Human Reproduction vol.12 no.11 pp.2399–2401, 1997

Small diameter versus conventional laparoscopy: a prospective, self-controlled study

Onur Karabacak[1], M.Bülent Tiras, M.Zeki Taner, Haldun Guner, Akgun Yildiz and Mulazim Yildirim

Gazi University Medical Faculty, Department of Obstetrics and Gynaecology, Besevler, Ankara, Turkey

[1]To whom correspondence should be addressed at: PO Box 61-06500, Ankara, Turkey

The objective of this study was to determine visual quality, diagnostic accuracy, and surgical merits of small diameter laparoscopy (SDL). Thirty-seven patients were randomly selected. The indications for laparoscopy were infertility, desire for tubal sterilization or chronic pelvic pain. Patients underwent SDL, followed by conventional laparoscopy (CL) as a control under general anaesthesia. Findings at operation were compared. The mean time for diagnostic work-up was longer with SDL than CL, 11.7 ± 5.6 versus 7.6 ± 3.2 min respectively ($P < 0.04$). Visual quality was scored from 4 to 1 by the operator; mean visual quality, mean endometriosis score and mean adnexal adhesions score were slightly lower with SDL than CL. Sensitivity of SDL in diagnosing endometriosis, adhesions, ovarian, uterine and pouch of Douglas lesions were 71, 58, 81, 89 and 73% respectively; specificity was 100, 96, 100, 100, 100% in the same order. Suction irrigation, cyst aspiration, tissue biopsies, simple adhesiolysis, tubal ligation and cauterization were easily performed with SDL. We conclude that SDL seems a good alternative to CL in diagnosing macro-pelvic anatomy and coarse pelvic pathologies and may also be good in performing surgical procedures such as: tubal ligation, biopsies and differential diagnosis of pelvic fluids. But SDL must be used cautiously in micro-oriented, functional conditions such as infertility, pelvic pain, endometriosis and adhesion scoring or treatment. SDL may be regarded as a less invasive but less sensitive tool with limited surgical merits.

Key words: laparoscopy/microlaparoscopy/small diameter laparoscopy

Introduction

Although early attempts to visualize the peritoneal cavity, with optical instruments, started in the beginning of the 20th century, great progress has been made in this field over the last 2 decades. Improvements in optical systems, light sources and video equipment have made significant advances in diagnostic and operative laparoscopy possible.

Laparoscopic surgery evolved from early single puncture technique to three puncture technique; one for the laparoscope and the other two for instruments. Five to 10 mm laparoscopes are used for operative laparoscopy, even though smaller diameter telescopes (5–7 mm) are more than adequate for diagnostic and operative laparoscopy. This is because documentation is essential, and larger diameter laparoscopes allow greater light transmission (Gomel *et al.*, 1986). Our unit has limited experience with 5 mm laparoscopes. We therefore chose to use 10 mm laparoscopes for better documentation, and light transmission.

The concept of the mini-laparoscopy was introduced relatively recently (Dorsey and Tabb, 1991) with the hope that smaller diameter telescopes and instruments would enable the procedure to be performed under local anaesthetic, as an 'office' procedure. Subsequently, several studies have reported on the use of small diameter laparoscopy (SDL), 0.5–1.4 mm in diameter (Risquez *et al.*, 1992, 1993), 1.8 mm diameter (Dorsey and Tabb, 1991; Childers *et al.*, 1992) and 2 mm diameter (Bauer *et al.*, 1995; Downing *et al.*, 1995). The purpose of this study is to compare our findings by using 1.75 mm and conventional laparoscopy in both diagnostic and operative interventions, with the goal of defining the place of small diameter laparoscopy in clinical practice.

Materials and methods

A total of 37 patients, mean ± SD age 32.6 ± 5.9 years, who were attending the clinic within a 4 month period was randomly selected to undergo SDL. Following Institutional Review Board approval, informed consent was obtained from all study patients. The first three authors operated on the cases randomly. Videolaparoscopy using a 1.75 mm microlaparoscope (Pixie-Needle scope and EnView vision system; Origin Medsystems, Menlo Park, CA, USA) was performed initially. The operative findings were dictated simultaneously. Conventional videolaparoscopy, using a 10 mm laparoscope (Origin Medsystems), was then performed (gold standard) by the same operator. These operative findings were recorded by the operator and also one of the authors, who watched the operation live. The procedures were recorded on a VHS tape by a conventional video cassette recorder. The indications for laparoscopy in the study group included infertility (16 cases, 43.3%), tubal sterilization (11 cases, 29.7%), pelvic pain (four cases, 10.8%), and others such as adnexal cysts and repeat laparoscopies (six cases, 16.2%).

