126,787 ±

41,938 and 85,940 ± 21,638. The LBT windows were 46% larger than the DSO windows ($p < 0.001$). **Conclusions:** We objectively proved that the utility of the LBT method for widening the surgical corridor created during hemilaminectomy.

ID: AGS26/905
P1082: Cauda equina neuroendocrine tumour complicated by intra-tumoural hemorrhage in a young male: a case report and literature review

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Introduction: Cauda equina neuroendocrine tumors (CE-NET) are a rare group of intradural extramedullary (IDEM) tumours and are hard to differentiate from other forms of IDEM tumors such as schwanommas and ependymomas on imaging. While literature surrounding CE-NET and others IDEM tumors continues to grow, evidence on complications such as intra-tumoral hemorrhage remains rare, with few cases reported in the literature. We present a rare care of intra-tumoral hemorrhage in a CE-NET causing impending conus medullaris syndrome. **Material and Methods:** The patient, a 35-year-old Caucasian male with no significant past medical history presented with a 1-day duration of atraumatic severe lower back pain with radicular symptoms in the L1 dermatome, precipitated by weightlifting. This was complicated by acute retention of urine, although digital rectal exam revealed an intact anal tone and neurological exam was unremarkable. Magnetic resonance imaging (MRI) detected an intradural extramedullary mass lesion adjacent to the conus medullaris at the T12-L1 level with heterogenous enhancement, suggestive of intra-tumoral hemorrhage. The exact tumor type was unknown. Consequently, the patient underwent T12/L1 laminectomy and excision of lesion. A literature review was conducted for similar cases of intra-tumoral hemorrhage in IDEM tumors. **Results:** Histopathological examination of the tumour showed sheets of round, mononuclear cells in vascularized stroma with well-differentiated features. Keratin positivity and non-specific staining supported the diagnosis of neuroendocrine tumour (NET) over paraganglioma. Post-operatively, neuromonitoring demonstrated significantly improved somato-sensory evoked potential (SSEP) from L3-S1, which was found to be diminished pre-operatively. The patient's lower back pain demonstrated considerable improvement and the patient's pain was well-controlled with oral analgesia by post-operative day 4. Neurological exam was unremarkable, although patient demonstrated mild left scrotal neuropathic pain, possibly secondary to dissection of the nerve root. The patient was discharged by post-operative day 5. Our literature review found that schwanomma remains the most common tumour histology presenting with intra-tumoural hemorrhage (63%), followed by PGLs (16%) and ependymomas (11%). Clinically, majority of cases present with bilateral lower limb weakness and some cases may present with delayed onset of severe pain due to the indolent nature of the tumour. In terms of management, majority of studies in the literature have demonstrated good outcomes including short length of hospital stay and complete resolution of symptoms. The recurrence rate after gross total resection of CE-NETs remains low even with aggressive tumour characteristics at the start, ranging from 0-7%. **Conclusion:** Intra-tumoural hemorrhage in a CE-NET tumour is rare, yet can cause debilitating symptoms. Hence, it should be strongly considered in a patient suspected to have IDEM and presenting with acute severe lower back pain. Radiographic evaluation is insufficient to identify the exact tumour type for IDEM tumours, although some features of intra-tumoural hemorrhage can be identified. Histology is often required for the definitive diagnosis of CE-NET. Surgical resection remains the gold standard management for IDEM tumours with quick resolution of symptoms and low recurrence rate.

ID: AGS26/910
P1083: Clinical presentation, diagnostic challenges, and surgical outcomes of spinal paragangliomas: a 15-year institutional experience

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Introduction: Spinal paragangliomas are rare neuroendocrine tumors, most commonly arising in the cauda equina and filum terminale region, representing 3-4% of spinal lesions. Despite their benign histology, they present with nonspecific symptoms and radiological overlap with other spinal tumors, making preoperative diagnosis challenging. This study aimed to present a consecutive series of patients with surgically treated spinal paragangliomas, describing their clinical presentation, diagnostic features, treatment strategies, and

outcomes. **Material and Methods:** We retrospectively reviewed all patients who underwent surgery for spinal paragangliomas at our institution between January 2010 and July 2025. Demographic, clinical, radiological, histopathological, and surgical data were extracted from medical records. Outcomes were assessed using recurrence rates and McCormick grades. Gross total resection (GTR) was attempted in all cases. Statistical analysis was descriptive and performed using R. **Results:** Nine patients (mean age 52.3, 55.6% < 6 months symptom duration) were included. The most common symptom was low back pain (77.8%), followed by leg pain/numbness (22.2%) and gait difficulty (11.1%). Neurological signs were absent in 77.8% of patients, while motor deficits occurred in 22.2%. MRI revealed lumbar involvement in 77.8%, sacral in 11.1%, and cervical/thoracic in 11.1%. Most tumors were intradural extramedullary (88.9%) and ≤ 20 mm in size (55.6%). Histopathology confirmed paraganglioma with universal chromogranin positivity, synaptophysin positivity in 88.9%, S100 positivity in 88.9%, and Ki-67 ≤ 8% in 88.9%. Surgical approaches included hemilaminectomy (44.4%), total laminectomy (44.4%), and hemilaminectomy for cervical/thoracic lesions (11.1%). GTR was achieved in all cases without perioperative complications, and nerve root/filum preservation was universal. Time from diagnosis to surgery was ≤ 1 month in 55.6%. Hospital stay was 3-4 days in 77.8% of patients. Radiologically, all tumors were T1 isointense, with T2 hyperintensity in 77.8%. Contrast enhancement was observed in all, with cystic components in 33.3% and hemorrhagic features in 11.1%. Over a median follow-up ranging from ≤ 6 months to > 5 years, no recurrences were observed. Functionally, 88.9% achieved McCormick grade I, while one patient remained grade V due to severe deficits. **Conclusion:** Spinal paragangliomas, although rare, should be considered in the differential diagnosis of intradural extramedullary spinal tumors, particularly in the lumbar and sacral regions. MRI features are suggestive but not definitive, necessitating histopathological confirmation. Surgical management with GTR is safe, feasible, and provides excellent outcomes with no recurrences observed during follow-up. Early recognition and complete excision are key to optimizing long-term prognosis.

ID: AGS26/934
P1084: Surgical treatment results of chordoma (3-23 yrs follow up)

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Introduction: Chordoma is a rare type of cancer that is seen in the skull base and spine. It is diagnosed 1 in million people every year. It is a slow-growing but locally aggressive tumor. Even after surgery recurrence rates are high (40-60%). Because of Complicated location of the tumor, needs extensive experience. **Material and Methods:** Between 2000-2023 we operated 21 chordoma case. 4 were female and 17 were male. Age distribution were 10-72 yrs. 2 were at the C1-2 location whereas 3 were at the mobil spine. The rest were at the sacrum. Longest follow up was 20 yrs. **Results:** Within 21 patients 2 patient died early postoperative period while 6 were died 3 yrs postop-8 yrs postop. All patients had local recurrences 2yrs to 5yrs. time. Most common complication infection and management of surgical wound and instrument failure. **Conclusion:** Since chordoma is resistant to chemotherapy and radiotherapy, the main treatment is surgical removal of the tumor within the safe zone. Local recurrence is 100% within 10 yrs postoperatively. Then years overall survival is around 40-50%.

ID: AGS26/954
P1085: Utility of carbon fiber-reinforced polyetheretherketone implants in spinal oncology: a single-center experience on safety, clinical feasibility, and postoperative care

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Introduction: Carbon fiber-reinforced polyetheretherketone (CFRP) implants are gaining attention in spinal oncology due to their radiolucency, which enhances postoperative imaging and facilitates precise radiotherapy planning. Despite these theoretical benefits, real-world data on their clinical integration and impact on postoperative management remain limited. This observational study aimed to evaluate the practical use of CFRP spinal implants in patients with primary and metastatic spinal tumors. The goal was to assess their clinical feasibility, safety, and contribution to imaging-based follow-up and adjuvant therapy planning. **Material and Methods:** A retrospective chart review was conducted on patients treated with CFRP instrumentation for spinal tumors at a tertiary care center between 2022 and 2025. Collected data included patient demographics, surgical details, postoperative outcomes, and use of adjuvant therapies. **Results:** Forty-five patients were included, with 19 diagnosed with primary spinal tumors and the remainder with metastatic tumors. The patient cohort included 21 males (46.7%) and 24 females (53.3%), with a mean age of 58.9 ± 15.4 years. The median Spine Instability Neoplastic Score at the spinal index level was 9 (interquartile range [IQR]: 4.5-12). All patients underwent decompression with instrumentation, and cage placement was performed in 17 patients (37.8%). The median span of instrumentation

covered five levels (IQR: 3-7). Fully CFRP constructs were used in 17 patients (37.8%), while hybrid constructs were implemented in the remaining 28 patients (62.2%). The mean clinical follow-up was 14.6 ± 13.9 months. At final follow-up, neurological function improved or remained stable in 42 patients (93.3%) compared to their preoperative baseline. The most frequently observed postoperative complications included cerebrospinal fluid leakage and deep vein thrombosis, each occurring in 4 patients (8.9%). Three patients received revision surgeries because of complications, including distal junctional failure, proximal junctional failure, and tumor recurrence, all diagnosed and planned based on MRI findings. Regarding CFRP instrument-related complications, one patient (2.2%) showed screw haloing. No complications involving CFRP rods, plates, or cages were observed. No intraoperative hardware failures or delayed implant-related complications necessitating revision occurred. Postoperative MRI was obtained in 43 patients (95.6%). In 19 cases (44.2%), imaging was triggered by the onset or worsening of symptoms. MRI was used for immediate postoperative assessment in 37 patients (86%), such as evaluating decompression adequacy. Long-term follow-up MRI was conducted in 15 patients (34.9%), while only six patients (13.9%) had MRI specifically for planning and evaluating adjuvant therapy effects. Fifteen patients (33.3%) received adjuvant radiotherapy. MRI was used for treatment planning in 6 cases (40%), while 9 (60%) relied solely on CT. Two patients (4.4%) experienced local recurrence, both of which were detected on MRI, with a median time to recurrence of 9.5 months. **Conclusion:** CFRP spinal implants provide a safe and efficacious alternative to traditional titanium instruments, offering additional advantages in imaging and radiotherapy planning. Nonetheless, inconsistent adjuvant care practices limit the full realization of these benefits. Standardized protocols and studies involving larger cohorts with extended follow-up are needed to validate their long-term value.

ID: AGS26/975
P1086: Survivorship after surgical treatment of metastatic spinal disease including cord compression causing instability or neurological deficit at a single regional centre.

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Introduction: Metastatic spinal cord compression is a serious sequela of malignancy that can lead to neurological deficits and significant impairment in quality of life, with surgery being an integral part of its treatment. Survivorship after surgery can be varied depending on the type of cancer and extent of metastatic disease. **Objective**: Review the survivorship outcomes of patients undergoing surgery for metastatic spinal disease including cord compression. **Material and Methods:** Retrospective case analysis of prospective data collected for 123 patients treated surgically for metastatic spinal disease including cord compression at a UK regional centre between June 2018-June 2024. Analysis of case records of patients from online clinical case notes and PACS imaging systems. All patients underwent surgical treatment, and defined outcome is survival duration after surgical treatment. **Results:** Our study showed a mean survival duration of 2.032 years. **Conclusion:** A mean survival of 2.032 years highlights progress in survivability, likely attributed to advancements in patient selection, perioperative management, refined prognostic models, and improved multidisciplinary care.

ID: AGS26/984
P1087: Non-syndromic osteochondroma of lumbar spine: a systematic review of management and outcomes

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Introduction: Osteochondromas are the most common benign bone tumors, but rarely arise in the lumbar spine. Due to their infrequency, understanding of their clinical presentation, management, and outcomes is limited, with most available data derived from case reports and small series. This systematic review aims to synthesize the literature on non-syndromic lumbar spine osteochondromas and to present an illustrative institutional case. **Material and Methods:** A systematic search was conducted in PubMed, Embase, Web of Science, and Scopus from database inception to April 2024, following PRISMA 2020 guidelines. Studies reporting clinical cases or series of non-syndromic lumbar spine osteochondromas with sufficient details on presentation, tumor characteristics, management, and outcomes were included. The risk of bias was evaluated using the Joanna Briggs Institute (JBI) tools for case reports and case series. Data extraction encompassed demographics, clinical characteristics, tumor

features, operative management, and postoperative outcomes. **Results:** A total of 39 studies encompassing 56 patients were included. The mean age was 42 years; 59% were male. Most lesions originated from the inferior articular process (43%) and commonly affected L4 and L5. The mean lesion size was 29.7 ± 22.2 mm, with significantly smaller lesions in patients with radiculopathy than those with low back pain or palpable mass ($p = 0.00034$). Radiculopathy (50%) and low back pain (25%) were the most frequent presentations ($p < 0.001$). The majority (80%) underwent posterior surgical excision without instrumentation, with en-bloc resection performed in 78.5%. Complete symptomatic improvement was observed in 94% of patients, and recurrence was rare. **Conclusion:** Lumbar spine osteochondromas most frequently arise from the inferior articular process and often produce radiculopathy due to intracanalicular growth. Surgical excision-especially en-bloc resection-yields excellent outcomes and a low recurrence rate. Conservative treatment may be considered in selected asymptomatic patients. Early recognition and individualized management are essential for optimal outcomes.

ID: AGS26/990
P1088: Patient outcomes and survivorship after surgical treatment of metastatic spinal disease including cord compression presenting with instability or neurological deficit at regional centre

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Introduction: Metastatic spinal compression is a significant disease process that can be life threatening. While survival after surgery is dependent on type of cancer and extent of metastates. There is no consensus on life expectancy after surgery. Surgery remains crucial for symptom control and improved quality of life. Review patient reported outcome measures (EQ5D/VAS) and survivorship after surgery for metastatic spinal disease including cord compression. **Material and Methods:** Retrospective case analysis of prospective data collected for 49 patients treated surgically for metastatic spinal disease including cord compression at a UK regional centre by a single surgeon between June 2018-June 2024. Analysis of online clinical case notes, PACS imaging, and the British Spine Registry. All patients underwent surgery. Primary outcome: survival duration post-surgery; secondary outcome: quality of life (EQ5D/VAS). Data on surgical type, cancer demographics, and complications were recorded. **Results:** Our study showed mean survival after surgery of 2.6y. Patients had a SINS score range of 8-17. 33 out of the 49 patients completed EQ5D/VAS questionnaire. Average pre- and post-op index scores were 0.13 and 0.52 respectively. Average pre- and post-op VAS scores were 45.2 and 67.2 respectively. **Conclusion:** Improved EQ5D/VAS scores and a mean survival of 2.6 years highlight ongoing better care standards and the role of surgery as an adjunct in enhancing quality of life for these patients.

ID: AGS26/1067
P1089: What is the incidence of symptomatic thromboembolism post-surgical treatment of spinal metastases in an Asian cohort of patients

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Introduction: It is estimated that over 10% of cancer patients develop symptomatic spinal metastasis, and with advances in oncological and surgical treatment, more patients are being treated surgically for spinal metastases. The presence of cancer, spinal surgery and loss of mobility are all considered to be risk factors for thromboembolism. The risk of symptomatic thromboembolism (deep venous thrombosis/pulmonary embolism) has not been defined and hence we aim to identify the percentage of patients who develop symptomatic thromboembolism as well as the risk factors for this. **Material and Methods:** This is a retrospective cohort study of patients treated between 2005 to 2024 at the National University Spine Institute Singapore. Inclusion criteria included patients surgically treated for symptomatic spinal metastases, excluding

patients treated with only kyphoplasty/vertebroplasty. Patient clinical, demographic, neurological and oncological data were collected. The primary outcome measured was symptomatic thromboembolism, defined as symptomatic pulmonary embolism (PE) or symptomatic deep venous thromboembolism (DVT) diagnosed within 90 days of surgical treatment. This was diagnosed on CT- pulmonary angiogram and duplex ultrasound. No pre- or post-operative chemoprophylaxis was prescribed. Univariate and Multivariate analysis was performed. **Results:** In total, 503 patients were included in this study of whom 20 (4%) were diagnosed with symptomatic thromboembolism. Of these patients 16 (3.2%) were female and 4 (0.8%) were male. On univariate analysis, days of SHD/ICU stay, length of stay, female sex, presence of medical complication and higher Bilsky Grade (1C to 3) was associated with significantly higher rates of symptomatic thromboembolism. On multivariate analysis female sex ($p = 0.013$) and higher Bilsky Grade (1C to 3) ($p = 0.003$) was significantly associated with symptomatic thromboembolism. The incidence of post-operative hematoma requiring surgical treatment was 9 (1.8%) of patients. There were no cases of mortality secondary to thromboembolism. **Conclusion:** The incidence of symptomatic thromboembolism in patients post spinal tumor surgery is reported to be between 11-20%, however in our cohort the incidence was 4%. This was despite the absence of a consistent chemoprophylaxis protocol in our Centre. This might be due to the perceived lower incidence of symptomatic thromboembolism in Asian patients when compared to western populations. However, this paper highlights the need to identify patients at increased risk and provide appropriate chemoprophylaxis. These include patients of female sex and with higher grade cord compression Bilsky 1C to 3.

