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RESEARCH

Single double-loaded anchor repair of isolated Lafosse III subscapularis tears in patients not involved in physically demanding activities provides satisfactory functional and radiologic outcomes at minimum 5-year follow-up

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Abstract

Purpose To evaluate the outcomes of single-anchor repair for isolated Lafosse III subscapularis tears in patients not engaged in physically demanding activities.

Methods Patients with isolated subscapularis tears who underwent arthroscopic surgery between 2014 and 2020 were retrospectively evaluated. The inclusion criteria were patients who underwent single double-loaded anchor repair for Lafosse III tears and were not involved in physically demanding activities. Assessments included the American Shoulder and Elbow Surgeons (ASES) score, Constant-Murley Score (CMS), Visual Analog Scale (VAS), range of motion, specific clinical tests, and magnetic resonance imaging encompassing tendon integrity, cross-sectional area (CSA), vertical diameter, and transverse diameters.

Results 27 patients (mean age 52.4 ± 10.3 years; mean follow-up 80.8 ± 18.6 months) were included in the study. The final follow-up demonstrated significant improvements in the ASES (44.0 ± 12.4 to 82.4 ± 14.1), CMS (49.1 ± 15.3 to 85.3 ± 11.1), VAS (5.7 ± 2.1 to 1.3 ± 2.2), and internal rotation (L4 to T8) ($p < 0.001$ for all). The positivity of clinical tests decreased substantially: Bear-Hug, from 93% to 18%; Belly-Press, from 89% to 15%; and Lift-Off, from 89% to 18% ($p < 0.001$ for all). Radiological analyses indicated maintained tendon integrity in 93% of patients and increases in CSA (1.292 ± 453 to 1.544 ± 609 mm²) and vertical diameter (72.2 ± 11.9 to 82.2 ± 15.3 mm) ($p < 0.001$ for both).

Conclusions Single double-loaded anchor repair provides satisfactory functional recovery and tendon integrity after five years in patients with isolated Lafosse III subscapularis tears who are not involved in physically demanding activities. These findings suggest using a single anchor offers surgeons a reliable method that combines technical simplicity with durable clinical success in patients without high functional demands.

Level of evidence Level IV, therapeutic study, retrospective case series.

Keywords Subscapularis tears · Isolated tears · Single anchor · Lafosse classification · Functionel outcomes · Repair integrity

Introduction

The subscapularis muscle is the *largest* and *strongest* among the rotator cuff muscles [1–4]. Furthermore, Burkhart et al. [5] introduced another "-st" to the description, noting that arthroscopic subscapularis repair is the *last* component of rotator cuff repair to be mastered. The primary goal of such repair is to restore joint function through adequate fixation [6–9]. Accordingly, studies reported that a stable construct in isolated subscapularis tears can be achieved using a single suture anchor for tears involving the upper one-third, and multiple anchors for larger tears [6, 7, 10–14].

However, the optimal number of anchors remains uncertain in upper two-thirds tears of the tendon, namely in

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Lafosse type III tears [15]. Although increasing the number of anchors is considered preferable for tears involving more than the upper one-third [10, 11, 16–18], several studies have reported that such tears can be repaired with a single anchor [1, 2, 19–23]. Furthermore, biomechanical studies have reported that single-anchor repairs in subscapularis tears involving half of the tendon demonstrate similar biomechanical performance to those involving upper quarter [24, 25]. Nevertheless, there is still insufficient clinical evidence to confirm whether this biomechanical performance of a single anchor can be reflected in clinical outcomes. Considering these aspects, a study investigating the outcomes of isolated Lafosse III subscapularis tear repairs using a single anchor in patients with defined clinical profiles could provide valuable guidance for surgeons in determining clear surgical treatment strategies.

Therefore, this study aimed to evaluate the outcomes of single-anchor repair for isolated Lafosse III subscapularis tears in patients not engaged in physically demanding activities. We hypothesized that arthroscopic single double-loaded anchor repair would provide satisfactory functional and radiological results at a minimum follow-up of five years.

Methods

Study design and patient selection

A retrospective cohort design was employed to investigate patients with isolated subscapularis tears who underwent arthroscopic repair between November 2014 and September 2020. The study protocol was approved by the Institutional Review Board (No. ……), and informed consent was obtained from all patients included in the study. The research complied with the ethical guidelines established by the Declaration of Helsinki. Also, this study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cohort studies; the completed checklist is provided as Supplementary Material. The surgical procedures were performed by a senior orthopedic surgeon (….) with specialized expertise in shoulder surgery. The inclusion criteria were (1) patients who underwent arthroscopic repair of isolated Lafosse III subscapularis tears using a single suture anchor; (2) a minimum postoperative follow-up duration of five years; and (3) availability of complete data, including patient-reported outcome measures (PROMs), surgical video recordings, and magnetic resonance imaging (MRI). The exclusion criteria were (1) isolated Lafosse I (partial upper one-third tears), II (complete upper one-third tears), and IV (complete tear of the tendon) subscapularis tears; (2) previous surgery on the affected shoulder; (3) glenohumeral joint osteoarthritis; (4) active participation in shoulder-involving sports activities or working in heavy occupations (Tegner activity scale ≥ 4, including swimming); these patients were treated with two suture anchors; (5) incomplete imaging or clinical data; and (6) patients who did not attend the final follow-up assessment or refused to undergo MRI [15]. The study flowchart is provided in Fig. 1. A final assessment was planned for all patients who met the inclusion criteria, including clinical examination and MRI acquisition.

