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ORIGINAL ARTICLE

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Laparoscopic myomectomy: feasibility and safety —a retrospective study of 762 cases

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Abstract The objective of this retrospective study of a case series was to evaluate patients with symptomatic uterine myomas managed by laparoscopic myomectomy—the clinical features, operative techniques, and intraoperative and postoperative morbidity. The subjects consisted of a total of 762 women who underwent endoscopic surgery for uterine leiomyomas at a private advanced endoscopy and assisted reproductive technology centre over a 13-year period. Data were collected on baseline clinical characteristics, details of surgery, intraoperative and postoperative complications, and hospital stay. A total of 1,375 myomas were removed; the most common indication was infertility (50.9%), and the majority of myomas (49.52%) were intramural. The mean duration of surgery was 95 min, and the average blood loss was 250.5 ml. The average hospital stay was 1.3 days. Major complications included an unexplained postoperative death and one laparotomy for postoperative bleeding. We conclude that laparoscopic myomectomy is a relatively safe procedure. Most cases can be completed by a laparoscopic approach, and the remaining may require a laparoscopic-assisted myomectomy. The risk of complications is comparable to that with the open procedure, whereas morbidity and length of hospital stay are much lower.

Keywords Leiomyomas · Fibroids · Uterine myomas · Myomectomy · Laparoscopy · Endoscopy

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Introduction

Uterine leiomyoma is the most common tumour, affecting around 20–25% of the female population [1]. It has now been a quarter of a century since the first case of myomectomy by laparoscopy was reported by Semm and Mettler in 1979 [2]. Several large case series on myomectomy using endoscopic techniques have been published [3–8], which have confirmed its feasibility, safety, and advantages over conventional laparotomy, including shorter hospital stay, lower cost, less postoperative morbidity, and a consequent earlier return to normal activities. Nevertheless, the role of laparoscopic myomectomy as a treatment option for symptomatic uterine fibroids has been questioned [9], the main concerns being the need for surgical intervention for small myomas, the removal of large myomas through small abdominal incisions, and the quality of the uterine repair when performed laparoscopically, especially in women contemplating future pregnancy.

The indications for surgical management of uterine myomas include abnormal uterine bleeding unresponsive to conservative treatment, high level of suspicion of malignancy, growth after menopause, infertility with distortion of the endometrial cavity or tubal occlusion, pain or pressure that interferes with quality of life, urinary tract frequency or obstruction, or iron deficiency anaemia related to abnormal uterine bleeding [10].

Considering the increased frequency of diagnosis with the rising use of ultrasound, delaying attempts at pregnancy until an older maternal age and maintaining the possibility of future childbearing are no longer the sole reasons for patients to avoid hysterectomy; the frequency and the need for myomectomy are bound to go up.

Any new intervention in medicine should be valid, feasible, and safe and have benefits over conventional techniques in terms of reducing morbidity associated both with the disease and with treatment. It should also be cost-effective.

To address this issue, we retrospectively analysed data on myomectomies performed over a 13-year period to

evaluate the feasibility, limits, and complications of myomectomy performed endoscopically and to assess the intraoperative and postoperative morbidity associated with the procedure.

Materials and methods

Clinical records were retrieved for women who underwent surgical treatment via endoscopic procedures for uterine leiomyomas in the period June 1993 to October 2005. Data were collected on demographic characteristics; the chief indication for the intervention; the number, size, and location of fibroids; the surgical technique; concomitant pelvic pathologies; intraoperative and postoperative morbidity; and duration of hospital stay. Cases in which resection of myomas was performed by a hysteroscopic approach alone were omitted from the study.

In all cases, the number of myomas as well as their dimensions were determined preoperatively by transvaginal and transabdominal sonography. In most cases, the ultrasound study was performed by one of the authors.

A myoma was defined as subserous if the greatest diameter lay outside the uterine contour; the fibroid was also judged intramural in cases of marginal submucosal extension, provided that the greatest diameter was outside the uterine cavity. Moreover, a tumour was classified with respect to the uterine body as anterior, fundal, or posterior. The presence of other pathology and associated operative procedures were noted. Laparoscopic-assisted myomectomy was defined as the use of mini-laparotomy (<5 cm) to perform either enucleation of myoma or uterine closure [11]. Conversion to laparotomy was defined as the use of laparotomy before the end of cleavage of all the myomas.

The operating time was defined as the "skin-to-skin" time and excluded the anaesthetic and set-up times. The incidence of intraoperative and postoperative complications, febrile morbidity, analgaesia requirements, and postoperative hospital stay were recorded for all patients. Postoperative fever was defined as body temperature ≥38°C on two consecutive measurements obtained at least 6 h apart, excluding the first 24 h.