ID: AGS26/1102

P1090: Pre-operative angioembolisation is not associated with reduced intra-operative blood loss in surgically treated metastatic epidural spinal cord compression (MESCC)

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Introduction: Metastatic spine tumor surgery (MSTS) for Metastatic Epidural Spinal Cord Compression (MESCC) can be associated with significant blood loss. Increased blood loss is associated with increased morbidity and mortality. Angioembolization is increasingly employed to reduce perioperative blood loss, however its role is controversial in non-hypervascular tumors. In this study, we aim to investigate the predictive factors of increased blood loss in patients undergoing MSTS for MESCC. **Material and Methods:** This is a retrospective cohort study of 424 patients treated at the National University Spine Institute, Singapore, between 2005 and 2024. Demographic and oncological data were collected and operative data, including Operative Time, Surgical Approach (Posterior, Anterior, Anterior and Posterior (Combined)), Number of Levels Decompressed and Instrumented, Surgical type (Open vs Minimally Invasive Surgery (MIS) vs Hybrid), and Surgical Invasiveness (Decompression vs Separation Surgery vs Corpectomy/ en-bloc excision). Tumors were further classified into Hypervascular (Renal/Thyroid/Liver/Gallbladder) and non-hypervascular tumours. Univariate and multivariate analysis was performed to identify predictive factors for increased blood loss. **Results:** 424 patients were identified, 208 (49.1%) were male and 216 (50.9%) were female. Mean total blood loss was 775mLs, total blood loss ranged from 250-6400 mLs, mean transfusion was 295 mLs, mean transfusion ranged from 0-3500 mLs. 49 (11.6%) patients had hypervascular tumors and 86 (20.3%) patients underwent pre-operative embolization. 309 (74.1%) underwent Open procedures, 91 (21.8%) MIS procedures and 17 (4.1%) underwent Hybrid procedures. The Posterior approach was the most common with 375 patients (89.7%), followed by Anterior approach with 12 patients (2.9%) and the Anterior and Posterior (Combined) approaches with 28 patients (6.7%). On multivariate analysis, the number of levels instrumented ($p = 0.047$), female sex ($p = 0.021$), hypervascular tumor histology ($p \leq 0.01$), open surgical approach ($p \leq 0.01$) and combined surgical approach ($p = 0.019$) was found to be associated with significantly higher intra-operative blood loss. On further subgroup analysis, preoperative angioembolization was not associated with significantly higher intra-operative blood loss. **Conclusion:** Preventing excessive perioperative blood loss can reduce surgical morbidity and mortality. Intra-operative measures such as Minimally Invasive Surgical approaches, avoiding excessive levels of instrumentation and Anterior and Posterior (Combined) approaches where possible are surgical measures that can prevent blood loss. Identifying patients at risk of increased blood loss and adopting a multidisciplinary approach to reducing blood loss in these patients may also play a role. The role of angioembolization is controversial in non-hypervascular tumors, while current literature suggests that it has a role in hypervascular tumours, it did not significantly reduce blood loss in our cohort.

ID: AGS26/1106
P1091: Psychological impact of spine sarcoma on wellbeing

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Introduction: Spinal sarcomas are rare but highly aggressive tumours that often require extensive and complex treatment, including surgery, chemotherapy, and/or radiation. Despite such intensive care, recurrence is common, and treatment frequently results in long-term physical and neurological impairment. The psychological burden of spinal sarcoma is significant, yet remains under-researched, with mental health outcomes often overlooked in favour of physical ones. Preliminary data from AO Spine indicate that patients treated for spinal sarcoma report psychological wellbeing comparable to those with other life-altering illnesses like AIDS or ischemic heart disease. This study sought to address the current gap by exploring the mental health impact of spinal sarcoma and identifying support needs to improve overall patient wellbeing. **Material and Methods:** We conducted qualitative, semi-structured interviews with 16 patients who received diagnosis and treatment for spine sarcoma. **Results:** Following treatment, patients reported difficulties in accessing specialised rehabilitation and pain management. Many report that their GPs and physiotherapists lack the necessary training and sarcoma-related expertise to provide adequate support. Barriers to psychological care were frequently reported and social isolation was common. As a result, patients with spine sarcoma reported experiencing reduced quality of life, along with high levels of anxiety and depression. Their family members may also experience significant stress as they navigate the complexities of sarcoma diagnosis and treatment. The life-changing nature of diagnosis/treatment can leave spouses and family members unexpectedly taking on caregiving responsibilities, managing significant financial pressures, and struggling to talk about spine sarcoma with their children. **Conclusion:** These challenges highlight the need for targeted guidance for patients with spine sarcoma and their families. The findings also highlight the need for improved post-treatment care that addresses the multi-faceted impact that spine sarcoma can have on patient wellbeing. Finally, the findings illustrate the need for upskilling clinical care teams who provide support to patients to reduce barriers to diagnosis, increase knowledge around sarcoma and improve access to holistic care.

ID: AGS26/1124
P1092: Spino-pelvic reconstruction combined with vascularised fibular graft in the treatment of Ewing sarcoma involving the iliac wing

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Introduction: In malignant pelvic tumors, a limb-sparing procedure is a more favorable treatment for the patient than hemipelvectomy, but it challenges the surgeon. These cases present two patients with spinopelvic fixation after tumor resection and reconstruction with vascularised fibular graft (VFG). **Patients and Methods: Case-1:** A 15-year-old male patient applied to the orthopedics outpatient clinic for about two months with low back pain on the left side. He had muscle weakness in the lower extremities, more prominently on the left. A massive mass in the iliac wing was detected and the biopsy revealed the diagnosis of Ewing sarcoma. **Case-2:** A 16-year-old female patient with pain in the right pelvic region has been admitted to the outpatient clinic. Imaging studies have revealed lytic lesions in the right iliac wing. The biopsy has been performed and the diagnosis of Ewing sarcoma has been made. Following the neo-adjuvant chemotherapy, iliac wing resection and sacropelvic fixation were planned for both patients. **Results:** After total resection of the iliac wing, the sacrum and the acetabulum were fixed with two spinal pedicle screws. The reduction was achieved with 2 rods, and bone-to-bone (sacrum-acetabulum) contact was established with a VFG. The patients did not develop any complications in the clinical follow-ups, mobilized with partial weight in the 1st month and full weight in the 3rd month. **Conclusion:** In

pediatric patients, biological reconstruction such as spino-pelvic fixations combined with VFG should be considered for limb-salvage and may prevent secondary deformities after resection of the massive bone.

ID: AGS26/1131
P1093: Intramedullary spinal cord tumors: the do's and the don'ts

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Objectives: Describe the current data and our experience of surgical treatment of IMSCT's. **Background:** Intramedullary spinal cord tumors (IMSCTs) are rare, predominantly benign tumors accounting for 20-30% of all spinal cord tumors. Intramedullary tumors can lead to severe neurological deficit in the form of motor and sensory disorders, decrease and loss of conductive function, which leads to a significant decrease in quality of life or even death. Although these tumors are quite thoroughly studied, surgical treatment of these patients remains a difficult, even arduous task. We describe our experience and what tips and tricks we found for ourselves after more than 1000 cases of intramedullary spinal cord tumors treated over the course of 25 years. **Methods:** Authors report the current recommended treatment options available from literature and their experience and know-how on surgical treatment of every tumor type based on experience of more than 1000 cases. Various uncommon tumour presentations and surgical nuances are extensively described. **Results:** Presentation contains our data on surgical treatment of more than 1000 cases of intramedullary spinal cord tumors, our tips and tricks for treating patients with various tumor types and a short analysis of our patients series. **Conclusions:** Surgery for IMSCT continues to be challenging due to the rarity of this disease, the high functional relevance of the spinal cord, and the consequent risk of inducing severe neurological deficits. Taking into account modern surgical Methods, wide knowledge and treatment experience in most cases complete or maximally safe tumor resection can be achieved. Despite advancements in neurosurgical techniques and assistive devices, IMSCT resection still carries a considerable risk for neurological deterioration, reaching as high as 90% in the immediate postoperative period. We report our tips and tricks for treating patients with various tumor types and a short analysis of our patients series.

ID: AGS26/1132
P1094: Cavernous malformations of the spinal cord - Surgical treatment and nuances

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Objectives: To analyse our experience of surgical treatment of cavernous malformations of the spinal cord and describe the indications and techniques of surgical treatment. **Background:** Vascular tumors of spinal cord are a rare pathology, which is most often comprised of hemangioblastomas and cavernomas of different localization. These vascular tumors arise sporadically, however hemangioblastomas may be associated with the von Hippel-Lindau disease. The spectrum of clinical manifestations of these pathologies is quiet wide - from asymptomatic carriage to severe neurological deficit that lead to permanent disability or death of the patient. **Methods:** From 2002 to 2020 at Burdenko Neurosurgery Institute 70 patients with cavernous malformations at different spinal levels were operated. Preoperative assessment consisted of MRI data and thorough neurological examination. Patient status was assessed on before and after surgical treatment and analyzed. **Results:** Complete microsurgical removal of cavernous malformations of the spinal cord is the only treatment method that prevents recurrent hemorrhages. Indications for surgery are based on the clinical course of the disease and the patient's condition at the time of examination. In the presence of persistent neurological symptoms, surgery was performed even if their severity was insignificant (2 or more on the McCormick scale). In case of obvious hemorrhage and international macrohematoma, surgery is performed 2-3 weeks after the hemorrhage. With complete regression of symptoms (1 on the McCormick scale), surgery was not indicated and observation is recommended. **Conclusions:** Surgery of vascular tumors of the spinal cord is a sophisticated and multicomponent task that requires a search for the correct approach to treat the patient, a decision made on the need for

embolization of vascular tumor, as well as microsurgical treatment when needed.

ID: AGS26/1290
P1095: Intradural extramedullary tumors in the cervical spine: why "benign" does not always mean simple

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Cervical intradural extramedullary (IDEM) tumors, including schwannomas and meningiomas, are typically benign. However, their management is often complex due to the narrow cervical canal, proximity to critical neurovascular structures, and risk of postoperative instability. **Materials and Methods:** We retrospectively reviewed 12 patients with cervical IDEM tumors operated over 3 years. Clinical presentation, imaging, surgical approach, complications, and outcomes were analyzed. **Results:** The series included 7 schwannomas and 5 meningiomas. Gross total resection was achieved in 11 patients (91.6%). Surgical challenges arose mainly from ventral/ventrolateral tumor locations (n = 4) and foraminal extension (n = 3). Intraoperative neuromonitoring helped minimize neurological morbidity. Postoperative complications included cerebrospinal fluid leakage (n = 2) and transient neurological worsening (n = 1). No mortality occurred. At a mean follow-up of 18 months, 10 patients had excellent recovery, while 2 had mild residual deficits. One patient developed cervical kyphosis requiring secondary stabilization. **Conclusion:** Although histologically benign, cervical IDEM tumors can present significant surgical challenges. Tumor location, dural involvement, and spinal stability must guide resection strategy. Careful preoperative planning, microsurgical technique, and neuromonitoring are essential to optimize outcomes. This study illustrates that "benign" does not always equate to "simple" in spinal oncology.

ID: AGS26/1292
P1096: Safety of denosumab use in giant cell tumor of the axial skeleton: a systematic review

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Introduction: Despite numerous studies evaluating the use of denosumab in the management of giant cell tumor of bone (GCT), particularly in challenging anatomical locations such as the spine and sacrum, its long-term safety profile remains inadequately defined. While denosumab has demonstrated promising efficacy in reducing tumor size and facilitating surgical resection, concerns persist regarding potential adverse effects, recurrence rates, and optimal treatment duration-especially in cases where surgical options are limited or not feasible. The aim of the study was to analyze the available literature data focusing on the reported adverse events related to the administration of denosumab for the management of GCT localized in the axial skeleton. **Material and Methods:** Following PRISMA guidelines for systematic reviews, MEDLINE, EMBASE, Web of Science, the Cochrane Database of Systematic Reviews were queried for papers that reported on the efficacy and/or safety of the use of denosumab in spinal, sacral or pelvic GCT. Cohort studies and case reports were included in the study if 1) subjects had histologically confirmed GCT, 2) patient(s) got at least one dose of denosumab, 3) follow-up was longer than 12 months. Papers reporting on the safety information were ultimately analyzed, with an emphasis on clinically significant AEs that may be associated with denosumab use. **Results:** A total of 46 papers met the inclusion criteria (13 cohort studies and 33 case reports involving fewer than five subjects), of which 13 did not report any safety data. The final 33 papers reported data on 366 patients, with a mean age of 29.1 years and a female/male ratio of 1.8. 193 patients (52.7%) in the studied population underwent surgical therapy. Two-thirds of the patients (N = 249, 68%) had GCT in the sacro-pelvic region, while the rest had mobile spine localization of the tumor. Clinically significant denosumab related AEs were reported in 30 patients (8.2%). Most common AE was osteonecrosis of the jaw (13 pts, 3.6%). AEs related to calcium metabolism occurred in 8 cases (2.2%). 6 patients were diagnosed with the malignant transformation of the tumor (1.6%). 2 cases developed pathological fracture and one patient was diagnosed with an apical tooth granuloma. **Conclusion:** The available evidence indicates that clinically significant adverse events are not uncommon with denosumab treatment for axial skeleton GCT; however, the literature shows inconsistency in reporting its long-term safety profile. Malignant transformation/tumor formation rate is not to be neglected either. Based on our findings, daily Ca and Vitamin D supplementation, frequent dental check-ups and close radiological follow-up (MRI) are recommended. There is an urgent need for large, prospective cohort studies to gain a clearer understanding of the relationship between dosage, treatment duration and the safety and efficacy of denosumab in spinal GCT.

ID: AGS26/1382
P1098: Solitary spinal langerhans cell histiocytosis presenting with vertebra plana in a child: a case report and literature review

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Introduction: Langerhans cell histiocytosis (LCH) is a rare pediatric disorder characterized by the clonal proliferation of Langerhans cells, with a male predominance (2.5:1). It may present as a multisystemic disease (Letterer-Siwe), with bone and endocrine involvement (Hand-Schüller-Christian), or as isolated bone lesions (eosinophilic granuloma). Spinal involvement commonly manifests as vertebra plana, typically diagnosed through computed tomography (CT) and magnetic resonance imaging (MRI). **Case Presentation:** We describe a case of a 9-year-old male presenting with localized thoracic pain. Imaging revealed a lytic lesion affecting over 40% of the T5 vertebral body, consistent with vertebra plana. Histological confirmation of LCH was achieved via biopsy and immunohistochemistry (CD1a and CD207 positivity). Given the absence of neurological deficits or instability, the patient was managed conservatively with spinal orthosis and systemic chemotherapy (Vinblastine and Prednisone) per standard protocols. Clinical and radiological follow-up demonstrated resolution without recurrence. **Conclusion:** LCH should be considered in pediatric patients with lytic spinal lesions. In the absence of neurological compromise or instability, conservative management can yield excellent outcomes. Early recognition and a multidisciplinary approach are key to a favorable prognosis.

ID: AGS26/1418
P1099: A paradigm shift in age? Multiple myeloma with orthopedic manifestations in young patients

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Introduction: Multiple myeloma is a hematologic malignancy characterized by the clonal proliferation of plasma cells in the bone marrow, with a median age at diagnosis of approximately 68 years. However, an increasing number of cases in younger patients has been observed, raising the need to reconsider this disease as a possible common diagnosis in this age group. Up next, we describe a series of multiple myeloma cases in young patients with spinal involvement and discuss clinical implications for orthopedic and onco-hematologic practice. **Material and Methods:** We present four clinical cases diagnosed at a referral center: three men and one woman, all presenting with persistent axial pain and associated red flags. The diagnostic work-up included imaging studies (PET-CT, MRI, CT), hematologic evaluation, bone marrow biopsy, and genetic profiling (FISH). **Results:** All four patients showed multifocal lytic lesions involving the spine, in some cases neurological symptomas were associated. Secretory variants of multiple myeloma (IgA λ, IgG κ) were confirmed, with bone marrow infiltration ranging from 60-90%. Cytogenetic profiles revealed high-risk abnormalities, including 17p deletion, both (4;14) and (14;16) translocations. Despite being outside the typical age range, all patients met SLIM-CRAB criteria for active multiple myeloma. **Conclusion:** This case series highlights that multiple myeloma may present with severe orthopedic manifestations in patients younger than traditionally expected. Early recognition of clinical signs with prompt diagnostic evaluation is crucial to avoid delays in treatment. Our findings support the need to broaden clinical suspicion of multiple myeloma regardless of age, as epidemiological trends suggest an increasing diagnosis among younger adults.

ID: AGS26/1536
P1100: When difficulty arises in diagnosis of spinal tumour (telangiectatic osteosarcoma)

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Introduction: Telangiectatic osteosarcoma (TOS) of the spine is rare accounting only 0.086% of all primary osteosarcomas. In Bangladesh there is no case report of TOS. We found various difficulties in the way of diagnosis of spinal SOL in a 25 year old young man in Bangladesh. In the first two steps of diagnosis like FNAC and post-operative histopathology reveals ABC (Aneurysmal Bone Cyst). But from recurrent lesions, incisional biopsy reveals a case of TOS (Telangiectatic Osteosarcoma). We aim to present such a rare case like TOS and make awareness about its diagnostic difficulties. **Materials and Method:** It is an observational study. The study was conducted in Department of

Orthopedics and Spine Surgery in **Ad-din Women's Medical College & Hospital** during the period of **August, 2014** to **August, 2019**. We did X-RAY, MRI of lumber spine & CT angiogram & biochemical tests. MRI reveals aneurysmal bone cyst (ABC). Then we operated the patient & tissue histology report was in favour of ABC. After 6 month of surgery patient came back with recurrence of symptoms. Repeated X-ray was done revealing radiological feature like sunburst appearance. Tissue biopsy was done again report reveals osteosarcoma (Telangiectatic osteosarcoma of spine). Then the patient was treated by oncologist and got the treatment like chemotherapy & radiotherapy. Patient survived for 5 years. **Result:** Though we passed through the roads of diagnostic difficulties, at last we reached the correct diagnosis through which patient got the available treatment. **Conclusion:** The dilemmas associated with the diagnosis of TOS has been emphasized in literature. In particular as ABC is almost indistinguishable from TOS on radiograph. Hence the correct diagnosis rest on a careful histological examination.