Surgical procedure

The patients were operated in the semilateral decubitus position. The arthroscopic procedure began with insertion into the glenohumeral joint via the posterior viewing portal, utilizing a probe that was introduced through the anterior portal. A systematic evaluation of the rotator cuff, glenohumeral labrum, and long head of the biceps tendon (LHBT) was performed. Following the intra-articular assessment, the subacromial space was examined through the posterior portal. After completing the general arthroscopic overview, a detailed assessment of the subscapularis tendon was conducted (Fig. 2A-B). Both 30° and 70° arthroscopes were used to determine the amount of detachment. A posterior-level push maneuver, applied by an assistant, was employed to enlarge the subcoracoid space for better visualization. Lesion characterization was completed by the senior surgeon (….) according to Lafosse classification [15]. An additional anterolateral portal was established to enable instrument access and was used with the anterior portal during repair. The torn edge of the tendon was debrided, and its mobility toward the footprint was evaluated using a grasper. When necessary, surrounding adhesions in the rotator interval were released to optimize tendon mobilization. The insertion site for the suture anchor was prepared by removing soft tissue with a motorized shaver. A single double-loaded anchor (Healix; DePuy Mitek, Raynham, MA) was placed 5 mm medial to the medial border of the bicipital groove at the upper third of the footprint. A double-loaded single-anchor construct was preferred based on the assumption that comparable outcomes could be achieved with fewer anchors and reduced operative time. Subsequently, the subscapularis tendon was repositioned to its anatomic footprint using a grasper, and the appropriate sites for suture passage were identified. Both limbs of the sutures were passed through the tendon and secured in a mattress configuration, completing the repair (Fig. 2C). LHBT evaluation included the assessment of instability, tendinitis, tears, and superior labrum anterior to posterior (SLAP) lesions. Instability was evaluated using dynamic intraoperative tests [26]. In