All of the laparoscopies were performed under general anaesthetic, with the patient in the Trendelenburg position. After the bladder had been emptied, a speculum was passed and a Rubin cannula inserted through the cervix into the cavity of the uterus. A 2 mm Verres needle (Origin Medsystems) was passed through the umbilicus towards the pelvic cavity. A pneumoperitoneum was created by insufflating on average 1.5–2 l of carbon dioxide (CO_2). After the core of the Verres had been removed, the sleeve was sealed with a plastic cap to prevent gas leakage. Through a pinpoint hole in this cap, the

© European Society for Human Reproduction and Embryology

Downloaded from https://academic.oup.com/humrep/article/12/11/2399/664663 by Gazi Universitesi user on 10 December 2020

Table I. Evaluation of small diameter versus conventional laparoscopy. Values are means ± SD

Mean	SDL	CL	*P* value
Diagnostic work-up time (min)	11.7 ± 5.6	7.6 ± 3.2	< 0.04
Visual quality (+1 to +4 – best)	2.8 ± 0.7	3.9 ± 0.2	NS
AFS endometriosis score	20.8 ± 39.8	23.7±45.5	NS
AFS adnexal adhesions score	4.7 ± 9.3	6.0 ± 9.6	NS

NS = not significant; AFS = American Fertility Society.

Table II. Diagnostic accuracy of small diameter laparoscopy

Lesion	Sensitivity (%)	Specificity (%)	PPV	NPV
Endometriosis	71.4	100	100	93.7
Adhesion	58.3	96	87.5	82.7
Ovaries	81.2	100	100	87.1
Uterus	88.8	100	100	96.5
Pouch of Douglas	72.7	100	100	89.5

PPV = positive predictive value; NPV= negative predictive value.

microlaparoscope was advanced into the peritoneal cavity under visual control. The second and third special Verres needles were inserted to right and left inguinal regions. The Verres needle passed into the left inguinal region was 15 mm longer than the others, to allow the abdominal viscera to be manipulated. Attached to this needle was a 5 ml syringe containing saline, that was used to wash the tip of the SDL. The needle on the right-hand side was used for insufflation or to introduce flexible instruments (Origin Medsystems). After the procedure, a 10 mm incision was made in the umbilicus and after having passed a 10 mm trocar, a conventional 0 degree laparoscope was inserted into the abdomen. One or both of the inguinal Verres needles was replaced with 5 mm trocars as required.

In 11 cases, tubal sterilization was performed using the SDL on one side and the conventional laparoscope on the other side. In both procedures, two inguinal 5 mm trocars were inserted instead of the Verres needles. Both tubes were coagulated with 5 mm bipolar forceps and cut with a pair of scissors under visual control.

The statistical evaluation was performed using Student's *t*-test, Wilcoxon signed-rank test and linear regression analysis where appropriate.

Results

The mean time required to complete the diagnostic laparoscopy was significantly higher in SDL, than conventional laparoscopy (CL) (11.7 ± 5.6 versus 7.6 ± 3.2 min, $P < 0.04$), with the range from 3–25 to 3–15 min respectively (Table I).

When individual data were plotted on a scatter diagram, with the line of best fit for each surgeon, the mean time for SDL tended to decrease towards the end of the study for each surgeon, in a weak linear correlation from 15 min to 9 min [$r = -0.34$, $-0.61 < R < 0.00$ at 95% confidence interval (CI)]. The mean CL time was not changed throughout the study.

Visual quality was stratified as an ordinal variable from +4 (best), to +1 (poor) according to operator observations. Mean visual quality was slightly worse with SDL than CL (Table I).