ID: AGS26/1581
P1101: Thoracoscope-assisted WBB type 3B total en bloc excision of posterior pancoast tumor with spine invasion

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Introduction: A Pancoast tumor is an apical lung carcinoma that invades the chest wall, affecting structures such as the brachial plexus, vertebral bodies, and sympathetic ganglia. Posteriorly located Pancoast tumors pose a significant surgical challenge due to their intimate relationship with the vertebral column, spinal cord, and critical neurovascular structures. This case report details the successful en bloc surgical management of a posterior Pancoast tumor, which involved the T2 spine, highlighting the technical considerations and favorable oncologic outcomes. **Case Presentation:** We present a 48-year-old male with a history of smoking, who was referred with a persistent right chest wall pain and unilateral anhidrosis. Imaging studies, including CT, MRI and PET-CT, revealed a mass at the right lung apex with invasion into the T2 vertebral bodies and the T2-T3 nerve roots. A CT-guided biopsy confirmed invasive carcinoma with focal squamous differentiation. The patient underwent neoadjuvant chemoradiation, which resulted in a partial response. Following a multidisciplinary tumor board discussion, the patient was deemed a candidate for curative resection. A two-stage, en bloc resection of the tumor, a portion of the right upper lung lobe, right 2^{nd}, 3^{rd} rib and the T2 vertebral bodies with subsequent spinal reconstruction was performed. In the first stage, thoracoscope was used for portion of the right upper lung lobe excision, esophagus dissection and feeding artery ligation. Then, the patient was put into prone position for removal of the specimen and further reconstruction. **Discussion:** En bloc spondylectomy for tumors involving the spine is a complex procedure associated with high morbidity. However, for a select group of patients, it offers the only chance for a curative resection with clear margins. The use of the thoracoscopy can provide good visual acuity and relative flexible angle during the operation. The successful outcome in this case underscores the importance of a comprehensive preoperative evaluation, multidisciplinary planning, and a meticulous surgical technique to achieve complete resection and minimize complications. **Conclusion:** En bloc spondylectomy combined with thoracoscopy can be a safe and effective treatment strategy for posterior Pancoast tumors with vertebral invasion. This approach provides excellent local control and durable survival in carefully selected patients. This case demonstrates that with appropriate surgical expertise, a curative resection is possible for these challenging tumors.

ID: AGS26/1597
P1102: Grisel syndrome in adult patient

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Introduction: Grisel's syndrome is an infectious process of the soft tissues that affects bony and ligamentous elements, producing atraumatic instability of C1-C2. There is very little literature on cases in adults. **Material and Methods:** We present a 64-year-old male patient with a personal history of dilated cardiomyopathy, atrial fibrillation, and cervical spondyloarthropathy. He attends the spine surgery clinic due to headache and neck pain following a box falling on his head. After imaging studies, the condition is labeled as post-traumatic pain, and analgesic treatment and follow-up are prescribed. Two weeks after the trauma, he requires admission to the internal medicine department due to a 4-day history of cough with secretions he is unable to expectorate, odynophagia, and a "nasal" voice progressively worsening, with chills and fever sensation the night before admission. Cervical MRI identifies collections in the retropharyngeal space, inversion of the physiological cervical lordosis, and anterior listhesis of C4 over C5. Medical treatment with antibiotics and analgesics is indicated along with outpatient monitoring. After 6 weeks, due to clinical persistence with neurological worsening (muscle strength right upper limb 4/5, left upper limb 2/4, right lower limb 3/4, left lower limb 2/5; sensory 2/2), admission is arranged to complete the study. Repeat MRI shows increased epidural soft tissue with enhancement within the spinal canal at C1, C2, and C3 levels, poor definition of the joint spaces between lateral masses of C1 and C2, new

findings compared to the previous study. **Results:** Given the clinical severity and imaging findings, surgical intervention is decided. Diagnosis: acute spinal cord compression at C1-C2, suspected septic arthritis; acute on chronic spinal cord compression at C4-C5 with listhesis. Via a posterior midline cervical approach (pus is drained intraoperatively from lateral C1-C2 joints and approximately at C4-C5 level). Under fluoroscopic and neurophysiological control, screws are placed in the lateral masses of C1, pars of C2, lateral masses of C3, C4, C5, C6, and pedicles of T1-all bilaterally. A small occipital plate with five screws is placed. Central decompressive laminectomy is performed from C1 to C6. Granulation-like tissue causing circumferential compression between C1 and C2 is identified and removed; samples are sent for pathology and microbiology. Bilateral rods are then shaped and fixed. The procedure is performed with neurophysiological monitoring without intraoperative complications. The patient shows good postoperative evolution. Due to isolation of MRSA in 4/4 intraoperative cultures from 11/06 and 2/2 blood cultures taken during febrile peak, treatment with daptomycin is maintained and later switched to linezolid. After 4 weeks of hospitalization, the patient is transferred to a rehabilitation center with the following exam: **Neurological exam:** Free of rigidity or pain in all four limbs; normal tone. **Muscle strength upper limbs:** Right upper limb: C5 4/5, C6 4+/5, C7 4-/5, C8 4+/5, T1 4/5; Left upper limb: C5 3+/5, C6 4/5, C7 3+/5, C8 3+/5, T1 4/5. **Muscle strength lower limbs:** Right lower limb: L2 4+/5, L3 4+/5, L4 4+/5, L5 4+/5, S1 5/5; Left lower limb: L2 4/5, L3 4/5, L4 5/5, L5 4+/5, S1 3/5. Light touch sensation: bilateral hypoesthesia at C6-C7-C8, bilateral hypoesthesia from T10 to T12 and in the L5 territory. Trunk control is maintained in long sitting and short standing (with supervision) without assistive devices. Transfers from chair to standing and from supine to sitting are performed autonomously or with minimal assistance from one person. The patient walks with a walker inside the room. **Conclusion:** Although more typical in children as a complication of an otorhinolaryngological infection presenting as torticollis, treatment is usually conservative. The most frequently found pathogen is *Staphylococcus aureus*. In our case, the pre-existing degenerative pathology and direct trauma masked the clinical picture and caused the appearance of a spinal cord cuff requiring decompressive surgical treatment for resolution.

ID: AGS26/1695
P1103: Craniovertebral intradural meningiomas: analysis of surgical results (retrospective two-center study)

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Introduction: Craniovertebral region (CVR) meningiomas account for 0.3-3.2% of all meningiomas. The purpose of this research is to retrospectively analyze the results of surgical treatment of CVR meningiomas with justification of the choice of approach depending on the localization of the tumor matrix. **Material and Methods:** 36 patients with CVR meningiomas operated on in the period 2009-2022 years were included in this research. The overall functional status was assessed using the Karnofsky scale. The Frankel scale was used to assess motor conductors. The neurological status was assessed in detail by the function of the cranial nerves (PCMIS - Petroclival Impairment Scale). All patients underwent MRI before surgery, which verified the tumor matrix in the sagittal and axial planes, and calculated the tumor volume. Neurophysiological monitoring was performed intraoperatively: the function of the cranial nerves (CN) was monitored. The radicality of tumor removal was assessed using the D. Simpson scale. Control MRI, CT studies, assessment of the neurological and functional status were performed 2 weeks (upon discharge from the hospital) and 1 year after surgery. D. Paley's classification was used to analyze postoperative complications. **Results:** In the group of 36 patients, there were 6 men and 30 women. The average age was 45 (29-72) years. Initial dysfunction of the caudal CN was noted in 22.2% of patients. When assessing the functional status, the average score on the Karnofsky scale before the operation was 65.52 (± 6.41) points. In the postoperative period, an improvement in the functional status was noted to 71.71 (± 14.16) points at discharge, after 1 year, recovery to 86.9 (± 5.61) points. Before the

operation, conduction disorders were noted in the form of hemiparesis in 10 (27.8%) and tetraparesis in 4 (11.1%) patients. When assessing after 1 year, hemiparesis persisted in 2 (6%) and tetraparesis in 1 (3%) patient. Two weeks after the operation (at discharge), a decrease in the function of the cranial nerves was noted in 20 (55.6%) patients. One year after the operation, mild dysfunction of the caudal group of the cranial nerves persisted in 9 (25%) patients, moderate dysfunction - in 1 (2.8%) patient. According to the localization of the tumor matrix in the sagittal plane, the patients were divided into 3 groups: the lower third of the clivus - 15 (41.7%), the foramen magnum level - 18 (50%), the C1-C2 level - 3 (8.3%). According to the localization of the tumor matrix in the axial plane, two groups were distinguished: anterior (anterolateral) - 27 (75%), posterior (posterolateral) - 9 (25%). The rate of tumor resection (according to the Simpson scale) grade II was achieved in 25 patients (70%), grade III - in 8 (22%), grade IV - in 3 (8%). **Conclusion:** When the tumor matrix is localized at the level of the lower third of the clivus, the average volume of tumor tissue is the largest and the incidence of complications is higher compared to the location of the matrix at the level of the foramen magnum and C1-C2. For the anterior and anterolateral location of the tumor matrix, the posterolateral approach is optimal, and for the posterior and posterolateral localization of the matrix - the median suboccipital approach is optimal.

ID: AGS26/1787
P1104: Clinical profile and short-term outcomes of patients with spine tumors in a tertiary referral centre in Tanzania

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Introduction: Spine tumors, both primary and metastatic, contribute significantly to neurological disability and reduced quality of life. Their management is complex worldwide but is particularly challenging in low- and middle-income countries (LMICs), where patients often present late and access to advanced imaging, histopathology, and specialized surgical care is limited. Data from sub-Saharan Africa remain scarce, yet are essential to inform context-specific strategies for optimizing care and improving outcomes. **Objective:** To describe the clinical-demographic characteristics, clinical presentation, tumor profile, management, and short-term outcomes of patients with spine tumors managed at a tertiary referral center in Tanzania. **Materials and Methods:** We conducted a retrospective review of patients surgically treated for spine tumors at Muhimbili Orthopaedic Institute, Dar es Salaam, between March 2024 and August 2025. Data collected included demographic details, clinical presentation, imaging and referral patterns, tumor location, surgical management, histopathological findings, and short-term outcomes. Descriptive statistics were used for analysis. **Results:** A total of 51 patients were included, of whom 26 (51%) were male. Health insurance coverage was present in 68.6% of patients. The most common presenting symptoms were back pain (43.1%) and limb weakness (43.1%), with a median symptom duration of 4.5 months before presenting to the referral centre. Only 39.2% of patients had imaging and a definitive diagnosis established at the referring facility, reflecting gaps in peripheral diagnostic capacity. Tumor location was extradural in 47.1%, intradural-extramedullary in 31.4%, and intramedullary in 21.6% of cases, with the most common level involved being the thoracic spine. Metastatic lesions accounted for 15.7% of tumors. Histological confirmation was limited by poor follow-up; however, meningiomas (33.3%) were the most frequently reported pathology among those with results. The median length of hospital stay was 5 days. At discharge, 42 patients (82.3%) had unchanged neurological status compared to admission, 6 patients (11.8%) showed improvement, and 3 patients (5.9%) had deterioration. **Conclusion:** Patients with spine tumors in Tanzania typically present late, leading to delayed diagnosis and treatment. Diagnostic limitations in peripheral hospitals and weak referral systems exacerbate this challenge. Strengthening referral pathways, expanding access to advanced imaging, and ensuring timely histopathological follow-up are critical to improving outcomes. Further prospective studies are needed to evaluate the long-term impact of early referral and multidisciplinary care models on survival and functional recovery in LMIC settings.
Keywords: Spine tumors, referral systems, low-and middle-income countries, Tanzania

ID: AGS26/1880
P1105: Intramedullary spinal sarcoidosis presenting as a tumor mimic: diagnostic lessons from a surgical case

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Introduction: Intramedullary spinal sarcoidosis is an exceptionally rare presentation of a systemic granulomatous disease and can closely resemble primary intramedullary tumors on imaging. Misinterpretation may lead to unnecessary aggressive resections. We report a surgically managed case

and highlight key diagnostic lessons relevant to spinal oncology practice. **Materials and Methods:** A 36-year-old male with progressive cervical myelopathy was evaluated. MRI demonstrated an enhancing intramedullary lesion, initially suspected to be neoplastic. To obtain a definitive diagnosis, limited surgical decompression with biopsy was performed. Histopathology revealed non-caseating granulomas consistent with sarcoidosis. A focused literature appraisal was performed to contextualize diagnostic and therapeutic strategies in similar surgically managed cases. **Results:** Surgery allowed safe tissue sampling without neurological deterioration. The patient recovered well under postoperative corticosteroid therapy, achieving meaningful functional improvement. In the published literature, only a small number of intramedullary sarcoidosis cases have been confirmed histologically following surgical intervention. Most were managed with biopsy or limited decompression, rather than gross total resection, reflecting the infiltrative and ill-defined nature of these lesions. Clinical outcomes were generally favorable when surgery was combined with immunosuppressive therapy, although recurrence and long-term neurological sequelae remain documented. **Conclusion:** Intramedullary spinal sarcoidosis should remain an essential differential diagnosis in patients with intramedullary lesions, even in the absence of systemic manifestations. Early biopsy is pivotal for diagnostic accuracy and prevents unnecessary tumor resections. Recognition of this rare entity in the surgical decision-making process may improve long-term outcomes and optimize management strategies in spinal oncology.

ID: AGS26/1902
P1106: Complete resection fo osteoid osteoma in the cervical spine by totally endoscopic approach

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Introduction: Our team report a case of a 19 years old woman suffering from neck pain for the last 3 years (VAS 8, ODI 22), causing severe activities limitations, using pain killers 2 to 3 times a day, with CT and MRI showing an sclerosing lesion on the left lateral mass of the C5 vertebra. After failure of conservative surgery, it was proposed a surgical resection of the lesion, using endoscopic surgery, instead of traditional open surgery, which would have to resect the facet joint, and spine ligaments, resulting into instability of the spine, and thus an arthrodesis would had to be performed. **Material and Methods:** The patient was operated under general surgery, on prone position, with soft pads guarding the face and eyes, and intraoperative neurophysiological monitoring. A 7 mm skin incision was made 1 cm from midline on the left, above the left lateral mass of C5, using intraoperative radioscopy. The 30° uniportal spine endoscope was positioned, and cortical bone of the lateral mass was drilled, until a purplish-white lesion was identified and resected from the spine in a single piece. Thermal ablation was performed into the tumor site, and the skin was closed with simple suture. The procedure took less than 90 minutes. **Results:** The patient had a full recovery, and was discharged 12h after the surgery with a soft foam neck brace. She returned for examination after 14 days with resolution of the neck pain, and now after more than 1 year of follow-up she is pain free (VAS 0, ODI 0), with no neck limitations regarding to range of movement and activities. Pathological report confirmed it to be an osteoid osteoma. **Conclusion:** Full endoscopic spine surgery has been successfully used to treat several spine diseases, and its use for oncological purposes, specially related to bone tissue, might be of great advantages, regarding minimally invasiveness, spine stability maintenance, shorter surgery time, shorter hospital stay e faster recovery.

ID: AGS26/1978
P1107: Surgical management of intramedullary spinal cord metastases (ISCM): extent of resection outweighed by clinical and oncological factors

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Introduction: With the rarity and complexity of intramedullary spinal cord metastases (ISCM), evidence-based guidelines on surgical strategy are rare, especially concerning the ideal extent of resection (EOR). This study evaluates differences in clinical and surgical outcomes as well as short-term mortality among patients undergoing biopsy, subtotal, or gross total resection (GTR). **Material and Methods:** We retrospectively included 16 patients who underwent surgical treatment for histologically confirmed ISCM between 2015 and 2024. Stratified by EOR (biopsy, subtotal, or total resection), perioperative complications, neurological outcomes, and 90-day mortality were assessed. We also performed a literature review of ISCM surgical case series comprising ≥ 5 patients. **Results:** Sixteen patients were analyzed (median age 59 years; 56% male), with thoracic lesions representing the most common location (56%). Postoperative complications occurred in 19%, yet no permanent neurological impairment, intraoperative mortality, or transfusion requirements were observed. 90-day mortality was lowest among patients undergoing GTR (13%) vs. subtotal resection (60%) or biopsy alone (33%) ($p = 0.015$). Multivariate

analysis did not demonstrate an independent survival advantage of EOR (p = 0.834), indicating potential bias from patient selection. Across all groups, neurological function was either stable or improved. **Conclusion:** Surgical resection of ISCM is generally safe and can help symptom relief or stabilization. GTR was associated with lower early mortality rates. However oncological status and neurological deficits seemed more relevant prognostic factors. Hence, surgery should focus on clinical stability and be individualized according to the systemic disease burden and overall clinical status.