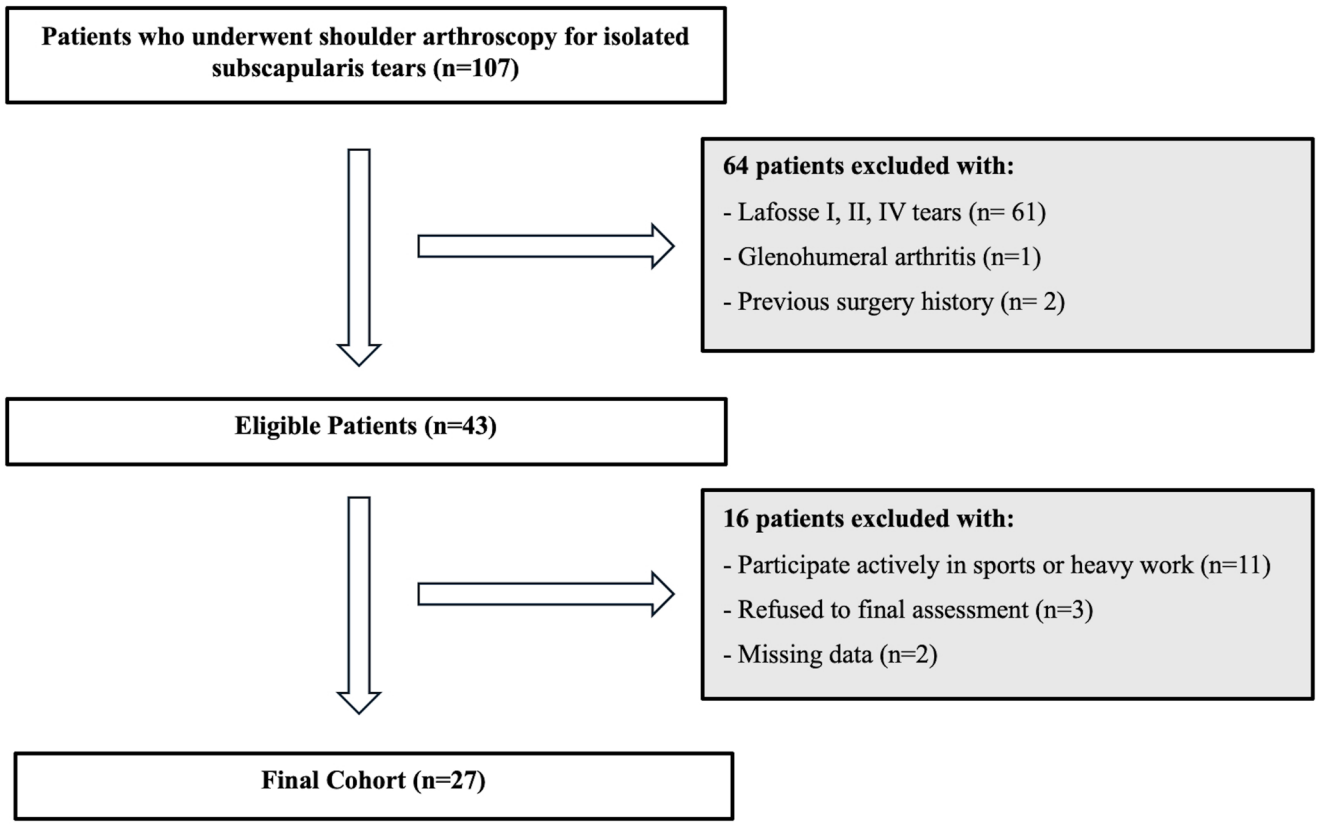


Fig. 1 Flowchart illustrating the process of selecting the study cohort following the application of exclusion criteria

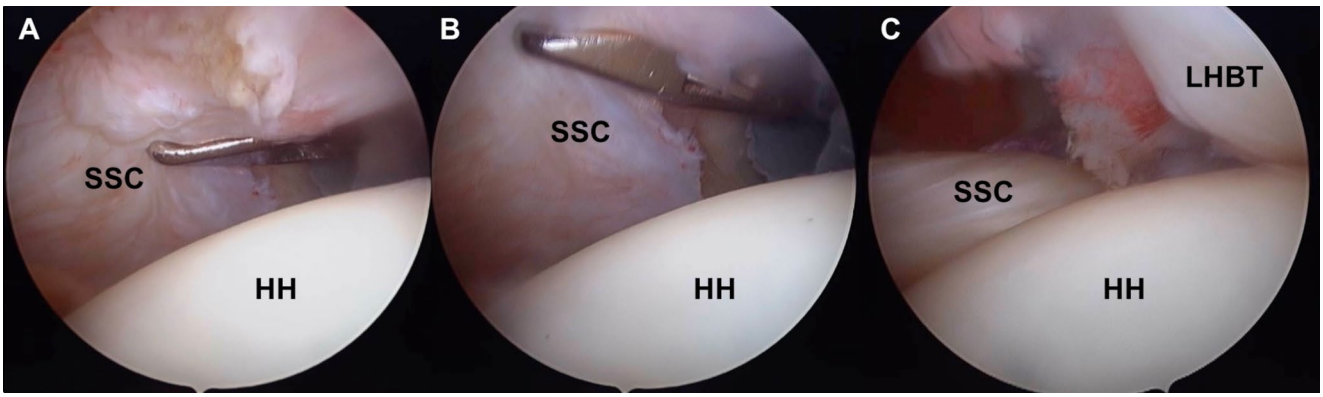


Fig. 2 Arthroscopic view of the right shoulder, with the patient in the lateral decubitus position and the arthroscope in the posterior viewing portal. Images (**A** and **B**) demonstrate the intraoperative assessment of the subscapularis tear using a grasper. Image (**C**) depicts the restoration of the tendon following repair. (*HH* humeral head, *LHBT* long head of biceps tendon, *SSC* subscapularis)

cases with biceps pathology, either tenotomy or tenodesis was performed based on the patient's expectations [27]. Tenotomy was preferred in patients with lower functional demands, minimal cosmetic concerns, and a primary focus on pain relief and rapid recovery. On the other hand, tenodesis was selected for patients concerned about postoperative deformity or the potential for persistent pain.

Postoperative care involved immobilization of the affected arm in a sling for four–six weeks. Passive forward flexion, external rotation to neutral, and circumduction exercises were commenced on postoperative day one. At the end of the fourth week, active-assisted range of motion (ROM) exercises were initiated. A structured, individualized rehabilitation protocol under supervision was implemented at eight weeks. Beginning at three months postoperatively, patients were encouraged to start strengthening exercises and return to routine activities.