Seven cases of endometriosis were diagnosed. Two normal cases diagnosed by SDL were diagnosed as stage 1 endometriosis by CL, and two cases of stage 1 endometriosis by SDL were diagnosed as stage 2 and 3 by CL (additional endometriomas). In the remaining three cases, there was correlation in the staging of the endometriosis, but not the American Fertility Society (AFS) score. Finally, mean AFS endometriosis score (AFS, 1985) was not different between SDL and CL in the whole group (Table I).

Twelve cases with tubal and/or ovarian adhesions were diagnosed. One case was misdiagnosed as having tiny adhesions by SDL. This was the result of insufficient mobilization of the sigmoid colon and left ovary, which was detected at CL (4.2%). Five tiny adhesions were not diagnosed by SDL, but were by CL (41.6%). However, the mean AFS adnexal adhesions score (AFS, 1988) was not different between SDL and CL within the whole group (Table I).

Two enlarged uteri and six small fibroids were diagnosed by both techniques. In one case, a 1 cm intraligamentous–posterior uterine fibroid was diagnosed only by CL.

Overall, 13 ovarian lesions, including ovarian cysts, adhesions, enlarged ovaries, corpus luteum and endometriosis, were diagnosed by both techniques. In one case, adhesions to the posterior aspect of the ovary and an ovarian fibroma <1 cm in diameter were seen by CL only. In another case, we were not able to see both ovaries because of dense adhesions. Adhesiolysis could only be performed by CL.

In the pouch of Douglas, three adhesions, three cases of endometriosis and two collections of blood were satisfactorily diagnosed by both techniques. One tiny adhesion close to the sigmoid colon and two endometriotic implants <1 cm in size were seen by conventional laparoscopy only.

Diagnostic sensitivity, specificity, positive and negative predictive value of the small diameter laparoscopy are outlined in Table II.

Surgical procedures such as suction irrigation, cyst aspiration, tissue biopsy, simple adhesiolysis, tubal ligation and cauterization were easily performed with SDL. Extensive adhesiolysis, ovarian cyst resection, suturing and myomectomy could only be performed using rigid 5 mm instruments, under the panoramic view of CL. Eleven tubal sterilizations were done effectively both by SDL and CL. There were no complications. Dye tubal insufflation was seen using both techniques.

Discussion

Childers *et al.* (1992) reported the use of 1.8 mm diameter laparoscopes in seven gynaecological oncology cases where biopsy or pelvic washing was performed. Risquez *et al.* (1992) reported a study using a 0.5 mm flexible falloposcope to visualize the pelvis. He published a series of 30 cases using the same technique. However, after the first four cases he changed to a 1.4 mm laparoscope to improve visualization (Risquez *et al.*, 1993). He reported the duration of laparoscopy between 1–15 min and visual quality as 'acceptable'. Endometriosis, pelvic adhesions, uterine fibroids, tubal pregnancy and uterine agenesis were found. He performed nine laparoscopic sterilizations and one case had zygote intra-Fallopian transfer (ZIFT). He concluded that in selected cases, the technique could potentially replace conventional laparoscopy

Downloaded from https://academic.oup.com/humrep/article/12/11/2399/664663 by Gazi Universitesi user on 10 December 2020

but with reduced picture size, quality and patient discomfort. All of the four studies above were carried out without control and under local anaesthesia.

Bauer *et al.* (1995) published a study of 41 patients with two different 1.9 mm microlaparoscopes. He investigated 28 of the patients (Group I) in a prospective, self-controlled study. The indication for laparoscopy was infertility, pelvic pain, or need for second look under general anaesthesia. SDL correctly diagnosed endometriosis, adhesions (filmy, dense and perihepatic), inguinal herniae, peritoneal tumour implants and even a prolapsed inter-vertebral disc. CL confirmed all pathologies. Although there was no statistical comparison, CL diagnosed two new cases; a unilateral tubal malformation and i.p. tumour implants. A further study of 13 patients (Group II) underwent SDL only for infertility, oncological work-up and biopsy under analgesia–sedation. Downing *et al.* (1995), using the same 1.9 mm microlaparoscope, reported 20 cases investigated for infertility or pelvic pain. After SDL, 19 cases had CL. SDL was completed in 5–10 min. He used neurolept anaesthesia for the majority of cases. Out of six gamete intra-Fallopian transfer (GIFT) cases, one case had bleeding following vaginal oocyte retrieval. Peritoneal lavage was performed by CL and haemostasis secured. An endometriosis case diagnosed by SDL was not confirmed by CL. They favoured SDL, especially for cases of endometriosis, for early initial diagnosis and in young patients in the diagnosis and management of pelvic pain.