ID: AGS26/1985
P1108: Sacral metastasis from pulmonary adenocarcinoma mimicking a chordoma: a case report and literature review

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Introduction: Chordomas are rare tumors commonly arising in the sacrum, often posing diagnostic and therapeutic challenges. Rarely, metastatic lesions from primary pulmonary adenocarcinoma can mimic sacral chordomas both clinically and radiologically. We present a case of sacral metastasis from lung adenocarcinoma initially suspected to be a chordoma. We aim to describe a rare case of sacral metastasis from lung adenocarcinoma mimicking a primary chordoma and to highlight the importance of differential diagnosis in sacral masses. **Material and Methods:** A 58-year-old man presented with chronic sacral pain and constipation. Neurological examination was unremarkable. MRI revealed a 63x46 mm lobulated sacral mass suggestive of chordoma, infiltrating soft tissues and abutting the posterior rectal wall. CT scan confirmed a lytic sacrococcygeal lesion. **Results:** The patient underwent surgical resection. Intraoperatively, the tumor appeared friable, hemorrhagic, and right-sided with adjacent bone lysis. Gross total resection was achieved. Histopathological analysis revealed a necrotic, poorly differentiated carcinoma. Immunohistochemistry confirmed a metastatic adenocarcinoma consistent with a pulmonary origin. A thoracoabdominal CT scan identified a right lung mass, sacrococcygeal osteolytic metastases, liver nodules, and a right adrenal metastasis. **Conclusion:** This case emphasizes the importance of considering metastatic disease in the differential diagnosis of sacral tumors. Pulmonary adenocarcinoma, although rare, can present as a sacral mass mimicking chordoma. Multidisciplinary evaluation, including advanced imaging and histopathological assessment, is essential for accurate diagnosis and management.

ID: AGS26/2006
P1109: Intradural metastatic melanoma of the spine: staged surgical management and delayed neurological recovery

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Introduction: Intradural metastatic melanoma is one of the rarest presentations of spinal tumor dissemination, reported almost exclusively in isolated case reports. Overall, intradural spinal metastases account for only 0.8-3.9% of symptomatic spinal metastases, with intradural extramedullary disease estimated at ≤5% in radiologic series. Within this already rare group, melanoma represents an exceptionally uncommon etiology. These lesions are typically associated with rapid neurological decline, poor prognosis, and limited evidence regarding delayed recovery after surgical treatment. **Material and Methods:** A 56 year old female presented with severe cervical pain and rapidly progressive tetraparesis. A posterior cervicodorsal pigmented cutaneous lesion was identified, without prior melanoma diagnosis. Neurological evaluation revealed an incomplete cervical cord syndrome, classified as ASIA C. MRI demonstrated intradural extramedullary lesions at C6-C7 and T3 with critical cord compression. At admission, the primary tumor was unknown. Surgical decision-making was guided by SINS (14, unstable) and neurological status (ASIA C). A presumptive application of Tokuhashi (score 8) and Tomita (score 6), assuming a high-grade malignancy, supported an aggressive but palliative surgical strategy. These scores were later confirmed retrospectively after histopathology revealed high-grade metastatic melanoma. A staged surgical approach was performed, consisting first of posterior cervical decompression with instrumented fusion from C4-T5, durotomy, and intradural tumor resection at C6-C7 under continuous multimodal neurophysiological monitoring, followed by right anterolateral thoracotomy with T3 corpectomy and tumor excision. **Results:** Neurological stability was preserved intraoperatively. Histopathology confirmed high-grade metastatic melanoma with moderate proliferative activity Ki67 10%. The patient remained ASIA C preoperatively and immediately after surgery, but at three months follow up she demonstrated a remarkable delayed neurological recovery, improving to ASIA D. **Conclusion:** This case illustrates that

even in intradural melanoma metastasis an entity of extreme rarity and poor prognosis presumptive prognostic scoring (Tokuhashi, Tomita), combined with SINS and ASIA, can guide urgent surgical decisions prior to histological confirmation. Staged decompression with intradural tumor resection under neurophysiological monitoring and stabilization preserved spinal cord integrity and enabled meaningful delayed recovery. These findings emphasize that the absence of immediate postoperative improvement does not preclude significant neurological gains, reinforcing the importance of multidisciplinary strategies in spinal oncology.

ID: AGS26/2013
P1110: Photodynamic nail stabilization for pathologic sacral insufficiency fracture treatment and prevention after sacrectomy

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Introduction: Oncologic patients are at risk of sacral insufficiency fractures (SIF) secondary to pathologic lesions, osteoporosis, or surgical treatments such as partial sacrectomy. The photodynamic nail (PDN) is a MIS skeletal stabilization device with the potential to reduce morbidity and enhance MRI compatibility. The objective of this study was to assess the safety and efficacy of sacral PDN stabilization when used for the treatment or prevention of SIFs. **Material and Methods:** A retrospective chart review of patients who underwent PDN sacral fixation for treatment or prophylaxis of SIF was conducted. Primary outcome measures were fracture stability, fracture prevention, and device-related complications. Secondary outcomes were postoperative pain and ambulatory status. **Results:** Eight patients were identified (mean age of 57.3 years). Seven patients underwent trans-sacral trans-iliac fixation. There were no implant-related complications. The average time for follow-up was 6.6 months. Average pre- and post-operative visual analog pain scores were 8.4 and 1.4, respectively. Pre-operatively 2 patients were wheelchair dependent, 3 ambulated with walkers, and 3 with no assistive devices. Ambulatory status remained stable or improved in all cases. All fractures were stable at the most recent follow-up. No fractures developed in the 3 patients treated prophylactically after partial sacrectomy. **Conclusion:** Early clinical results suggest that PDN is a viable option for SIF treatment and prevention after partial sacrectomy. Pain improved after fracture stabilization and no fracture developed in the prophylactic stabilization group. Future studies with larger numbers and long-term outcomes are warranted. Furthermore, on-going investigations into the biomechanical behavior of PDNs placed into compromised sacral bone will be useful in developing patient specific treatment plans.

ID: AGS26/2059
P1111: Spinal tumors in unusual locations: learning from the unexpected

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Introduction: Spinal tumors usually occur in predictable locations. Rarely, they present in atypical sites, mimicking vascular, infectious, or malignant lesions, which complicates diagnosis and surgical planning. Reporting such cases improves clinical awareness and surgical strategies. **Materials and Methods:** We retrospectively reviewed three patients with spinal tumors in unusual locations, focusing on clinical presentation, imaging, surgical approach, and outcomes. **Results:**

• Case 1: A 27-year-old female with a cervical extradural schwannoma extending into the vertebral artery foramen, initially suspected as a vascular lesion. Complete excision was achieved using microsurgical dissection and intraoperative neuromonitoring.

• Case 2: A 40-year-old male with a thoracic intramedullary hemangioblastoma, presenting with rapid paraparesis and no von Hippel-Lindau disease. Surgical resection was performed with careful attention to spinal cord preservation.

• Case 3: A 19-year-old female with a lumbar extradural meningioma, a rare histologic variant. Total resection was achieved without compromising spinal stability. **Conclusion:** Spinal tumors in atypical locations pose diagnostic and surgical challenges. Awareness of unusual presentations, precise imaging interpretation, and adaptable microsurgical strategies are essential to optimize outcomes. Sharing these cases enhances diagnostic accuracy and guides surgical decision-making in complex spinal oncology scenarios.

ID: AGS26/2171
P1112: Sacropelvic hydatid disease presenting with cauda equina syndrome: a rare parasitic cause of neurological decline

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Introduction: Osseous hydatidosis is a rare manifestation of Echinococcus granulosus infection, accounting for less than 4% of all cases. The spine is the most frequently affected skeletal site, with sacropelvic involvement being extremely uncommon. In Chile, the national incidence in 2023 was 3.3 per 100,000, with the Araucanía Region -where this case originates- reporting 8.9 per 100,000 and the highest number of hospital discharges nationally. Sacral hydatidosis often presents insidiously, but can result in devastating neurological sequelae due to cauda equina compression. We report a complex case of sacropelvic hydatidosis with progressive neurological deterioration, highlighting key surgical and diagnostic considerations. **Material and Methods:** A 28-year-old woman from rural southern Chile (endemic zone) with a history of untreated hydatidosis presented with progressive low back pain, bilateral leg weakness, neurogenic bladder requiring intermittent catheterization, and fecal incontinence. Neurological examination revealed flaccid paraparesis, bilateral foot drop (M0 dorsiflexion), saddle anesthesia, and areflexia. Imaging showed prior lumbopelvic arthrodesis, but due to sacral symptoms, new MRI and CT scans were obtained. These revealed multiloculated cystic lesions eroding the sacrum and presacral space with compression of sacral nerve roots. **Results:** The imaging findings were consistent with invasive hydatid disease involving sacral segments S1-S3, extending bilaterally (WBB sectors 3-9, layers A-E). The case mimicked other destructive sacral lesions such as chordoma or tuberculous spondylitis. Due to the extent of involvement and prior fixation, resection was limited. Surgical management included prior laminectomy and spinopelvic fixation (S2AI screws). Intraoperatively, 20% hypertonic saline was used as a scolicidal agent for cavity irrigation, following WHO recommendations. Postoperative medical therapy with Albendazole (800 mg/day) was maintained. Despite residual neurologic findings such as foot drop and neurogenic bladder, the patient achieved functional ambulation using a cane and currently maintains an independent lifestyle while caring for her 4-year-old daughter. **Conclusion:** Sacropelvic hydatidosis, although rare, should be considered in endemic areas in patients with lumbosacral symptoms and atypical imaging findings. High clinical suspicion and early imaging are essential. The use of the WBB surgical classification adapted to the sacrum allows better planning of resections in these destructive cases. Management requires a multidisciplinary team approach. Surgery aims to decompress, stabilize, and reduce cyst burden, while antiparasitic therapy helps mitigate recurrence. This case illustrates that, even in the context of extensive bone and neural involvement, a well-planned surgical and medical strategy can preserve long-term function and quality of life.

ID: AGS26/2222
P113: Occipitocervical fixation for osteolytic metastasis of C2 secondary to lung carcinoma: case report and literature review

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Introduction: Metastatic involvement of the upper cervical spine is uncommon but poses significant surgical challenges due to the risk of craniocervical instability and neurological compromise. The axis (C2) is a rare metastatic site; however, osteolytic infiltration may lead to cervicobrachialgia, impending pathological fracture, and functional decline. Occipitocervical fixation has been reported as an effective strategy to achieve pain control, prevent instability, and improve quality of life, even in the palliative setting. **Material and Methods:** We report the case of a 56-year-old male, previously autonomous, diagnosed with pulmonary adenocarcinoma. The patient initially underwent left lower lobectomy with mediastinal lymphadenectomy through a video-assisted thoracoscopic (VATS) approach. During follow-up, an osteolytic metastatic lesion of C2 was identified, associated with cervicobrachialgia and a high risk of instability. A posterior occipitocervical fixation was performed as a prophylactic stabilization procedure with the aim of pain relief and prevention of pathological fracture. **Results:** The surgery was completed without intraoperative or postoperative complications. The patient reported significant relief of cervicobrachialgia in the immediate postoperative period and was mobilized early. At the most recent follow-up, he remained neurologically and functionally stable. The literature supports occipitocervical fixation as the most frequently reported surgical strategy for C2 metastases, either alone or combined with vertebroplasty. Published series demonstrate consistent pain reduction, improvement in neurological function, and median survival ranging between 12 and 18 months, with low rates of complications. **Conclusion:** Osteolytic metastases of C2 secondary to lung carcinoma are rare but clinically relevant due to its

destabilizing potential. Posterior occipitocervical fixation is a safe and effective surgical option, providing pain control, prevention of pathological fracture, and maintenance of functional autonomy in selected patients. This case highlights the importance of a multidisciplinary approach and supports, in line with current literature, the role of surgical stabilization as a palliative measure with a meaningful impact on quality of life.

ID: AGS26/2346
P1114: Current management of giant cell tumor in the spine: case report and literature review

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Introduction: Giant cell tumor (GCT) of the spine is a primary benign but locally aggressive neoplasm, with the potential to destroy vertebral bodies, cause spinal cord compression, and present frequent recurrences. Surgical treatment is particularly challenging due to adjacent anatomical structures and the need to preserve spinal stability. Resection remains the treatment of choice, usually combined with vertebral reconstruction to restore spinal biomechanics. **Material and Methods:** A 21-year-old female with a cervicothoracic GCT (C7-T1) underwent staged surgeries. In April 2023, she received a T1 laminectomy with partial tumor resection, followed by posterior instrumentation from C5 to T3 with transmass lateral screws at C4-C6 and pedicle screws at T1-T3. In March 2024, due to tumor progression (66 × 41 × 40 mm) and spinal cord compression, a third surgery was performed through sternotomy and anterior cervicothoracic approach with the oncology team. Corpectomy of C6-T2 was performed using ultrasonic aspirator, with macroscopic tumor resection (8 × 7 × 6 cm) and reconstruction using expandable mesh-plate (60 × 61 mm), three expandable screws (14 mm), and demineralized bone matrix. **Results:** The patient evolved without immediate complications, with complete motor function recovery and adequate spinal stability after reconstruction. She is currently under clinical and radiological follow-up, receiving adjuvant medical therapy with denosumab. **Conclusion:** Staged resection with combined posterior and anterior approaches, complemented by vertebral reconstruction, represents an effective surgical strategy for cervicothoracic GCT. This case exemplifies the technical complexity and the need for structured planning to achieve local control and spinal stability. Denosumab may serve as a valuable adjuvant in recurrent or incompletely resected tumors.

ID: AGS26/2383
P1115: Epidural cavernous hemangioma: case report

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Introduction: Epidural cavernous hemangiomas are rare benign vascular malformations of the spine, representing less than 1% of all spinal tumors. They are typically located in the intramedullary or intradural compartments, while the purely epidural form is exceptionally uncommon. Clinical manifestations are often related to progressive spinal cord or nerve root compression, such as radiculopathy, motor weakness, or sensory deficits. Acute presentations are unusual and can lead to diagnostic uncertainty, as imaging findings frequently mimic other vascular malformations or neoplastic processes. We present the case of a 49-year-old woman who presented with acute orthostatic headache, in whom imaging revealed an epidural vascular lesion. The case highlights the challenges in diagnosis and the importance of surgical management. **Material and Methods:** A 49-year-old female patient presented to the emergency department with acute-onset orthostatic headache, without additional neurological deficits on examination. Laboratory findings were unremarkable. Magnetic resonance imaging (MRI) of the spine demonstrated a well-defined epidural vascular lesion, with radiological characteristics initially suggestive of a lymphangiomatous malformation. After a multidisciplinary discussion, the patient was scheduled for surgical resection through a posterior laminectomy approach. Intraoperatively, a vascular, encapsulated epidural lesion was identified and completely excised. The specimen was submitted for histopathological analysis to confirm the diagnosis. **Results:** The surgical procedure was uneventful, with minimal intraoperative bleeding despite the vascular nature of the lesion. The mass was completely resected, and no dural involvement was observed. Histopathological analysis revealed dilated vascular channels lined by a single layer of endothelial cells, consistent with cavernous hemangioma. Postoperatively, the patient experienced complete resolution of her headache and had no new neurological deficits. She was discharged in good condition. At follow-up, she remained asymptomatic, with no evidence of recurrence on imaging. **Conclusion:** Epidural cavernous hemangiomas are extremely rare vascular lesions, often misdiagnosed due to their atypical clinical presentation and nonspecific radiological features. Although the most common presentation is progressive neurological impairment, this case demonstrates that acute symptoms such as orthostatic headache may also occur, further complicating the diagnostic process. Preoperative

identification is challenging, as imaging may suggest alternative diagnoses, including lymphangiomatous or neoplastic lesions. Surgical excision is both diagnostic and therapeutic, and complete resection generally leads to excellent outcomes with low recurrence rates. Awareness of this rare entity is essential for clinicians, radiologists, and surgeons, as early recognition and timely surgical intervention can prevent neurological deterioration and allow definitive treatment. This case underscores the importance of including epidural cavernous hemangioma in the differential diagnosis of spinal epidural vascular lesions presenting with atypical symptoms.

ID: AGS26/2417
P1116: Comparison of instrumented fusion versus decompression alone in spinal tumor surgery

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Introduction: The optimal surgical approach for spinal tumors remains debated. While decompression relieves neural compression, fusion may improve stability and long-term outcomes. This study compares decompression alone versus decompression with fusion in spinal tumor surgery. **Materials and Methods:** A retrospective cohort of 82 patients undergoing resection of spinal tumors (2022-2025) was analyzed. Group A: decompression only (n = 40); Group B: decompression with instrumented fusion (n = 42). Outcomes included postoperative pain (VAS), neurological improvement (ASIA grade), reoperation rate, and complications. **Results:** Both groups achieved neurological improvement ($p < 0.01$). Fusion group had superior maintenance of spinal stability with fewer reoperations (5% vs 18%, $p = 0.04$). Operative time and blood loss were greater in the fusion group ($p < 0.01$). Complication rates were similar (14% vs 12%, $p = 0.76$). **Conclusion:** Fusion provides long-term stability benefits in spinal tumor surgery at the cost of longer surgery. In patients with pre-existing instability, fusion should be strongly considered, while decompression alone may suffice in select cases.