Radiologic evaluation

All patients underwent standardized shoulder MRI examinations on a 3.0-Tesla scanner (Siemens Magnetom, Erlangen, Germany) with a dedicated shoulder coil. The imaging protocol included oblique sagittal T1-weighted (repetition time/echo time [TR/TE] 632/10 ms), oblique coronal T2-weighted fat-suppressed (TR/TE 2800/84 ms), oblique sagittal proton density-weighted (TR/TE 3980/44 ms), and axial proton density-weighted (TR/TE 3220/40 ms) sequences. Slice thickness was 3.5–4 mm, with a 0.4-mm interslice gap. Field of view was 160 mm, with a matrix size of 320 × 256 pixels. Siemens syngo. via workstation was used for data analysis. Repair integrity was evaluated according to the Sugaya classification (Type I: normal thickness; Type II: preserved thickness with focal high signal area; Type III: tendon thinning without discontinuity; Type IV: minor discontinuities suggestive of a small tear; Type V: distinct medium- to large-sized tear) [28, 29]. Types I–III were considered intact, whereas Types IV–V were classified as retears [28]. The T1-weighted oblique sagittal plane, oriented perpendicular to the supraspinatus tendon, was used to assess subscapularis muscle atrophy according to the method defined by Scheibel et al. [30] At the section of the Y shaped position representing the junction of the scapular spine and the coracoid process, vertical, cranial-transverse, and caudal-transverse diameters of subscapularis muscle were measured (Fig. 3A). Moreover, to obtain a quantitative assessment of the subscapularis, the outer margin of the muscle was manually delineated using the software. The cross-sectional area (CSA) of the subscapularis was calculated in square millimeters according to the method described by Zanetti et al. [31] (Fig. 3B). Fatty degeneration was assessed using the Goutallier classification [32]. Two radiologists independently evaluated all MRIs. Intra- and inter-observer reliability were assessed to ensure consistency in the MRI interpretation. To evaluate intra-observer agreement, one author (….) reanalyzed all the images two weeks after the initial review. For the inter-observer analysis, another author (….), who was unaware of the other radiologist's assessment, independently reviewed all MRIs randomly.

Functional outcome evaluation

A blinded author (….), unaware of the study design and objectives, conducted the final clinical examination to minimize potential evaluation bias. All patients who met the inclusion criteria were contacted and invited to participate in the outcome visit. Each patient was initially asked whether they had undergone revision surgery on the operated shoulder since the index procedure. Functional evaluation was then conducted in two stages. First, subscapularis-specific clinical tests, including the bear-hug, lift-off, and belly-press tests, were performed, followed by ROM assessment using a goniometer. Second, PROMs were assessed using the American Shoulder and Elbow Surgeons (ASES) score, Constant-Murley Score (CMS), and Visual Analog Scale (VAS). Preoperative clinical examination findings and PROM data were retrieved from the patients' charts and compared with the final follow-up dataset. The difference between the pre- and postoperative results was used to

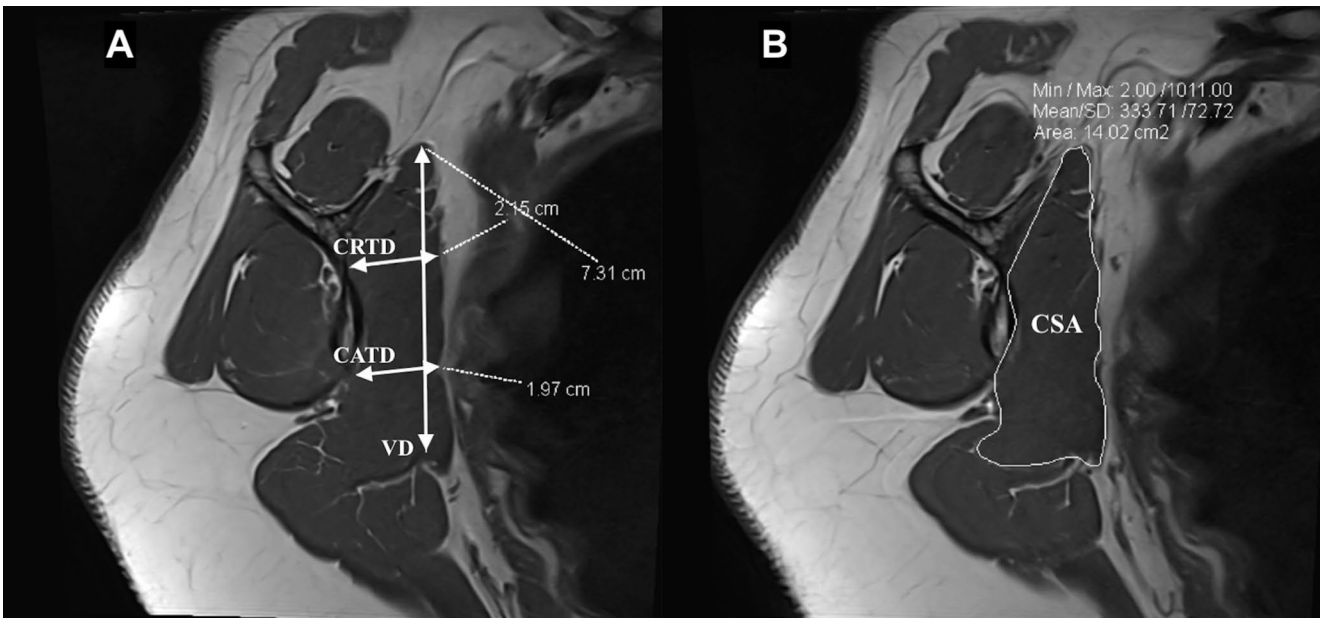


Fig. 3 Measurements of the subscapularis muscle vertical diameter (VD), cranial- transverse diameters (CRTD), caudal-transverse diameters (CATD), and cross-sectional area (CSA) on parasagittal T1-weighted magnetic resonance images

quantify functional recovery and evaluate the overall clinical effectiveness of the procedure.