We evaluated additional parameters beyond those in the studies cited above. The mean time needed for diagnostic work-up was significantly longer with SDL. The identified reasons were not the learning curve, but the lower picture quality, difficulties with near and far focusing, fogging of the lens despite the use of preventative agents, the need for irrigation and the slip of tissues during manipulation. The mean visual quality was slightly worse with SDL than 'the best' CL picture. However, the visual quality difference in the diagnosis of endometriosis and adhesions was insignificant. Both mean scores were a few points higher with CL, but the difference was not significant. Concerning the diagnostic accuracy, the specificity of SDL was almost 100%, but the sensitivity was low, between 58–88%. The cases in which the SDL and CL findings differ represent insignificant misdiagnoses. We may speculate that the lesions missed with minimal endometriosis and adhesions may have a little impact on treatment. On the other hand, there were cases with stage differences.

Although different laparoscopes were used, our findings were not completely consistent with the findings of Bauer *et al.* (1995). SDL does not seem to provide fully comprehensive diagnosis. The reasons for that may not only be the smaller and slightly poorer images, but may also be due to the thin second probe, which was not as effective in elevating the pelvic structures as the rigid probe. Downing *et al.* (1995) favoured the SDL for early-initial investigation; we have found SDL less invasive because of the small diameter, but also less sensitive for initial investigation and less refined for surgery. CL may be reserved for selected cases, after SDL diagnosis under local anaesthesia.

In conclusion, SDL seems a good alternative to CL in diagnosing macro pelvic anatomy and coarse pelvic pathologies and may also be good in performing surgical procedures such as tubal ligation, biopsies (gonadal, cyst wall, tumour) and differential diagnosis of pelvic fluids (pus, blood and serous fluid). But SDL must be used with caution in micro-oriented, functional conditions, such as infertility, pelvic pain, endometriosis and adhesion scoring or treatment. SDL may be regarded as a less invasive tool with limited diagnostic accuracy and surgical merits compared to conventional laparoscopy.

References

American Fertility Society (1985) Revised American Fertility Society classification of endometriosis: 1985. *Fertil. Steril.*, **43,** 351–352.

American Fertility Society (1988) The American Fertility Society classifications of adnexal adhesions, distal tubal occlusion, tubal occlusion secondary to tubal ligation, tubal pregnancies, Müllerian anomalies and intrauterine adhesions. *Fertil. Steril.*, **49,** 944–955.

Bauer, O., Devroey, P., Wisanto, A. *et al.* (1995) Small diameter laparoscopy using a microlaparoscope. *Hum. Reprod.*, **10,** 1461–1464.

Childers, J.M., Hatch, K.D. and Surwit, E.A. (1992) Office laparoscopy and biopsy for evaluation of patients with intraperitoneal carcinomatosis using a new optical catheter. *Gynecol. Oncol.*, **47,** 337–342.

Dorsey, J.M. and Tabb, C.R. (1991) Mini-laparoscopy and fiber optic lasers. *Obstet. Gynecol. Clin. N. Am.*, **18,** 613–617.

Downing, B.G. and Wood, C. (1995) Initial experience with a new microlaparoscope 2 mm in external diameter. *Aust. NZ J. Obstet. Gynaecol.*, **35,** 202–204.

Gomel, V., Taylor, P.J., Yuzpe, A.A. and Rioux, J.E. (eds) (1986) *Laparoscopy and Hysteroscopy in Gynecologic Practice*. Yearbook Publishers, Chicago, p. 35.

Risquez, F., Pennehouat, G., Foulot, H. *et al.* (1992) Transcervical tubal cannulation and falloposcopy for the management of tubal pregnancy. *Hum. Reprod.*, **7,** 375–376.

Risquez, F., Pennehouat, G., Fernandez, R. *et al.* (1993) Microlaparoscopy: a preliminary report. *Hum. Reprod.*, **8,** 1701–1702.

Received on October 11, 1996; accepted on August 8, 1997

Downloaded from https://academic.oup.com/humrep/article/12/11/2399/664663 by Gazi Universitesi user on 10 December 2020