ID: AGS26/2438
P1117: Management of intramedullary spinal cord tumors

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Introduction: Intramedullary spinal cord tumors are rare lesions, accounting for approximately 4-10% of all central nervous system (CNS) tumors and nearly 25% of intradural spinal tumors in adults. In pediatric populations, this number is significantly higher, representing nearly 50% of intradural spinal neoplasms. These tumors present unique diagnostic and therapeutic challenges due to their location within the spinal cord parenchyma. The advent of magnetic resonance imaging (MRI) has dramatically enhanced early diagnosis and anatomical localization. Despite advances in microsurgical techniques, including intraoperative neurophysiological monitoring and high-definition microscopy, the surgical management of intramedullary spinal cord tumors remains demanding due to risks of neurological deterioration. This study aims to detail our institutional experience in managing such tumors, assess clinical outcomes, and identify prognostic indicators for recovery. **Material and Methods:** A total of 27 patients who underwent surgery for intramedullary spinal cord tumors between 2018 and 2024 at Meenakshi Mission Hospital, Madurai, were retrospectively reviewed. Patients of all age groups and both genders were included. Data were collected regarding patient demographics, symptomatology, neurological status (using the Modified McCormick scale), tumor location on MRI, histopathological diagnosis, extent of surgical resection, and postoperative course. All surgeries were performed under general anesthesia in the prone position. Standard posterior midline approaches with multilevel laminectomy or laminoplasty were used. Tumors were accessed via midline myelotomy and resected using microsurgical techniques. Gross total resection was attempted in all cases. Postoperative neurological status was recorded, and follow-up was maintained for a minimum of 6 months. Complications, recurrence, and functional recovery were analyzed. **Results:** Among the 27 patients, 15 were males and 12 females, with a mean age of 29.4 years (range: 4-61 years). The average duration of symptoms prior to diagnosis was 92 days. The most common presenting complaints were motor weakness (all 27 cases), followed by sensory disturbances (18 cases) and bowel/bladder dysfunction (11 cases). Tumor location included cervical (9), cervicodorsal (3), dorsal (10), dorsolumbar (2), and conus/cauda region (3). Preoperative functional assessment revealed that 13 patients were Modified McCormick Grade III, 8 were Grade II, and 6 were Grade IV. Histologically, ependymomas (12 cases) and low-grade astrocytomas (9 cases) were the most common, followed by hemangioblastomas (3), cavernomas (2), and one case of intramedullary metastasis. Gross total resection was achieved in 23 patients (85.2%), and subtotal resection in 4 cases due to infiltrative tumor nature. Postoperative complications included one case of new-onset paraplegia, two cases with transient worsening of motor power, and one wound-related complication. At 6-month follow-up, 20 patients showed stable or improved neurological function, with the mean postoperative Modified McCormick score improving from 3.1 to 2.7. There were no mortalities. **Conclusion:** Intramedullary spinal cord tumors, though rare, require high clinical suspicion and timely intervention to optimize

outcomes. Ependymomas and low-grade astrocytomas form the majority of such lesions. Gross total excision, wherever feasible, should be the surgical goal, especially for well-demarcated tumors such as ependymomas. Preoperative neurological status and tumor histology are key predictors of functional outcome. A multidisciplinary approach with meticulous microsurgical technique and vigilant postoperative care ensures favorable long-term results.

ID: AGS26/2569
P1118: Augmentation techniques with silicone in spine oncologic surgery

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Introduction: Since its introduction, pedicle screw instrumentation in all fields of spine surgery, has afforded stronger biomechanical constructs, higher fusion rates, fewer instrumented levels, better outcomes and lower complication rates, when compared to previous surgical techniques. However, it mainly depends on a robust screw purchase on the pedicle and a solid bone-implant interface which decreases in the presence of osteopenia, infection or cancer diseases, possibly leading to catastrophic implant failure. Cement augmentation of the instrumented vertebrae coupled with standard or fenestrated screws, has been successfully used to improve the bone-implant interface and pullout strength, potentially improving long-term outcomes by reducing the length of the implant and the overall complications. Polymethylmethacrylate (PMMA) is the most commonly used pedicle screw augmentation cement, showing several advantages including rapid solidification, biocompatibility, physician familiarity and cost effectiveness. Reported drawbacks which include a high exothermic polymerization temperature, the lack of osteoconductive properties and the possible difficulties during revision surgery prompted the research of new materials. VK100® is a silicon filling material, biocompatible, non-exothermic and with elastic properties more similar to bone, if compared to PMMA. **Material and Methods:** We report our results using augmentation technique in pedicle screw instrumentation with VK100, for patients affected by spinal metastases. **Results:** Between 2020 and 2025, a series of 14 patients with vertebral metastases have been operated with spinal fixation implemented with augmentation making use of VK100® silicon filling material of the fixed levels. They were 5 males and 9 females, median age was 61.5 (range 58-74). Histology of the tumors included: lung carcinoma in 6 cases, breast carcinoma in 4, kidney carcinoma in 2, thyroid and uterus carcinoma in one case respectively. Pathologic vertebral levels were L2 (n°5); L3 (n°4); L5 (n°1), D12 (n°2); D11 (n°1); D8 (n°1). Indication for surgery were pain which was present in all patients and/or neurologic deficits and spinal instability. Fixation techniques include open decompression plus percutaneous fixation one-three levels above and below the pathologic levels and augmentation in 10 cases, percutaneous fixation and augmentation in 4 cases. Overall augmentation with silicone was performed in 41 vertebral bodies. There were not technical issues, standard technique (first vertebroplasty and then positioning of the screws) were employed in 11 cases, fenestrated screws in the last three cases without time constraints related to the curing process of the filling material. Antero-posterior and lateral double fluoroscopy or intraoperative CT scan were employed. The mean survival was 12 months ±8 months (5 patients are still alive). All patients showed a significant reduction of pain measured by VAS and Dennis Pain Scale. There were no significant complications related to the procedure: four cases of asymptomatic silicone leakages and one case of asymptomatic pulmonary embolism. One patient developed after surgery a mild paraparesis which improved with corticosteroids. In all cases the patients were able to receive adjuvant systemic therapies or radiotherapy/radiosurgery. Until now we did not observe any case of pull out of the screws or failure of the systems implanted and therefore no conclusions about technical issues of revision surgery can be drawn in oncologic patients. **Conclusions:** In our experience, silicone VK100® appeared to be a safe and effective filling material for augmentation techniques in spine fixation. Its biomechanic properties, low elastic modulus, long working time, absence of exhortemic reaction may be particular useful in oncologic patients.

ID: AGS26/2752
P1119: Spinal ependymoma and glioblastoma: association, degeneration or misdiagnosis

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Ependymoma and glioblastoma are two distinct types of central nervous system tumors. While the former arises from ependymal cells lining the ventricles, the latter originates from glial cells. Both tumors most commonly occur in the brain,

with spinal cord involvement being rare. To date, no cases of association or malignant transformation between these two tumor types have been reported. In this article, we present the case of a 25-year-old female patient with a history of anemia, who was admitted in December 2024 for intercostal neuralgia associated with motor deficit and bladder dysfunction. Imaging revealed an anteroposterior tumor at the D3-D4 and D4-D5 levels, with additional lesions at C3 and C7. She underwent surgery with incomplete resection of a dorsal intradural extramedullary lesion. Histopathological examination confirmed a Grade 3 anaplastic ependymoma. Before chemotherapy could be initiated, the patient was re-admitted in February 2025 for bilateral C7 neuralgia with worsening motor deficit. MRI demonstrated enlargement of the C3 and C7 tumors, as well as new lesions in the sacral region. She underwent biopsy of a C6-C7 intramedullary lesion, which unexpectedly revealed a Grade IV glioblastoma. MRI performed at the time of surgery showed no cerebral involvement. The patient was subsequently referred for radiotherapy and chemotherapy. Given these histological findings and the absence of similar cases in the literature, we considered the possibilities of misdiagnosis, tumor association, or malignant transformation. However, a definitive conclusion cannot be drawn, and our interpretation remains hypothetical pending the reporting of additional cases in the future.

ID: AGS26/2789

P1120: From diagnosis to donation: lived experiences, consent, and support needs in craniospinal oncology research

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Introduction: Craniospinal tumours are rare, aggressive cancers that disrupt both neurological function and quality of life. While tissue donation for research is vital for developing new treatments, consent is often sought at the height of emotional distress and clinical uncertainty-moments when patients may feel least prepared to decide. Understanding this journey from diagnosis to donation is essential to make research participation both ethical and effective. This national cross-sectional survey captures the lived experiences of people with primary craniospinal tumours, examining consent timing, communication, and explores the potential use of digital adjuncts as shared decision-making tools within this process. **Material and Methods:** A national, cross-sectional online survey was co-designed with patient advisors and completed by 50 UK adults diagnosed with primary brain tumours or spinal sarcomas. Recruitment occurred via patient networks, advocacy groups, and across social media platforms. The survey combined closed and open-ended questions exploring diagnosis experiences, emotional responses to tissue donation requests, consent timing and clarity, involvement of clinicians/family, and attitudes toward an NHS-hosted digital dynamic consent portal. Quantitative data were analysed descriptively; qualitative responses underwent thematic analysis. **Results:** 50 respondents (62% female, 70% White, 36-75y; 32% brain tumour, 68% spinal sarcoma), only 52% recalled being asked to donate tissue; almost a quarter found this stressful, citing poor timing, emotional overload, and lack of context. 62% preferred discussions in specialist appointments, not pre-/day-of surgery. While two-thirds found information clear, over a third had no chance to ask questions. Consent was obtained mainly by clinicians or nurses. Family discussion was uncommon (49%), yet most who hadn't (79%) wished they could. Digital engagement was near-universal (96%), with 94% favoring a digital consent portal offering tumour-specific education, FAQs, as useful decision-making resources-security concerns were rare (8%). Findings highlight missed communication opportunities and strong appetite for digital consent tools. **Conclusion:** Patients with craniospinal tumours are eager to contribute to research but seek better timing, clearer communication, and emotional support in tissue donation consent. They strongly support a flexible, personalised dynamic digital consent platform, securely delivered via NHS systems, with tailored information and ongoing engagement. Co-designed with patients, such tools could address missed opportunities, enhance autonomy and experience and embed ethical, person-centred practices-offering a clear roadmap to improve care and accelerate translational craniospinal research.

ID: AGS26/2811

P1121: Preoperative embolization of spinal metastatic bone disease and its effectiveness in reducing intraoperative blood loss: case report from a single center study

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Introduction: Surgery for spinal metastatic tumors is challenging due to both technical difficulties and the risk of significant intraoperative blood loss. Theoretically, preoperative embolization reduces the tumor's blood supply, thereby decreasing intraoperative bleeding. This report presents our experience with preoperative embolization for spinal metastatic tumors in the thoracic region. **Material and Methods:** 12 patients included in this study. We performed three preoperative embolization procedures for tumors involving the thoracic spinal column and nine surgeries without preoperative embolization. Tumor and spinal angioarchitecture were evaluated using MRA and conventional spinal angiography. Our center utilized Interlock and IDC detachable embolization coils (Boston Scientific). The degree of embolization was graded as complete, near-complete, or partial. In this study, we excluded total blood loss reported by anesthesia and included only blood loss measured after tumor exposure. The embolization procedure is performed 1 day prior to surgery. **Results:** Near-complete embolization was achieved in two patients, while one patient had partial embolization. There is no complication related to embolization procedure. The mean intraoperative blood loss in the preoperative embolization group was 1,445 mL, compared to 2,450 mL in the non-embolization group. **Conclusion:** Preoperative embolization of spinal tumors can be performed with a high success rate, even in developing countries with limited angiosuite facilities. Compared to surgery without embolization, preoperative embolization significantly reduces intraoperative blood loss in patients with spinal metastatic disease.

ID: AGS26/2855
P1122: Spinal metastases of unknown primary: is bone biopsy essential for diagnosis?

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Introduction: Spinal metastasis is a common occurrence in patients with various cancers and myeloid diseases, and the spine accounts for about 80% of all bone metastases. Delayed diagnosis of primary cancer in patients with spinal metastases of unknown origin (SMUO) adversely affects prognosis and increases the risk of skeletal-related events. The purpose of this study was to evaluate the usefulness of tumor markers, chest and abdominal CT, PET/CT, and bone biopsy for identifying the primary cancer in patients with SMUO. **Material and Methods:** This retrospective study included patients with SMUO who were treated at our institution between 2018 and 2023. Among a total of 73 patients identified, 64 who underwent electrophoresis, laboratory testing, chest and abdominal CT, PET/CT, and bone biopsy were included in the final analysis. The primary outcome measure was the diagnosis of the primary cancer. We assessed the sensitivity and specificity of tumor markers and electrophoresis to determine their diagnostic value. In addition, the diagnostic yields of CT, PET/CT, and bone biopsy were compared with each other. **Results:** Among the 64 patients included in the study, the final diagnosis was established in 59 cases. Lung carcinoma was the most common malignancy, followed by hepatocellular carcinoma (HCC), multiple myeloma, and prostate carcinoma. Tumor marker levels were elevated in 44 of 64 patients. HCC, multiple myeloma, and prostate carcinoma each demonstrated a marker with high sensitivity and specificity (AFP, M protein, and PSA, respectively), whereas no tumor marker with adequate sensitivity was identified for lung carcinoma. The primary site was detected in 44 patients (68.8%) by chest and abdominal CT and in 46 patients (71.9%) by PET/CT. Bone biopsy established the final diagnosis in 35 patients (54.7%). **Conclusion:** In SMUO, specific tumor markers such as AFP and PSA, as well as protein electrophoresis, appear to be useful for the final diagnosis. Chest and abdominal CT and PET/CT are valuable for identifying solid tumors, but not hematologic tumors. Bone biopsy showed a lower diagnostic yield for solid tumors compared to CT or PET/CT.

ID: AGS26/2873
P1123: Aggressive thoracic vertebral hemangioma: a rare cause of spinal cord compression

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Introduction: Vertebral hemangiomas are common benign vascular lesions, often discovered incidentally and usually asymptomatic. They account for 10-12% of the general population and represent 2-3% of spinal tumors. In rare instances, these lesions exhibit aggressive behavior, extending beyond the vertebral body and leading to spinal cord compression. **Material and Methods:** We present the case of a 14-year-old girl with progressively worsening back pain and paraplegia secondary to spinal cord compression. Imaging revealed features consistent with an aggressive thoracic vertebral hemangioma. The patient underwent urgent decompressive laminectomy, and histopathological analysis confirmed the diagnosis. **Results:** The patient achieved complete neurological recovery. During follow-up, however, she developed progressive thoracic kyphosis, which required a second surgery consisting of corporectomy with osteosynthesis. **Conclusion:** This case highlights the diagnostic

and therapeutic challenges of aggressive vertebral hemangiomas in the pediatric population. Early recognition and timely surgical management are crucial to achieve favorable neurological outcomes and to prevent long-term spinal deformity.

ID: AGS26/2889
P1124: Primary intradural extramedullary extraosseous Ewing's sarcoma of thoracic spine: a case report and literature review

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Introduction: Extraosseous Ewing's sarcoma is a highly malignant mesenchymal tumor that rarely occurs in the spinal canal, and its clinical outcomes remain poorly defined. To date, only a few cases of primary intradural extramedullary Ewing's sarcoma have been reported, with heterogeneous follow-up results. **Material and Methods:** We report the case of a 14-year-old girl presenting with Brown-Séquard syndrome due to an intradural extramedullary lesion at level of T7, located anterolaterally on the right, compressing the spinal cord and causing neurological compromise. **Results:** The patient underwent a T7 hemilaminectomy with gross total resection of the intradural extramedullary tumor. She demonstrated significant neurological improvement postoperatively. Histopathological analysis confirmed the diagnosis of Ewing's sarcoma, and she was subsequently referred for adjuvant chemotherapy and local radiation therapy. **Conclusion:** This case illustrates the exceptional occurrence of intradural extramedullary Ewing's sarcoma in children. Early recognition and prompt surgical intervention are essential for neurological recovery, but long-term outcomes remain uncertain given the rarity of this entity.

ID: AGS26/2941
P1125: Isolated posterior epidural plasmacytoma causing spinal cord compression: a case report and review of the litterature

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Introduction: Isolated extraosseous epidural plasmacytoma, without involvement or collapse of the vertebral bodies, is an extremely rare entity. Only a few cases have been reported in the literature, and their clinical management and outcomes are not well defined. **Material and Methods:** We report the case of a 70-year-old male who presented to our department with progressive paraparesis. Imaging revealed an isolated posterior epidural mass at the T9-T10 level, causing spinal cord compression. **Results:** The patient underwent gross total resection of the mass and achieved complete neurological recovery. Histopathological examination confirmed the diagnosis of plasmacytoma. **Conclusion:** This case highlights the rare occurrence of isolated epidural plasmacytomas and emphasizes the importance of early recognition and prompt surgical management. Gross total resection can lead to excellent neurological recovery in these rare lesions.

ID: AGS26/2953
P1126: Spinal plasmacytoma: a case series of four operated patients

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Introduction: Spinal plasmacytoma is a rare but serious condition that can occur either as a solitary lesion or as part of multiple myeloma. Its clinical and radiological presentation is often variable, posing diagnostic challenges. We present four cases of spinal plasmacytoma managed surgically in our department. We aim to report a series of four cases of spinal plasmacytoma and highlight the diagnostic and therapeutic challenges involved. **Material and Methods:** Four patients were operated for spinal plasmacytoma:

- **Case 1**: A 58-year-old woman with progressive mechanical low back pain for two months. MRI showed a pathological L2 fracture; CT confirmed 50% vertebral height loss.
- **Case 2**: A 60-year-old woman with a history of mitral valve disease and asthma, experiencing chronic resistant back pain. MRI showed suspicious L2 signal anomalies and distant lesions. She later developed a compression fracture of L2.
- **Case 3**: A 75-year-old woman in complete remission from multiple myeloma since 2020, presenting with new-onset back pain and urinary symptoms. MRI revealed compression fractures at D7 and L4, with L4-L5 spondylolisthesis.
- **Case 4**: A 58-year-old man with mixed axial pain, costal pain, and spinal stiffness. CT and MRI revealed osteolytic lesions at D9-D10 with vertebral collapse and epiduritis. In all cases, pathological examination confirmed plasmacytoma.

Results: All patients underwent surgical decompression and stabilization. Postoperative outcomes were favorable, with significant clinical improvement and uncomplicated recoveries. **Conclusion:** Spinal plasmacytoma should be considered in the differential diagnosis of vertebral lesions and persistent back pain. Early diagnosis and multidisciplinary management

are crucial for optimizing patient outcomes. This series illustrates the role of combined therapies-surgery, radiotherapy, and in selected cases chemotherapy-in effective disease control.