Statistical analysis

The required sample size was estimated a priori around the minimal clinically important difference (MCID) values [33, 34] For a two-sided paired comparison (α = 0.05, power = 0.80), detecting a true preoperative-to-postoperative change equal to the MCID of the patient-reported outcomes given the observed dispersion of change scores required no more than 21 patients (for the Constant-Murley score, the most conservative outcome). The enrolled cohort of 27 patients therefore exceeded the a priori requirement and provided at least 89% power to detect a change as small as the MCID for each patient-reported outcome. Statistical analyses were performed using R software and SPSS (version 28.0). The significance level was set at α = 0.05 for all inferential tests. Normality of continuous variables was assessed using the Shapiro-Wilk test. Preoperative and postoperative PROMs, ROMs, and MRI measurements were compared using paired statistical tests. For continuous variables, paired t-tests were employed when data met normality assumptions; otherwise, Wilcoxon signed-rank tests were used. Active internal rotation, recorded as the vertebral level reached during the hand-behind-back maneuver, was treated as an ordinal variable. The number of levels gained per patient was summarized with the median and interquartile range and compared using the Wilcoxon signed-rank test.For each continuous outcome the magnitude of change was summarized using the standardized response mean (SRM; mean change divided by the standart deviation of the change scores, numerically equivalent to the paired Cohen's d_z), with 95% confidence intervals from the noncentral t distribution, verified by bootstrap resampling (10,000 replicates). As 11 paired comparisons were performed, p values were additionally adjusted with the Holm and Benjamini-Hochberg procedures to assess robustness to multiplicity. The MCID thresholds were calculated using a distribution-based approach, defined as one-half the standard deviation of change scores across the cohort [35, 36]. Subscapularis-specific clinical tests were analyzed as dichotomous outcomes (positive/negative), and changes from preoperative to postoperative status were evaluated using McNemar's test. Agreement of MRI measurements was evaluated using intraclass correlation coefficients (ICCs) for continuous variables and Cohen's kappa for categorical data. ICC values > 0.75 indicate good reliability, > 0.90 excellent; kappa values > 0.80 are considered excellent, 0.60–0.80 are indicated substantial agreement [37, 38].

Table 1 Patient Demographics and Baseline Characteristics

Variable	
Age, yr, mean ± SD (range)	52.4 ± 10.3 (29–72)
Sex, male/female, n (%)	7 (26%) / 20 (74%)
Dominant extremity involved, n (%)	19 (70.4%)
Symptom duration, mo, mean ± SD (range)	13.5 ± 9.2 (2–43)
Follow-up, mo, mean ± SD (range)	80.8 ± 18.6 (60–128)
Fatty degeneration grade*, 0/1/2/3, n	11 / 11 / 2 / 3

yr, year, *mo* month, *SD* standard deviation

* Goutallier classification: grade 0, normal muscle; grade 1, presence of fatty streaks; grade 2, more muscle than fat; and grade 3, equal proportions of fat and muscle

Results

The final study cohort comprised 27 patients, with a mean follow-up duration of 80.8 ± 18.6 months (range, 60–128 months). The majority of patients were female, and in most cases, the dominant extremity was affected (Table 1). A history of trauma was reported in 63% ($n = 17$) of the patients. Fatty degeneration was classified as Goutallier grade 0 or 1 in 81% ($n = 22$) of the cases (Table 1). Evaluation of LHBT pathologies revealed the following: tendinitis with instability in 14 patients, partial tear with instability in five, isolated instability in three, and a SLAP lesion with instability in two. Tenotomy was performed in 15 of these patients, and tenodesis in nine.

Compared with the preoperative values, the ASES score, CMS, and VAS for pain showed significant improvements (87.2%, 73.5%, and 76.8%, respectively) at the final follow-up (Table 2). Additionally, an MCID achievement rate of 96% was observed for ASES, CMS, and VAS, based on threshold values of 8.4, 8.1, and 1.1, respectively. In a subgroup analysis comparing PROM improvement between the tenotomy and tenodesis groups, no significant differences were observed in ASES (37.2 ± 18.6 vs. 36.0 ± 14.0; $p = 0.86$), CMS (35.3 ± 17.1 vs. 32.3 ± 15.2; $p = 0.66$), or VAS scores (4.2 ± 1.9 vs. 4.4 ± 2.8; $p = 0.85$). Subscapularis-specific tests that were largely positive before surgery became negative in most patients (Table 2). At postoperative evaluation, three patients demonstrated a persistently positive Bear-Hug test despite intact tendon integrity. Median active internal rotation improved from the L4 to the T9 vertebral level, corresponding to a median improvement of 7 levels (interquartile range, 5–11) ($p < 0.001$) (Table 2). Both active forward flexion ($p < 0.001$) and abduction ($p < 0.001$) also improved compared to preoperative values, whereas active external rotation ($p = 0.078$) did not change significantly (Table 2). All comparisons that were significant before adjustment remained significant after Holm and Benjamini-Hochberg correction across the 11 paired comparisons. No anchor-related complications were observed intraoperatively, and