ID: AGS26/2979
P1127: Management of C2 hemangiomas with kyphoplasty in the cervical spine: a case report

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Cervical spine hemangiomas, although rare, can lead to significant clinical symptoms, including pain and neurological deficits, particularly when they adopt an aggressive course. Conventional management typically involves conservative approaches or invasive surgical intervention, both of which pose challenges, especially in the sensitive cervical region. Kyphoplasty, a minimally invasive procedure, presents a novel alternative for vertebral stabilization and pain relief. This case report discusses a symptomatic C2 vertebral hemangioma successfully managed with kyphoplasty, underscoring its effectiveness and safety in this anatomically complex region. **Case Presentation:** A 57-year-old female presented with a six-month history of progressively worsening neck pain radiating to the occipital area, accompanied by intermittent upper limb numbness. Magnetic resonance imaging (MRI) revealed a substantial hemangioma in the C2 vertebra, contributing to cortical thinning and mild spinal canal encroachment. Conservative management had failed to alleviate her symptoms. Kyphoplasty was performed under fluoroscopic guidance, involving the injection of bone cement. The procedure was completed without complications, and the patient reported significant pain relief within 24 hours. At three-month follow-up, imaging confirmed stable cement placement, with no evidence of complications or symptom recurrence. **Clinical Discussion:** Although traditionally employed for vertebral compression fractures, kyphoplasty is emerging as a viable treatment for symptomatic cervical spine hemangiomas. Its minimally invasive nature offers significant advantages in the cervical region, where conventional surgery poses heightened risks due to the proximity of critical neurovascular structures. In this case, kyphoplasty provided rapid symptomatic relief and stabilization of the C2 vertebra, demonstrating its potential efficacy in managing benign lesions in the cervical spine. However, the procedure necessitates meticulous patient selection and precise technical execution to mitigate risks, such as cement leakage, which could have severe consequences in the cervical spine. **Conclusion:** This case illustrates the promise of kyphoplasty as a therapeutic option for symptomatic cervical spine hemangiomas, offering substantial pain relief and vertebral stabilization with a reduced risk profile compared to more invasive surgical methods. The successful outcome in this instance suggests that kyphoplasty may become an important tool in the management of benign cervical spine lesions, particularly in challenging anatomical locations like the C2 vertebra. Further studies are warranted to establish best practices and assess long-term outcomes associated with this technique.

ID: AGS26/3044
P1128: Aneurysmal bone cyst of spine-multidisciplinary management, outcomes and recurrence rate

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Introduction: We report twenty four cases of spinal aneurysmal bone cysts (ABCs) managed surgically at The Spine Foundation, Mumbai. This case series aims to highlight the clinical presentation, imaging and pathological findings, and the role of surgical excision following pre-operative embolization in the management of spinal ABCs and recurrence of disease. **Method:** A retrospective review of operating room logs from 2004 to 2025 identified twenty four patients with spinal ABCs who underwent surgical treatment at our institution. Data collected included clinical presentation, radiological and pathological features, surgical interventions, postoperative outcomes and recurrence rates. **Results:** 16 patients were female (66%), with ages ranging from 13 to 25 years (mean age: 17.75 years). Lesion distribution included the thoracic spine in twelve cases (50%), cervical spine in six cases (25%), and lumbar spine in six (25%). Common presenting symptoms were back pain, gait instability, and progressive limb weakness. No patient underwent pre-operative embolization followed by surgical excision and spinal fixation. Postoperative outcomes showed varying degrees of neurological and symptomatic improvement. Recurrence was seen 3 patients (12.5%). **Conclusion:** Spinal ABCs are benign but potentially aggressive lesions that may cause significant neurological symptoms. They often present with non-specific signs, making diagnosis challenging. Pre-operative embolization is a useful strategy to minimize intraoperative bleeding. Surgical decompression and stabilization remain the mainstay of treatment and can result in notable neurological recovery, even in patients with advanced deficits. Radiation therapy may

be considered as an adjunct in select or recurrent cases. ABCs have a high recurrence rate.

ID: AGS26/3069
P1129: 20-year single-center experience with a syndromic approach to surgical treatment of tumors and spondylitis of the cervical spine in children

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Introduction: Objective of the study is to analyze the immediate and long-term outcomes of surgical treatment in children with tumor and infectious destruction of the cervical vertebrae. **Material and Methods:** The study included data from 94 children. The following parameters were assessed: the effectiveness of perioperative halo fixation, surgical approaches, methods of spinal reconstruction and stabilization, dynamics of pain and neurological disorders, and the pattern of postoperative complications. The data were statistically processed using nonparametric analysis methods. Statistical analysis and visualization of the results were performed using the R programming language. **Results:** In 12.8% of cases, the halo device was used due to significant deformities and spinal stenosis. Of the 34 resections requiring a combined approach, 30 were performed in a single surgical session. The median duration of the surgical stage was 162.5 minutes, and the median blood loss was 100 ml. Anterior column reconstruction was required in 62.8% of cases, and posterior instrumental fixation was required in 42.6%. Local pain was relieved in all cases. Four patients with neurological impairments showed an improvement in their neurological status by one level or more according to the Frankel scale, two patients showed a deterioration by one level, and nine patients showed no significant change in their neurological status. Complications were observed in 26.6% of cases, with only five patients requiring repeat surgery. Destruction of three or more vertebrae impacts surgical outcome ($p = 0.0298$). **Conclusion:** A unified syndromic approach to treating children with cervical vertebral destruction is justified and is associated with a minimal incidence of clinically significant perioperative complications.

ID: AGS26/3101
P1130: Primary bone B-cell lymphoma presenting as cauda equina syndrome: a case report

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Introduction: Primary bone lymphoma (PBL) is a rare extranodal form of non-Hodgkin lymphoma (NHL), accounting for only 3-7% of primary bone tumors and less than 2% of all NHL cases in adults. According to the World Health Organization (WHO), it is characterized by isolated or multiple bone involvement without visceral or nodal disease. Clinical presentation with myeloradicular compression symptoms, such as cauda equina syndrome, is particularly uncommon. This highlights the critical role of neurosurgeons not only in initial management and decompression but also in obtaining biopsy material and ensuring timely referral for oncohematologic treatment. **Material and Methods:** We report the case of a 30-year-old man, previously healthy, who presented with a 3-month history of incapacitating low back pain radiating to the left lower limb, followed by progressive gait impairment. Subsequently, he developed urinary and fecal retention, leading to admission to the Neurosurgery Department of Hospital Geral Clériston Andrade. He denied B symptoms, such as fever, night sweats, or weight loss. On physical examination, he exhibited grade IV paresis in the left lower limb, associated with hypoesthesia, hypotonia, and muscle hypotrophy. Muscle strength was grade III and reflexes grade II in both lower limbs, along with saddle hypoesthesia. Laboratory tests were within normal limits. **Results:** Lumbosacral magnetic resonance imaging revealed an expansive, infiltrative lesion from S1 to S3, invading the left sacral ala and compressing the cauda equina roots. The patient underwent lumbosacral arthrodesis from L4 to S2 with L5-S1 foraminal decompression, resulting in partial improvement of neurological deficits. Bone biopsy from the S1 pedicle showed a round-cell infiltrate with necrosis. The initial immunohistochemical panel was inconclusive, requiring further analysis. The final evaluation confirmed a high-grade B-cell lymphoma with a germinal center pattern. The panel showed positivity for CD10, CD19, CD20, CD45, CD79a, PAX-5, BCL6, and FLI-

1, with a Ki-67 proliferation index greater than 90%. Markers such as CD3, CD30, TDT, MUM1, ALK, BCL2, CD138, EBV-LMP, Desmin, ERG, NKX2.2, and Myogenin were negative. Following diagnosis, the patient was promptly referred to an Onco-Hematology service. His young age and the high Ki-67 index suggested a favorable response to systemic chemotherapy with the R-CHOP regimen (rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone), combined with radiotherapy. Literature data indicate that PBL demonstrates a better therapeutic response compared to non-osseous lymphomas of similar histology. **Conclusion:** PBL is an exceptionally rare cause of cauda equina syndrome. Initial neurosurgical management is crucial for both decompression and biopsy, minimizing permanent neurological sequelae. Histopathological evaluation together with immunohistochemistry is essential for establishing a definitive diagnosis and ensuring rapid referral for appropriate onco-hematologic treatment.

References

1. Wang Zining et al. Two cases on primary bone marrow lymphoma. Cancer Pathogenesis and Therapy, v. 2, n. 1, 58-61, 2024.
2. Wang, Hao-Yuan et al. Primary bone marrow lymphoma: A hematological emergency in adults with fever of unknown origin. Cancer Medicine, v. 7, n. 8, 3713-3721, 2018.
3. Zhou, Hai-Yan et al. Primary bone lymphoma: A case report and review of the literature. Oncology Letters, v. 8, n. 4, 1551-1556, 2014.
4. Suresh, Pooja K. et al. Diffuse large B-cell lymphoma in blood and bone marrow: a rare presentation of leukemic phase at diagnosis. Hematology, Transfusion and Cell Therapy, v. 42, n. 2, 180-183, 2020.
5. Yohannan, Binoy; Rios, Adan. Primary diffuse large B-cell lymphoma of the bone. Journal of Hematology, v. 12, n. 2, 75, 2023.
6. Bindal, Poorva et al. Primary bone lymphoma: a case series and review of literature. Case Reports in Hematology, v. 2020, n. 1, 4254803, 2020.
7. Fonseca HC, et al. Linfoma ósseo primário: relato de caso. Hematology, Transfusion and Cell Therapy, v. 42, 234, 2020.
8. Wang Jia et al. A rare case report of primary bone lymphoma and a brief review of the literature. OncoTargets and therapy, 4923-4928, 2016.

ID: AGS26/3103
P1131: Minimally invasive resection of a thoracic spine osteoid osteoma: a case report

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Introduction: Osteoid osteoma is a benign osteoblastic tumor and in 10% of the cases occurs in the spine. Thoracic involvement is less frequent than lumbar or cervical, but clinically relevant due to persistent nocturnal pain, risk of spinal deformity, and rare neurological symptoms. The nidus typically arises from posterior elements, and complete excision is required to avoid recurrence. Minimally invasive tubular approaches may reduce morbidity and accelerate recovery. **Material and Methods:** We report the case of a 29-year-old male with one year of nocturnal dorsal pain without neurological deficits. MRI demonstrated an osteoid osteoma involving the right lamina and inferior articular facet of T8. The patient underwent surgical excision using a minimally invasive tubular retractor system with partial T8 facetectomy. **Results:** The procedure and hospital stay were uneventful. Wound healing was satisfactory, with no local or systemic complications. Histopathology confirmed an osteogenic lesion consistent with osteoid osteoma. At three-month follow-up, the patient was asymptomatic, with complete pain resolution and full return to daily activities without functional limitations. **Conclusion:** This case illustrates a rare osteoid osteoma of the thoracic spine and the efficacy of minimally invasive tubular resection. The approach enabled complete nidus excision with minimal soft tissue disruption, leading to rapid recovery and excellent short-term outcome. Minimally invasive surgery should be considered a safe and effective option for posterior element osteoid osteomas of the spine.

ID: AGS26/3114
P1132: Pathologic fracture of a lumbar vertebra secondary to metastatic pancreatobiliary adenocarcinoma presenting with paraplegia: case report

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Introduction: Vertebral body compression fractures are common in elderly patients. The main etiology is osteoporosis, but metastatic cancer must be included in the differential diagnosis of severe low back pain. In men, the most frequent source of bone metastasis is prostate cancer, while metastases from pancreatic neoplasms are rare and carry a poor prognosis, since disease presentation often relates to invasion of abdominal structures. Osseous metastases are uncommon and,

when present, usually occur at advanced stages. They typically manifest as osteolytic lesions, while osteoblastic lesions are extremely rare. Thus, cases such as ours are scarcely reported and stand out due to their rarity. **Material and Methods:** A 68-year-old male, hypertensive, with prior venous thromboembolism, was admitted with low back pain radiating to the lower limbs, associated with paresthesia and urinary incontinence for two years. He had progressed to paraplegia one year earlier, becoming unable to walk. On admission, he was lucid, oriented, and responsive (Glasgow 15). Lower limbs were atrophic with proximal paraplegia and muscle strength grade 2. He presented with antalgic flexor posture and severe pain aggravated by mobilization. Previous imaging demonstrated a pathologic fracture at L2, with suspected malignant spinal neoplasm. Imaging revealed an expansive lesion with soft tissue and calcified components, leading to destruction and diffuse thinning of the L2 vertebral body, measuring 12.3 × 8.5 × 6.3 cm, highly suspicious for neoplastic involvement. CT showed thoracolumbar scoliosis and lytic lesions in L1. CT angiography suggested pulmonary thromboembolism, and chest CT identified pulmonary nodules. Urine culture isolated multidrug-resistant *Pseudomonas aeruginosa*. **Results:** The patient underwent two major surgeries: posterior fixation from L1 to L4 on the right with L2 Over The Top laminectomy and extradural lesion resection for biopsy, followed by vertebral tumor resection and deformity correction. Histopathology and immunohistochemistry confirmed metastatic pancreatobiliary adenocarcinoma with positive markers MUC-05 AC, EMA, and CK7. He received prolonged antibiotic therapy for *Pseudomonas* (4 weeks) and full anticoagulation for VTE and PE. A stage 4 sacral pressure ulcer evolved with infection by *E. coli* and fistula at the lumbar surgical site. One month after surgery, the patient presented marked clinical frailty (Karnofsky 30-40%, ECOG 3) and progressive deterioration. Given the advanced neoplastic disease, the palliative care team was involved. He was discharged for continuation of treatment at home. **Conclusion:** Vertebral fractures due to metastasis from pancreatobiliary adenocarcinoma are rare and carry a poor prognosis. This case highlights the importance of investigating persistent low back pain with progressive neurological deficit and underscores the need for multidisciplinary management and palliative care in advanced disease.

References

1. Chih YP, Wu WT, Lin CL, Jou HJ, Huang YH, Chen LC, Chou LW. Vertebral compression fracture related to pancreatic cancer with osteoblastic metastasis: a case report and literature review. Medicine (Baltimore). 2016;95(5):e2670. doi:10.1097/MD.0000000000002670. PMID: 26844499.

2. Mao C, Domenico DR, Kim K, Hanson DJ, Howard JM. Observations on the developmental patterns and consequences of exocrine pancreatic adenocarcinoma: findings of 154 autopsies. Arch Surg. 1995;130(2):125-34. doi:10.1001/archsurg.1995.01430020027005. PMID: 7848070.

3. Gregory LS, Choi W, Burke LJ, et al. Breast cancer cells induce osteolytic bone lesions in vivo through suppression of osteoblast activity in mice. PLoS One. 2013; 8(7): e68103. doi:10.1371/journal.pone.0068103. PMID: 23844213.

4. Pneumaticos SG, Savidou C, Korres DS, Chatziioannou SN. Pancreatic cancer's initial presentation: back pain due to osteoblastic bone metastasis. Eur J Cancer Care (Engl). 2010; 19(1):137-40. doi:10.1111/j.1365-2354.2007.00920.x. PMID: 19708936.

5. Pawar A, Schlader E, Mac-Thiong JM, Maurais G, Dion D, Bédard D. Rare metastatic adenocarcinoma to the spine infiltrating three adjacent foramen in lumbar vertebrae. Orthopedics. 2010;33(12):928. doi:10.3928/01477447-20101021-26. PMID: 21162500.

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P1133: Balloon kyphoplasty in multiple myeloma-related vertebral compression fractures: a systematic review of clinical outcomes and safety

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Background: Vertebral compression fractures (VCFs) are among the most common and debilitating skeletal complications of multiple myeloma (MM). Balloon kyphoplasty has emerged as a minimally invasive intervention to stabilize vertebrae, restore height, and alleviate pain, yet evidence specific to MM remains fragmented. **Objective:** To systematically review the clinical outcomes, safety, and broader implications of balloon kyphoplasty in patients with MM-related VCFs. **Material and Methods:** This review was conducted in accordance with PRISMA 2020 guidelines. PubMed, Cochrane Library, and ScienceDirect were searched from inception to March 2025. Eligible studies included prospective or retrospective cohorts and case series with ≥ 5 MM patients treated with kyphoplasty. Outcomes of interest included pain, function, vertebral height restoration, complications, and additional systemic or psychosocial effects. **Results:** Of 304 records identified, 10 studies met inclusion criteria, encompassing > 460 patients and several hundred vertebral levels. Across studies, kyphoplasty consistently achieved rapid and durable pain reduction, with sustained improvements in disability indices such as the Oswestry Disability Index, EQ-5D, and Karnofsky Performance Status. Radiographic analyses demonstrated partial vertebral height restoration and correction of kyphosis, though some regression occurred over time. Cement leakage rates ranged from 4-26%, but were almost universally asymptomatic. Beyond

symptomatic relief, kyphoplasty enabled earlier resumption of systemic therapy and improved psychosocial outcomes, including reductions in fatigue, anxiety, and depression. **Conclusions:** Balloon kyphoplasty is a safe and effective intervention for MM-related VCFs, providing not only symptomatic relief but also functional and systemic benefits. Further randomized studies are needed to refine patient selection, optimize timing, and establish its role within comprehensive myeloma management.

ID: AGS26/3198
P1134: Mature teratoma of the conus medullaris in an adult: a rare case report

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Introduction: Spinal teratomas are exceedingly rare lesions, particularly in adults. They are most commonly reported in children and adolescents, with the conus medullaris being an exceptional location. We present the case of a 37-year-old woman with a mature spinal teratoma, highlighting the diagnostic challenge and surgical outcome. **Material and Methods:** A 37-year-old female with a medical history of treated hepatic and pulmonary hydatid cysts presented with chronic low back pain evolving over 3 years, associated with bilateral non-systematized sciatica and neurogenic claudication. During the past year, she developed bladder dysfunction requiring intermittent catheterization and constipation. Neurological examination revealed lumbar tenderness, decreased reflexes on the left, absent reflexes on the right, but no motor or sensory deficit and no saddle anesthesia. MRI revealed a well-defined, oval intradural lesion at L1-L2, oval, hyperintense on T1/T2 suggesting subacute hemorrhage, without contrast enhancement. Differential diagnosis included intradural schwannoma or organized hematoma. **Results:** The patient underwent L1-L2 laminectomy and microsurgical excision of the lesion. Postoperatively, she remained neurologically intact, with only transient lower limb paresthesia. Histopathological examination confirmed a mature teratoma, composed of adipose tissue, respiratory epithelium, acinar structures, squamous epithelium, and glial tissue with reactive gliosis. No immature elements or malignant transformation were identified. **Conclusion:** Spinal teratomas of the conus medullaris in adults are rare and may mimic more common intradural lesions on imaging. MRI findings are nonspecific and histopathology remains the gold standard for diagnosis. Complete surgical excision is the treatment of choice and can achieve excellent outcomes with preservation of neurological function. This case underlines the importance of considering teratoma in the differential diagnosis of intradural conus medullaris lesions, even in adult patients.

ID: AGS26/3206
P1135: Spinal metastases from an intracranial anaplastic meningioma: a rare case and review of the literature introduction

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Introduction: Meningiomas are usually benign tumors, but atypical and anaplastic variants may exhibit aggressive behavior, including extracranial metastases. Spinal dissemination is exceedingly rare, representing approximately 0.1% of operated meningiomas. We report a case of multiple spinal metastases from an intracranial anaplastic meningioma, with a review of the literature. **Material and Methods:** A patient with a history of surgically treated intracranial meningioma was admitted with progressive spinal symptoms. Clinical presentation, radiological findings, and histopathological features were analyzed. Literature data regarding spinal meningioma metastases were reviewed to contextualize this case. **Results:** Spinal MRI revealed multiple vertebral lesions consistent with metastatic involvement. Histopathological analysis confirmed metastatic deposits originating from the previously diagnosed intracranial anaplastic meningioma. The patient's clinical course was marked by progressive neurological decline despite multidisciplinary management. **Conclusion:** Spinal metastases of meningiomas are extremely rare but should be considered in patients with a history of atypical or anaplastic meningiomas presenting with new spinal symptoms. The prognosis of metastatic meningiomas depends largely on the histological subtype, with anaplastic variants carrying a poor outcome. This case underlines the importance of long-term follow-up in patients with high-grade meningiomas and raises awareness of their metastatic potential.

ID: AGS26/3212
P1136: Malignant hematologic diseases with vertebral involvement: a retrospective series of 11 cases

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Introduction: Spinal involvement in hematologic malignancies accounts for 5-13% of tumor-related spinal cord compressions, and may be inaugural. Multiple myeloma and non-Hodgkin lymphoma are the most frequent etiologies. **Material and Methods:** We retrospectively reviewed 11 patients surgically treated for vertebral involvement of hematologic malignancies between 2017 and 2025. The cohort included 5 men and 6 women, mean age 53 years (range 31-84). All underwent spinal MRI and surgical management consisting of laminectomy with instrumentation (n = 9), corporectomy with fixation (n = 1), or CT-guided biopsy (n = 1). **Results:** The main presenting symptoms were motor weakness (n = 8), radicular pain (n = 2), and sphincter dysfunction (n = 1). Neurological examination revealed paraparesis in 2 cases and complete paraplegia in 7. MRI showed thoracic involvement in 7 cases and lumbar in 4, with vertebral body lesions in 8, combined vertebral and posterior arch involvement in 3, and epidural extension in 9. Histopathology revealed multiple myeloma (n = 4), plasmacytoma (n = 3), B-cell lymphoma (n = 3), and acute myeloid leukemia (n = 1). Spinal involvement was the first manifestation of hematologic disease in 9 patients. Adjuvant therapy included chemotherapy (n = 9) and radio-chemotherapy (n = 2). At 3 years, survival was 45% (5/11 patients). **Conclusion:** Vertebral localizations of hematologic malignancies are a rare but serious cause of spinal cord compression. MRI is the gold standard for diagnosis and assessment of extension. Surgical decompression with stabilization, combined with systemic therapy, provides symptom relief and functional improvement. Prognosis remains poor and is mainly determined by early diagnosis and the underlying hematologic disease.

ID: AGS26/3214
P1137: Paraspinal muscle fatty infiltration and Modified Frailty Index as predictors of perioperative outcomes in patients treated surgically for spinal metastatic disease

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Introduction: The objective of this study was to identify the role of lumbar paraspinal muscle fatty infiltration, as quantified by the Goutallier classification, and perioperative outcomes in patients undergoing surgical treatment for metastatic spinal disease. **Material and Methods:** Patients undergoing surgical intervention for metastatic spinal disease were retrospectively identified through a single institution since 2021. Preoperative magnetic resonance imaging at the L4-5 level was used to assign Goutallier grades of paraspinal muscle fatty infiltration. Baseline demographics, comorbidities, and frailty status were collected using the Modified Frailty Index (MFI-5). Outcomes of interest included length of hospital stay, discharge disposition, postoperative complications and adverse events, readmission and reoperation rates within 180 days, and morbidity (death). The relationships between demographics, Goutallier grade, MFI-5 score, and postoperative outcomes were analyzed using Chi-squared analyses, Kruskal-Wallis tests, and multivariable regression. **Results:** A total of 43 patients met inclusion criteria**,** 27 males and 16 females with a mean age of 65.7 years and mean Goutallier grade of 2.16**.** Tumor types varied including prostate (n = 9), lung (n = 7), renal (n = 6), and breast (n = 2). There was no significant association between Goutallier grade and length of stay (p = 0.410), surgical time (p = 0.407), reoperation (p = 0.485), readmission (p = 0.557), or non-home discharge (p = 0.472). Complication rates overall did not differ significantly when deaths were included as complications (p = 0.470). However, analysis of death as a distinct morbidity outcome revealed a significant association with Goutallier grade (p = 0.029), with higher Goutallier scores, particularly grade 4, demonstrating increased mortality risk. **Conclusion:** Paraspinal fatty infiltration was not associated with differences in perioperative resource utilization or general complication rates. However, higher Goutallier grades were significantly linked to increased mortality following surgery for spinal metastasis. These findings support fatty infiltration as a potential noninvasive imaging biomarker of poor prognosis and mortality risk in this population, providing value for preoperative counseling and individualized risk stratification.

ID: AGS26/3219
P1138: Sacral chordomas: a series of four cases

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Introduction: Chordomas are rare malignant bone tumors arising from notochordal remnants. They represent the most frequent sacral tumors, predominantly affecting patients over 50 years old. We present a retrospective analysis of four patients treated for sacral chordoma over the past twenty years, focusing on clinical presentation, imaging, surgical management, complications, and postoperative outcomes. **Material and Methods:** Four male patients aged 52-89 years (mean 70) were included. Clinical, radiological, surgical, and follow-up data were retrospectively analyzed. **Results:** All patients presented with localized sacral pain; one had bilateral sciatica, and another had a palpable sacral mass. Preoperative bladder dysfunction was present in all patients, with one also showing

perineal hypoesthesia. No motor deficits were observed. Preoperative pulmonary metastases were found in the oldest patient. Surgical management included subtotal resection in two patients and partial resection in the other two. Recurrence occurred in all cases, prompting reoperation in three patients. Overall survival ranged from 17 months to 11 years (mean 47 months). **Conclusion:** Sacral chordomas are rare but aggressive tumors. Maximal surgical resection remains the treatment of choice, reducing recurrence and metastasis risk, but often at the cost of significant neurological sacrifice. Early diagnosis is essential to optimize surgical outcomes and preserve function. Long-term follow-up is mandatory due to the high rate of recurrence.

ID: AGS26/3228
P1139: From collapse to comeback: paediatric cervical Ewing's sarcoma response to chemo-radiotherapy

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Introduction: Ewing's sarcoma is a malignant tumour that most frequently affects children and adolescents. Ewing's sarcoma involving the cervical spine is exceptionally rare in children. Early clinical presentation may be subtle, often as persistent spinal pain without neurological deficit. Here, a young boy presented with Ewing's sarcoma of the C4 vertebra with soft tissue invasion and spinal cord compression. **Material and Methods:** A boy in his first decade presented with gradually worsening neck pain over several weeks. The pain was localised and not associated with recent trauma, fever, or systemic symptoms such as night sweats or weight loss. MRI of the spine revealed collapse of the C4 vertebral body, with hyperintense soft tissue spanning prevertebral and neural foramina regions and accompanying para-spinal extension. No major cord compression was seen, and the remainder of the spine was unremarkable. CT-guided biopsy of the lesion was performed. Histopathological examination revealed uniform small, round, blue cells arranged in sheets with necrosis and occasional vague rosette formations. Immunohistochemistry was positive for vimentin, CD99, NKX2.2, and FLI1, and negative for synaptophysin, chromogranin, WT1, and MyoD-1-confirming Ewing's sarcoma. Staging workup, including PET-CT, revealed disease localised to the cervical spine without evidence of distant metastases. The child was started on an interval-compressed regimen of chemotherapy comprising vincristine, doxorubicin, and cyclophosphamide, alternating with ifosfamide and etoposide (VAC/IE protocol). Definitive radiotherapy was subsequently delivered to the cervical spine to maximise local control. **Results:** The patient showed rapid improvement in pain and energy levels within months of commencing therapy. Functionally, he resumed full participation in school and regular childhood activities. Repeat imaging with MRI and PET-CT post-therapy showed resolution of the soft tissue component, persistence of vertebral collapse (vertebra plana), and no evidence of active or metastatic disease. No neurological deficits or late toxicity have been observed over one year of surveillance. Continued monitoring for recurrence, spinal deformity, or long-term sequelae is ongoing. **Conclusion:** Persistent neck pain in children warrants prompt MRI and staged diagnostic workup to exclude malignancy. Chemotherapy and targeted radiotherapy are the pillars of modern management for spinal Ewing's sarcoma. Non junctional, stable, neurologically intact paediatric patients should be managed with combined chemo-radiotherapy. Surgery should be reserved for instability or neurological compromise.

ID: AGS26/3238
P1140: Primary intradural cervical malignant melanoma: a case report

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Introduction: Primary malignant melanoma of the central nervous system (CNS) is extremely rare, with spinal involvement being even less common. It belongs to the group of CNS melanocytic tumors. We report a case of intradural cervical melanoma causing spinal cord compression. **Material and Methods:** A 51-year-old male with no significant medical history presented with 6 months of left C6 radicular pain, gait disturbances, bladder dysfunction, and sexual impotence. Neurological examination revealed spastic gait, quadripyramidal syndrome, bilateral Babinski, positive Hoffmann, and a sensory level above C5. MRI of the cervical spine showed a 3.2 cm intradural, extramedullary posterolateral lesion extending from C5 to C7, displacing the spinal cord anteriorly, with heterogeneous T1 signal, superior hyperintense "cap sign," moderate gadolinium enhancement, and heterogeneous T2 signal. Systemic work-up was negative. Surgical intervention consisted of total resection via posterior approach. Histopathology and immunohistochemistry were used to confirm diagnosis. **Results:** Postoperatively, radicular pain, gait disturbance, and bladder dysfunction significantly improved. Residual pyramidal signs and sexual dysfunction persisted. Follow-up MRI showed no local recurrence. Systemic evaluation excluded a primary melanoma elsewhere, confirming the diagnosis of primary intradural malignant melanoma. **Conclusion:** Primary intradural cervical melanoma is rare. MRI facilitates preoperative suspicion, but histopathology is definitive. Surgical resection is the main treatment, often combined with adjuvant radiotherapy.

Prognosis can be favorable with regular MRI follow-up to detect local or distant recurrence.

ID: AGS26/3245
P1141: Spinal Ewing sarcoma: report of two cases

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Introduction: Primary spinal Ewing sarcoma is rare. Management typically involves a combination of surgery and adjuvant radio-chemotherapy. Prognosis remains poor due to aggressive tumor biology and potential neurological compromise. **Material and Methods:** We report two pediatric cases of primary spinal Ewing sarcoma surgically treated between 2018 and 2025. Clinical presentation, imaging, surgical intervention, and outcomes were analyzed. **Results: Case 1:** An 11-year-old boy with no prior history presented with acute spinal cord compression over 10 days, showing flaccid paraplegia and hypoesthesia at D10-D12. MRI revealed a right paravertebral mass with intracanalar extension from D10 to L2. He underwent D12-L3 laminectomy with complete tumor resection. Postoperatively, partial neurological improvement was observed. Systemic staging was negative. Despite adjuvant radio-chemotherapy, the patient died 10 months later from medullary aplasia. **Case 2:** A 5-year-old girl presented with a 2-month history of spinal cord compression, including spastic tetraparesis and sphincter dysfunction. Imaging revealed C2 osteolysis with dysplastic changes. Posterior surgical decompression was performed emergently. Postoperative neurological status remained stable. She died 7 months later from acute respiratory distress due to infection. Both patients demonstrated rapid neurological compromise. Surgery allowed partial or temporary symptom relief, but long-term outcomes were poor despite multimodal therapy. **Conclusion:** Spinal Ewing sarcoma is a rare but aggressive malignancy in children. Early recognition is critical, particularly in young patients presenting with lytic vertebral lesions and soft tissue involvement. Prognosis remains guarded, even with aggressive surgical and adjuvant treatment.

ID: AGS26/3290
P1142: Emergency detection of compressive spinal tumors: differential diagnosis with acute trauma - Literature review

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Introduction: Acute paraparesis or quadriparesis often prompts suspicion of spinal trauma in emergency settings. However, compressive spinal tumors may present with a similar acute neurological picture, posing a diagnostic challenge. Early differentiation is critical to guide appropriate management and avoid delays in treatment. **Material and Methods:** A systematic literature review was conducted using PubMed and Google Scholar with the keywords: "compressive spinal tumor," "emergency presentation," "acute paraparesis," "differential diagnosis," and "spinal trauma." Studies describing cases of acute neurological deficits initially suggestive of trauma but ultimately attributed to neoplastic lesions were included. Data on clinical presentation, imaging findings, diagnostic delays, and outcomes were extracted. **Results:** Compressive spinal tumors may mimic acute traumatic cord injury, particularly when symptom onset is rapid. MRI is the gold standard for differentiation, revealing expansile lesions, vertebral body destruction, or epidural masses not apparent on standard X-rays. Misdiagnosis as trauma can lead to inappropriate immobilization and delay in definitive neurosurgical or oncological intervention. Early imaging and awareness of red flags (e.g., progressive deficits, history of malignancy, back pain preceding acute weakness) improve diagnostic accuracy and patient outcomes. **Conclusion:** In emergency settings, acute paraparesis may result from compressive spinal tumors rather than trauma. Prompt MRI and clinical vigilance are essential for accurate diagnosis, timely neurosurgical referral, and optimized neurological recovery. Emergency physicians must consider neoplastic causes in the differential diagnosis of sudden spinal cord syndromes.

ID: AGS26/3298
P1143: Bifocal spinal cord intramedullary cavernous malformations: case report

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Introduction: Cavernous malformations or cavernoma are hamartomas-like uncommon vascular malformations of the central nervous system characterized by abnormally dilated blood vessels with a thin endothelium without intervening normal nervous tissue. Spinal cord cavernomas are rare entity but has been reported in literature. **Material and Methods:** Here, we report an extremely rare case of bifocal localization of spinal cord intramedullary cavernous malformations in the cervical and thoracic regions. A 40-year-old Arabic man, who presented with a three month history of acute cervical and thoracic pain with progressive weakness of right lower limb. Neurological examination revealed a spastic monoparesis of his right leg. Spinal cord MRI revealed two cavernous malformations at cervical and thoracic level. The patient underwent a surgical excision of the two lesions and a histopathological examination done by two different pathology laboratories revealed the features of cavernous malformation. **Conclusion:** Spinal cord intramedullary cavernous malformations although rare have a significant morbidity. It should be diagnosed early on a range of nonspecific clinical and MRI findings and then treated early.

ID: AGS26/3309
P1144: Lumbar spinal epidural angiolipoma mimicking a discal herniation

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Introduction: Spinal angiolipomas are fairly intrequent benign tumours that are usually located in the epidural space of the thoracic column and represent 0.14% to 1.3% of all spinal tumours. Lumbar angiolipomas are extremely fare, representing only 9.6% of all apinal extradural angiolipomas. **Material and Methods:** The present report describes a rase case of a lumbar epidural angiolipoma, in a 38 year-old woman presenting with a S days history of paralytic sciatalgia. The clinical examination, found an obesity, and a neurological deficit of the right leg, Th lumbar CI; showed a typical image of a discal herniation at the LA-15 level. Per operative, we are estonished not to find a discal herniation, but a fibrous sticky yellowish hyper vascular tumor in the anterior epidural space, encompassing the dural sheath, and fusing into the foramina of L5. Histological study revealed the tumor as an angiolipoma. Symptoms were relieved after tumor excision, with immediate recovery of the deficit, after one month, there were no sequelae. **Conclusion:** Although extremely rare, lumbar epidural angiolipoma should be considered in the differential diagnosis of lumbar spinal epidural lesions. MRI is essential for diagnosis. The prognosis after surgical management of this lesion is favorable.