Table 2 Preoperative and Postoperative Functional Evaluations[a]

Variable	Preoperative	Postoperative	SRM [95% CI]	*P*-value
Bear-Hug Test	25 (93%)	5 (18%)	-	<0.001
Belly-Press Test	24 (89%)	4 (15%)	-	<0.001
Lift-Off Test	24 (89%)	5 (18%)	-	<0.001
Active internal rotation, vertebral level	L4 (Buttock - T12)	T9 (L1 - T3)	-	<0.001
Active external rotation	54.8 ± 15.4 [30–80]	57.9 ± 13.2 [40–80]	0.41 [0.02–0.81]	0.078
Active forward flexion	146.7 ± 27.3 [90–180]	169.3 ± 9.6 [145–180]	0.97 [0.66–1.39]	<0.001
Active abduction	138.1 ± 29.7 [90–180]	171.6 ± 7.9 [150–180]	1.27 [0.93–1.81]	<0.001
ASES	44.0 ± 12.4 [39.3–48.7]	82.4 ± 14.1 [77.1–87.8]	2.28 [1.55–3.00]	<0.001
CMS	49.1 ± 15.3 [43.4–54.9]	85.3 ± 11.1 [81.1 - 89.5]	2.24 [1.52–2.94]	<0.001
VAS	5.7 ± 2.1 [4.9–6.5]	1.3 ± 2.2 [0.5–2.2]	2.01 [1.35–2.67]	<0.001

Significant at P value ≤ 0.05 and are presented in bold

[a]Data are presented as mean ± SD [95% CI] for patient-reported outcome measures, and as the number of positive cases with percentages [n (%)] for subscapularis-specific clinical tests

SD standard deviation, *CI* confidence interval, *ASES* American Shoulder and Elbow Surgeons, *CMS* Constant-Murley Score, *VAS* Visual Analog Scale

Table 3 Preoperative and Postoperative MRI Measurements of Subscapularis

Variable	Preoperative mean ± SD [95% CI]	Postoperative mean ± SD [95% CI]	*P*-value
Cross Sectional Area, mm^2	1.292 ± 453 [1.112–1.471]	1.544 ± 609 [1.303–1.785]	**<0.001**
Vertical diameter, mm	72.2 ± 11.9 [67.5–76.9]	82.2 ± 15.3 [76.1–88.2]	**<0.001**
Cranial-transverse diameter, mm	20.9 ± 6.1 [18.4–23.3]	21.6 ± 6.0 [19.2–24.0]	0.311
Caudal-transverse diameter, mm	22.6 ± 5.6 [20.4–24.8]	23.4 ± 5.6 [21.2–25.6]	0.410

Significant at P value ≤ 0.05 and are presented in bold

mm millimeter, *SD* standard deviation, *CI* confidence interval

no postoperative infections or revision surgeries occurred during the follow-up period.

Radiological evaluation demonstrated significant restoration in the CSA and vertical diameter (Table 3). At final follow-up, Goutallier fatty degeneration grades were 0 in 12 patients, 1 in 13 patients, 2 in 1 patient, and 3 in 1 patient. Furthermore, based on the Sugaya classification for repair integrity, 92.6% ($n = 25$) of the patients were classified as Types I–III, while 7.4% ($n = 2$) were classified as Types IV–V (Table 4). CSA and Scheibel measurements showed good to excellent inter- (ICC = 0.841–0.983) and intra-rater (ICC = 0.861–0.966) reliability. For the Sugaya classification, Cohen's kappa indicated excellent intra-rater ($\kappa = 0.876$) and substantial inter-rater agreement ($\kappa = 0.775$).

Table 4 Final MRI evaluation results based on the Sugaya classification

Postoperative Repair Integrity (Sugaya Classification), *n* (%)	
Type I (normal thickness)	17 (64%)
Type II (normal thickness with focal high signal area)	6 (22%)
Type III (tendon thinning without discontinuity)	2 (7%)
Type IV (minor discontinuities suggestive of a small tear)	2 (7%)

Discussion

The present study demonstrated that satisfactory functional recovery and tendon integrity at a minimum five-year follow-up can be achieved with arthroscopic single double-loaded anchor repair in patients with isolated Lafosse III subscapularis tears who are not involved in physically demanding activities. These findings suggest using a single anchor provides surgeons with a reliable method that combines technical simplicity with durable clinical success in patients without high functional demands.