ID: AGS26/3311
P1145: A rare convergence: multiple spinal schwannomas and spinal instability in a non-NF2 patient

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Introduction: Schwannomas are a benign encapsulated tumors arising from Schwann cells of the nerve sheath, that can occur anywhere in the central nervous system. They most commonly occur however at the cerebello-pontine angle and the lumbar region. Schwannomas occurring at the conus medullaris and the Cerebello-pontine angle in the same patient however represent a rare association, especially in the absence of predisposing conditions such as type 2 neurofibromatosis. the occurrence of these tumours in patients showing no signs of NF-2 represents a rare occurrence, rarely reported in the literature. One more particularity reported in this case is the 20-year period that separates the symptoms of these two pathologies, thus raising the question on the pathophysiological phenomena at work in the absence of NF-2. **Case Report:** We report the case of a 60-year-old patient, who has a history of a cystic schwannoma of the right fifth cranial pair who consulted for a left L5 sciatica that has started about one year prior to consultation, and resisted to medical treatment. He had no history of trauma or fever. Upon clinical examination, the patient exhibited severe pain with difficulty walking, he reported a Visual analogue pain of 7/10. He however had no motor deficit, his reflexes were present, and the urogenital sphere examination as well as The cutaneous and ophthalmological examination showed no particularities, no signs of neurofibromatosis notably. His spine Radiographies showed a grade 1 listhesis between the L3-L4 and L4-L5 vertebrae. His spinal MRI showed multiples masses of the conus terminalis and spina equina whose radiologic characteristics were consistent with spinal schwannomas. The patient was operated on via a posterior approach, 12 pedicle screws were placed in the D11 to L4 vertebrae, and the tumors were removed in their entirety. The post operative course was

uneventful, and the patient was discharged on day 3. **Discussion:** Spinal schwannomas are relatively uncommon, accounting for approximately 0.3% of all primary intraspinal tumors. They most frequently occur in the lumbar region and typically originate from the dorsal nerve roots. While multiple spinal schwannomas are well-documented in patients with Neurofibromatosis Type 2 (NF-2), their presence in individuals without any clinical signs of NF-2 is exceptionally rare and sparsely reported in the literature. In this case report, we present a 60-year-old patient with a prior history of a cystic schwannoma affecting the right fifth cranial nerve. The patient sought medical attention for left-sided L5 sciatica. Imaging studies revealed multiple schwannomas located at the conus medullaris, along with evidence of spinal instability-an additional factor that complicated the surgical approach. The coexistence of multiple spinal schwannomas and spinal instability in a patient with a history of cranial nerve schwannoma, yet no signs of NF-2, represents a highly unusual clinical scenario. This rare constellation of findings highlights the importance of thorough diagnostic evaluation and individualized surgical planning, and it underscores a gap in the current literature that warrants further exploration. **Conclusion:** This case illustrates a rare presentation of multiple spinal schwannomas in a 60-year-old male patient, that has a history of a schwannoma of the fifth cranial pair. A multidisciplinary approach, including advanced imaging, and mutlidisciplinary surgical management, is crucial for accurate diagnosis and optimal patient outcomes.

ID: AGS26/3329
P1146: The hidden lesion - Cervicothoracic intramedullary ependymoma as a diferential diagnosis - A case report

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Introduction: A 61-year-old female presented with a one-year history of low back pain radiating to the left leg, accompanied by progressive neurological deficits that started with paresthesia on both legs and feet. Imaging of the lumbar spine revealed a grade I L4-L5 spondylolisthesis in the Meyerding scale, with mild central canal stenosis. Surgical management was pursued due to the severity of symptoms. The patient underwent a L4-L5 laminectomy and posterior fusion. During the procedure there was an incidental dural tear. After surgery the patient showed improvement in pain and neurological symptoms but a few days later a Cerebrospinal fluid (CSF) leak was noticed. The patient remained in conservative treatment suggested by the surgeon, until there was no more evidence of CSF leakage, which spanned for the next four months. A few days after the CSF leak stopped the patient started to progressively worsen again until she initiated to have paraparesis that evolved for the next two months, when she finally came to our consultation for the first time and was evaluated in our center. **Materials and Methods:** The patient's surgical and clinical reports were inspected. All the imaging files the patient had as well as the surgical video for the surgery we performed. When the patient was initially evaluated in our center, she presented with signs of progressively worse tetraparesis, with a grade 1 muscle strength on the lower limbs and grade 4 on the upper. A cervical and thoracic magnetic resonance image (MRI) was done and an intramedullary lesion was diagnosed between C7 and T3. A new surgery was proposed and the patient agreed. We performed laminotomy of C6 through T4, myelotomy, complete tumor resection, and laminoplasty. **Results:** Postoperatively, the patient's neurological status stabilized, with modest improvement in lower extremity strength by the fifth postoperative day, achieving a grade 2 muscle strength and allowing for discharge. A postoperative MRI showed a completed removal of the tumor with no surgical complications. **Conclusions:** This case highlights the importance of maintaining a broad differential diagnosis in patients presenting with new neurological deficits after spinal surgery. The unexpected detection of an intramedullary ependymoma underlines the value of comprehensive imaging and clinical vigilance. The initial improvement after the first surgery and its correlation to the CSF leak could've suggested other etiologies. Early surgical intervention was crucial in achieving partial neurological recovery and preventing further deterioration.

ID: AGS26/3361
P1147: Spinal skeletal metastases with local gelatinous production from primary pancreatic adenocarcinoma presenting with lower limb paraparesis

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Introduction: Pain and neurological symptoms in trauma surgery are often attributed to mechanical injury.Sometimes, that masks pathological processes occurring in the

background. Neoplastic cell disseminations in the spine are a rare occurrence, especially in patients with an unknown existing malignant process.In metastatic tumors, the most common are adenocarcinomas, especially from the lungs, breast, and prostate, while those from the pancreas occur much less often. When they appear, their most common localization in the spine is the thoracic and lumbar parts. In this case, we will show how a malignant involvement of the spine was incidentally discovered, which points out the importance of clinical thinking and differential diagnosis. **Case presentation**: In this case, we present a 62-year-old man that presented to the emergency department with complaints of progressive muscle weakness in the legs, and inability to walk and stand, for the last 3 months, which gradually worsened. He also had upper back pain for 6 months, for which he received anti-inflammatory drugs without improvement. On examination, complete sensation was preserved. Asia scored with an incomplete lesion Gr C. A series of examinations were performed, including CT and MRI of the thoracic spine, Bone scintigrafy, which showed pathological osteolytic fractures of the thoracic vertebral bodies III, IV and V, with compression of the spinal cord at the same level by the soft tissue substrate. An operative intervention was performed with transpedicular fixation (two levels above and below) and laminectomy, and a ground biopsy that was negative. Lab Tu marker shown Ca19-9 194 idicative for panreatic carcinoma. After the surgery the pain subsided and he started moving independently, with a walking aid and was sent to do physical therapy. Furthermore, in consultation with a gastroenterologist and oncologist, a pancreatic biopsy was performed, which finally confirmed the primary tumor pathologically (Moderately differentiated G2 invasive pancreatic ductal adenocarcinoma) and the patient began chemotherapy. 3 months after the surgery, the patient complained of pain in the surgical region, and on examination a large amount of fluctuating content was noted locally, which upon puncture, showed gelatinous mucinous material that continuously increased in the following period, which was resolved by placing a catheter. **Conclusion:** This case illustrates the importance of not overlooking the rare possibility of metastases. The appearance of pathological fractures of the vertebral bodies, besides other things, can be thought of as secondary metastases. This makes us think about their origin. What makes this case interesting is the serous mucin secretion from the disseminated neoplastic cells at the thoracic spinal level even after paliative surgical fixation and decompresion was made. Unfortunately, we are talking about terminal patients. However, an operational approach can significantly improve the quality of remaining life.

Keywords: Spinal metastases, paraparesis, mucin producion, pancreatic adenocarcinoma

ID: AGS26/3367
P1148: Aggressive Vertebral Hemangioma in a Pediatric Patient: A Rare Cause of Acute Spinal Cord Compression"

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Introduction: While Spinal hemangiomas typically present as benign slow growing asymptomatic lesions, they can rarely present extraosseous expansion and spinal cord compression, thus exhibiting atypical behaviour characteristic of "Aggressive hemangiomas" which are a rare type of hemangiomas which can be responsible of serious comorbidities and functional consequences through compression of the spinal cord. **Case Report:** We report the case of a 14-year-old male patient, with no medical history, who presented to the emergency room with complaints of weakness and sensitive loss of the legs as well as pain. He had no history of trauma or fever. On neurological examination the patient presented a paraparesis and diminished sensitivity at the level of the D6 vertebra. His patellar and achileen reflexes were increased with bilateral Babinski sign.His MRI showed a spinal mass at the level of the D6 vertebra that was responsible of compression of the spinal cord, whose caracteristics were consistant with an aggressive hemangioma. Emergency decompressive surgery was performed, and a decompressive posterior dorsal laminectomy was performed with significant improvement of the symptomes. However, the patient developed kyphosis post operatively, and so a second stage surgery was performed to remove the tumour and reestablish the sagittal balance. **Discussion:** Aggressive *hemangiomas* can exhibit extraosseous extension, cortical bone erosion, and spinal cord compression. These caracteristics were responsible In this case,of acute paraparesis, sensory deficits, and hyperreflexia. The MRI remains the cornerstone for diagnosis, with aggressive hemangiomas typically showing hyperintense signals on T1- and T2-weighted sequences and evidence of epidural extension. Surgical decompression is often the first-line treatment in cases of neurological compromise. In our patient, posterior laminectomy provided immediate relief of symptoms. However, the development of postoperative kyphosis highlights a known complication of extensive laminectomy, especially in the pediatric population where spinal biomechanics are still evolving. The need for a second-stage surgery to remove the tumor and restore sagittal balance underscores the importance of considering spinal stability during initial surgical planning. This case also raises awareness of the rare but serious nature of aggressive hemangiomas in children. While most literature focuses on adult presentations, pediatric cases-though infrequent-require prompt

recognition and multidisciplinary management to prevent long-term disability. **Conclusion:** This case underscores the importance of recognizing aggressive spinal hemangiomas as a potential cause of acute neurological deterioration, even in children. Prompt imaging and surgical decompression are critical to prevent irreversible deficits. Furthermore, careful surgical planning is essential to mitigate postoperative complications such as kyphosis, particularly in the growing spine. Multidisciplinary care and long-term follow-up are key to optimizing outcomes in these complex cases.

ID: AGS26/3378
P1149: Agressive spinal haemangioma Enneking Type II: case series and literature review

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Introduction: Vertebral hemangiomas are common and typically benign vascular lesions, with a prevalence of 10-12% in the general population and 2-3% of spine tumors. A small group of hemangiomas are categorised as aggressive haemangiomas. Operative haemangioma cases are rare. The salient features leading to operative care are acute presentation, presence of neurological deficit, intractable spinal or radicular pain and spinal instability. **Materials and Methods:** Our study is a retrospective study of case series of 8 cases of different age and sex. It included data from medical records, radiology and pathology reports. Study and research factors included age, sex, severity and acuity of clinical presentation, presence of neurological deficit, radiological findings, spinal instability, intervention done, post intervention outcome and follow up period. **Results:** In our series, age varied from 18 to 70 years with mean age of 45 years. Male to female ration was 2:1. One case was diagnosed in pregnant female. A 100% of our cases presented <4 months, three cases presented with acute neurological deterioration within 1 weeks and needed urgent surgical decompression. Seven out of 8 cases had neurological deficit (87.5%). All our cases were managed purely by surgical intervention (7 cases underwent spinal decompressive laminectomy, one case had surgical decompression and posterior spinal fixation) without the need for preoperative embolization. Intraoperative blood loss varied between 400-1300 ml. All cases had improvement of their symptoms and satisfactory clinical outcome with no complications. **Conclusion:** According to our series, rapid speed of onset, neurological deficit and painful instability are key factors in determining surgical intervention. Surgical decompression laminectomy is an acceptable surgical option to treat aggressive spinal haemangiomas with satisfactory clinical and radiological outcome.

ID: AGS26/3424
P1150: Primary thoracic melanocytoma: a case report and review of the litterature

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Introduction: Primary melanocytomas of the central nervous system are exceedingly rare, with the lumbar and thoracic spinal cord being uncommon sites of occurrence. These tumors typically arise at the cranial base, ventral medulla, or cervical spinal cord due to the higher concentration of leptomeningeal melanocytes in these regions. **Material and Methods:** We report the case of a 42-year-old male who presented with a three-month history of thoracolumbar back pain and progressive gait disturbance. Neurological examination revealed paraparesis and urinary retention. Spinal MRI identified a 31 × 15 × 13 mm intradural extramedullary mass at the D11 level, with evidence of intralesional hemorrhage. **Results:** The patient underwent subtotal resection of the lesion. Postoperatively, there was no significant recovery of motor function or bladder control. Histopathological analysis confirmed the diagnosis of spinal cord melanocytoma. The patient was discharged and referred for rehabilitation and adjuvant radiation therapy. **Conclusion:** Spinal melanocytomas are rare entities that pose diagnostic and therapeutic challenges. While surgical resection remains the primary treatment, achieving total removal is often limited by the tumor's location and adherence to neural structures. Postoperative functional recovery may be incomplete, emphasizing the need for multidisciplinary management, including rehabilitation and radiotherapy, to optimize long-term outcomes.

ID: AGS26/2330
P1153: Spinal Cord Metastasis of a Diffuse Large B-Cell Lymphoma: A RareClinical Presentation

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Introduction: Primary central nervous system (CNS) lymphomas are rare in immunocompetent patients. Among them, diffuse large B-cell lymphoma (DLBCL), a subtype of non-Hodgkin lymphoma, is the most frequent and typically involves the brain. Secondary CNS involvement from nodal lymphomas, particularly intramedullary metastases, remains exceptional. **Material and Methods:** We report the case of a 57-year-old patient with a history of DLBCL treated with

chemo- and radiotherapy, achieving complete remission. He presented with severe right-sided lumbosciatalgia, resistant to conventional analgesics and persisting at rest. Spinal MRI revealed a tumoral process of the conus medullaris extending to the cauda equina roots. Histopathological examination confirmed a secondary localization of lymphoma. **Results:** We report the case of a 57-year-old patient with a history of DLBCL treated with chemo- and radiotherapy, achieving complete remission. He presented with severe right-sided lumbosciatalgia, resistant to conventional analgesics and persisting at rest. Spinal MRI revealed a tumoral process of the conus medullaris extending to the cauda equina roots. Histopathological examination confirmed a secondary localization of lymphoma. **Conclusion:** Intramedullary metastases are uncommon but may occur in both immunocompetent and immunocompromised patients. In individuals with a history of lymphoma, such lesions should raise strong suspicion, though histological confirmation by surgical biopsy remains essential. Chemotherapy continues to be the mainstay of treatment, while these cases highlight the need for awareness of rare but severe CNS presentations of systemic lymphomas.

ID: AGS26/2326
P1152: Osteochondroma of the Cervical Spine: An Exceptional Atlas Localizationin a Child

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Introduction: Osteochondroma typically affects long bones, either as a solitary lesion or in the context of multiple hereditary exostoses. Spinal involvement is rare, accounting for only 1 -4% of all cases, and localization to the atlas is exceptional. **Material and Methods:** We report the case of a 13-year-old girl with a solitary osteochondroma arising from the posterior arch of the atlas, revealed by a posterior cervical swelling without associated neurological deficits. Preoperative imaging suggested the diagnosis, which was confirmed by histopathological examination following en bloc surgical excision of the lesion. **Results:** We highlight the radiological features of spinal osteochondromas and the surgical challenges posed by their proximity to critical structures, including the spinal cord and vertebral artery. Although rare, high cervical spine localizations are readily diagnosed with imaging. Surgery remains the treatment of choice, aiming for complete resection. **Conclusion:** The pathogenesis of osteochondromas remains uncertain. Prognosis is generally favorable after total excision, but potential complications such as neurological compression or, more rarely, sarcomatous transformation, justify surgical management even in asymptomatic cases.

ID: AGS26/2322
P1151: Extradural Spinal Metastasis from Nasopharyngeal Carcinoma Presenting with Acute Cord Compression: A Rare Case

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Introduction: Spinal metastases are a common cause of epidural spinal cord compression,most frequently originating from lung, breast, or prostate cancer. Metastaticspread from nasopharyngeal carcinoma (NPC). **Material and Methods:** We present the case of a 50-year-old male with no significant past medical history who was admitted with rapidly progressive motor weakness of the lower limbs, gait disturbance, and sphincter dysfunction. Neurological examination revealed spastic paraparesis with sensory level and signs of cord compression. Magnetic resonance imaging (MRI) of the spine demonstrated an extradural mass causing severe compression of the spinal cord. The patient underwent emergency decompressive laminectomy with complete excision of the lesion. Postoperatively, there was partial neurological improvement. Histopathological examination of the specimen revealed metastatic carcinoma consistent with nasopharyngeal origin. Subsequent investigations confirmed the presence of a nasopharyngeal primary tumor. **Results:** Subsequent investigations confirmed the presence of a nasopharyngeal primary tumor. **Conclusion:** Extradural spinal metastasis from NPC is an exceptional occurrence. This case illustrates the importance of considering metastatic disease in patients presenting with acute spinal cord compression and emphasizes the role of urgent surgical decompression followed by oncological management.