An overview of the literature on subscapularis tears indicates that more than one anchor may be required for tears extending beyond the upper one-third of the tendon [10, 11, 16–18]. However, recent studies have challenged this approach, suggesting that a single anchor repair can also be effective for larger tears [1, 2, 19–23]. Galasso et al. [1] reported significant clinical improvements at nine-year follow-up in 45 patients with Lafosse III - IV tears repaired using one or two anchors. Similarly, Mundakkal et al. [20] observed favorable outcomes in 40 patients with Lafosse III - IV tear patterns repaired with a single anchor over two years. Schnaser et al. [22] noted successful results in 17 cases treated with a single anchor, including tears larger than 25%, with no evidence of subscapularis retears at a mean follow-up of 15 months. Additionally, Bartlett et al. [19] and Oklaz et al. [21] reported satisfactory outcomes using a single double-loaded anchor for biceps tenodesis and subscapularis repair; remarkably, some patients in their series had Lafosse III tears. Consistent with these findings, the current study demonstrated that single-anchor repair for isolated Lafosse III subscapularis tears resulted in significant functional improvements at a minimum five-year follow-up, representing a considerable time [39]. This outcome may be

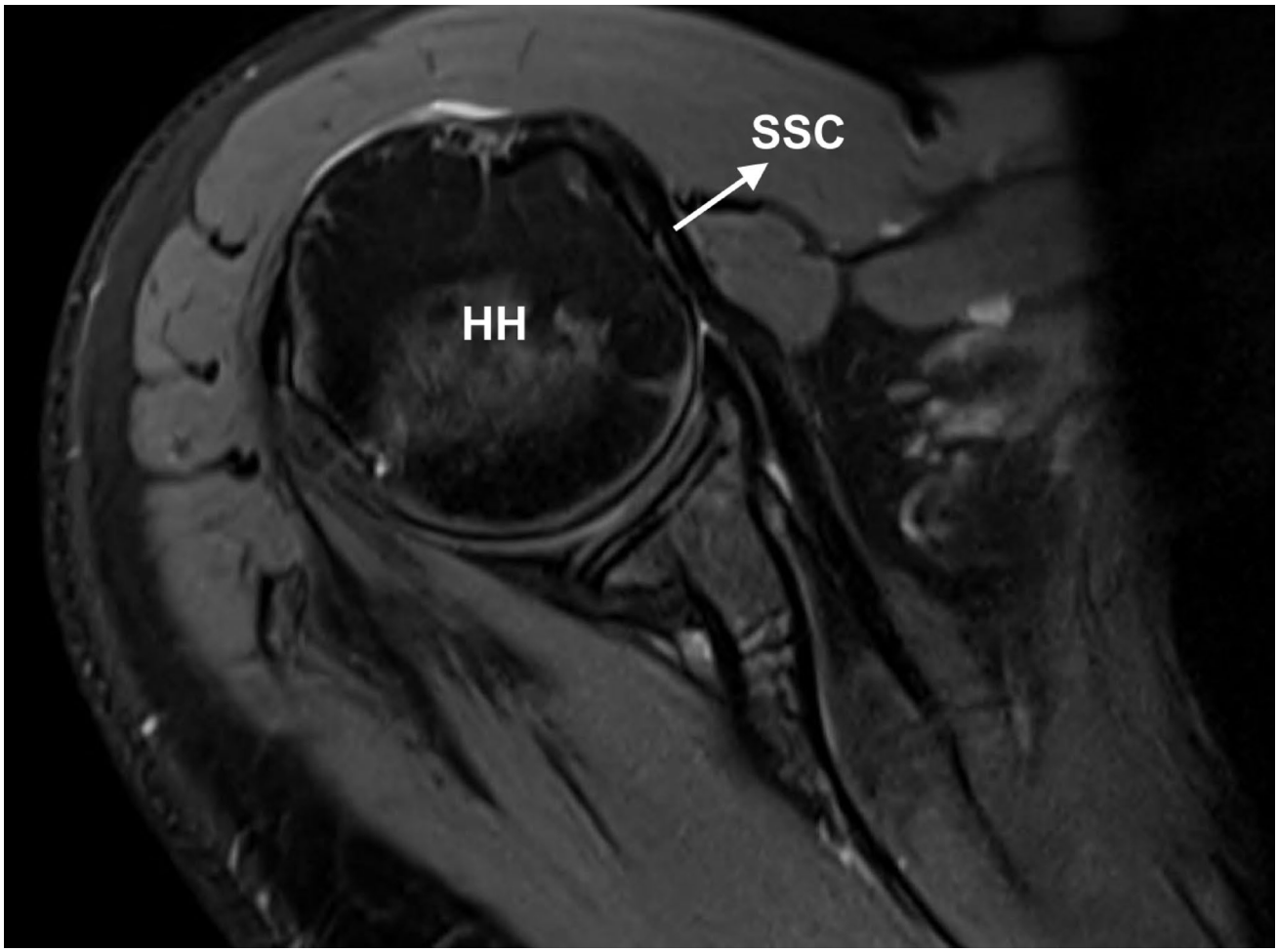


Fig. 4 Axial T2-weighted magnetic resonance image demonstrating the structural integrity of the subscapularis repair at final follow-up. (HH, humeral head; SSC, subscapularis)

attributed to the evaluation of a homogeneous patient cohort without high physical demands, as well as the effective biomechanical stability of the single-anchor repair. According to Lorbach et al. [24], the biomechanical performance of single-anchor repair in subscapularis tears involving half of the tendon is comparable to that observed in 25% tears. Based on this perspective, and considering that patients who do not engage in heavy occupations or shoulder-intensive sports (as in this study) are not subjected to high mechanical loads on the tendon, successful tendon healing can be reasonably expected in Lafosse type III tears in such cases. Furthermore, the marked improvement in PROMs suggests that structural tendon healing reflected into favorable clinical outcomes. However, an important consideration is that most patients underwent either tenotomy or tenodesis for concomitant biceps pathology according to patient expectations. Comparable outcomes between the two groups suggest that satisfactory results can be achieved in both cohorts; however, the contribution of concomitant biceps procedures to postoperative pain relief cannot be disentangled.

Another notable component of this study is the inclusion of MRI-based assessment to evaluate the repair outcomes. Remarkably, tendon integrity was maintained in 93% of patients at a mean follow-up of 80 months (Fig. 4). This finding aligns with the results of Galasso et al. [1], who reported 87% tendon integrity at nine years based on ultrasonographic evaluation, and Schnaser et al. [22], who observed no radiologic signs of subscapularis insufficiency at a mean follow-up of 15 months. Consequently, this evidence supports the reliability of single-anchor repair in preserving tendon integrity. MRI analysis also revealed an increase in both the CSA and vertical muscle diameter. Previous studies have reported varying statements regarding postoperative changes in the CSA and subscapularis muscle dimensions. Grueninger et al. [16] reported a significant increase in CSA following repair of Lafosse III and IV subscapularis tears. On the other hand, studies evaluating the repair of upper-one third tears found no significant change in CSA and transverse diameters in the postoperative period by Rhee et al. [40], and in CSA, transverse diameters, and

vertical diameter by Yang et al. [41] This discrepancy may be attributed to differences in tear size. Because, as proposed by Grueninger et al. [16], the increase in CSA may not reflect true muscle hypertrophy, but rather a volumetric change resulting from the restoration of the muscle to its natural length as the tendon returns to its anatomical position. Accordingly, larger tears could facilitate greater vertical restoration, potentially resulting in increased vertical muscle diameter and, subsequently, CSA. Conversely, smaller tears provide a more limited potential for vertical reconstruction, making significant postoperative restoration in the CSA less likely. Nonetheless, we believe that the main point is not whether the CSA increases, but rather that it does not decrease significantly. Because, the preservation of CSA indicates that the subscapularis muscle does not undergo atrophic changes and maintains its structural integrity [42]. This preservation may have an important role in sustaining favorable functional outcomes over time.

This study has several limitations. First, because no patient in the cohort underwent surgery with two anchors, a comparative analysis between single- and two-anchor repairs could not be conducted. Second, since we routinely use two anchors for patients with high physical demands, it is not possible to determine whether a single anchor would be adequate for this subgroup. Third, while the proven effectiveness of single-anchor repair in tears half of the tendon suggests its potential use for Lafosse type III tears, further research is necessary to directly assess the biomechanical strength of single-anchor repairs for tears involving the upper two-thirds. Fourth, the predominantly female and low-demand cohort, as well as the single-surgeon design, may limit the study's generalizability. Additionally, a sex-based subgroup analysis was not performed due to the high proportion of females. Fifth, the interpretation of clinical improvements may have been influenced by the high rate of concomitant biceps procedures, making it difficult to isolate the independent effect of subscapularis repair. Last, Lafosse classification was determined intraoperatively by the senior surgeon without independent verification, which may have introduced classification bias.

Conclusions

Single double-loaded anchor repair provides satisfactory functional recovery and tendon integrity after five years in patients with isolated Lafosse III subscapularis tears who are not involved in physically demanding activities. These findings suggest using a single anchor offers surgeons a reliable method that combines technical simplicity with durable clinical success in patients without high functional demands.

Author contributions E.B.O. and F.A. conceptualised and designed the study. F.A., A.A., and C.D. collected the data. E.A. and E.B.G. analyzed the MRI's. A.A. and E.B.O. analysed the data. E.B.O., F.A, and I.A. drafted the manuscript. U.K. revised the manuscript. All authors reviewed, refined and approved the final manuscript.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Conflcit of interest The authors declare no competing interests.

Ethical approval The study protocol was approved by the Institutional Review Board (……).

Informed consent Informed consent was obtained from all individual participants included in the study.

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