Preoperative evaluation was similar to that before any other major procedure. GnRH agonists were not used before surgery because we have found that degeneration of the myoma can make the surgical dissection more difficult when patients had received them.

All procedures were performed by the same surgeon (P.G.P.) using a similar technique. All myomectomies were performed under general anaesthesia. Hysteroscopy was always done to evaluate the uterine cavity. This was especially useful in patients with multiple myomas when submucous myomas could easily be missed on ultrasound examination. Normal saline was used as the distension media for diagnostic hysteroscopy, whereas glycine was used if hysteroscopic resection was necessary. A pneumoperitoneum at a pressure of 12 mmHg was established using a Veress needle and a carbon dioxide insufflator. For occasional cases, a higher pressure was required. This pressure was maintained throughout surgery at 12 mmHg.

Entry into the abdominal cavity through an umbilical incision or a higher one in cases of larger uteri was accomplished using a 10-mm trocar. In patients with a previous history of open surgery or in whom intraabdominal adhesions were suspected, entry under direct vision using a Ternamian EndoTIP (Karl Storz, Tuttlingen, Germany) was performed. Two ancillary 5-mm trocars lateral to the right and left epigastric vessels and a medial suprapubic trocar were inserted.

For submucous myomas, a 4-mm, 30° hysteroscope with a 26-F resectoscope was used. For laparoscopic myomectomy, the majority required use of a unipolar hook electrode, bipolar forceps, grasping forceps, scissors, a suction–irrigation cannula, a myoma screw, a needle holder, and an electrical morcellator.

A Spackman cannula was used for uterine manipulation. For a subserous myoma, the pedicle was coagulated using a bipolar forceps and cut using a hook electrode. For intramural myomas and subserous myomas with an intramural component, the myomas were injected with a dilute solution of vasopressin (20 IU in 10–20 ml saline). An incision was made on the most prominent part of the myoma through the uterine wall and the pseudocapsule. The incision was usually vertical for midline myomas and transverse for lateral ones. The myoma was enucleated by a combination of traction, using a 5-mm myoma screw, and dissection, using a grasping forceps and suction–irrigation cannula. The myoma screw was successively moved over the enucleated part so that traction could be applied in a direction perpendicular to the surface of the myoma. Any bleeding vessels on the pseudocapsule were coagulated before further dissection of the myoma, the use of bipolar forceps being kept to a minimum. Intrauterine instillation of methylene blue was used to confirm location of the endometrial cavity in cases of deep intramural myomas.

The incision was closed using interrupted absorbable sutures by intracorporeal suturing. The sutures used were either 1–0 polyglycolic acid (Dexon II, Tyco Healthcare, Norwalk, CT) or polyglactin 910 (Vicryl, Ethicon, India). We sutured the myometrium in one layer using curved needles, which enable deep bites on the myometrium to be taken. These were seromuscular, evenly spaced around a centimeter apart, and the edges of the uterine wound were always everted. This is the technique similar to the one described by Dubuisson et al. [8]. If the endometrial cavity was entered, it was closed in a separate layer, avoiding the endometrium.

The fibroids were removed with an electromechanical morcellator (Steiner or Sawalhe earlier, and now the Rotocut G1, Karl Storz, Tuttlingen, Germany). A mechanical morcellator was also used during the first few years. The 12/15-mm port was closed with Berci's fascial closure instrument (Karl Storz, Tuttlingen, Germany) under vision. At the end of the procedure, the peritoneal cavity was washed with saline solution. No additional adhesion prevention measures were used. A silicone drain was applied through one of the lateral ports and kept for 12 h.

Blood loss was estimated by calculating the difference between the volumes of irrigated and aspirated (intraoperative and drain) fluids. The drop in haemoglobin concentration was obtained for all patients.

Analgaesic therapy included one dose of diclofenac rectal suppository before extubating the patient. Thereafter, analgaesics were suspended and administered only at patient request; the usual medication used was an opiate (pentazocine). Before hospital discharge patients had to tolerate a normal diet, be able to dress themselves, be fully mobile around the ward, be analgaesic free, and be satisfied that they could manage at home.

Results

A total of 952 patients underwent endoscopic procedures for myoma removal. Of these, 107 patients were excluded from the study because of inadequate data regarding clinical findings and/or operative procedures. Of the remaining 845 patients, 83 were excluded because their procedures involved only hysteroscopic resection of myomas. In the remaining 762 patients, 673 had laparoscopic myomectomy, 27 had myomas removed by both the laparoscopic and hysteroscopic approaches, 60 had laparoscopic-assisted myomectomy, and two required hysteroscopic resection in addition to laparoscopic-assisted myomectomy.

The average age of the operated patients was 32.06 years (range 19–57). The most common indication for surgery was infertility (Table 1).

A total of 1,375 myomas were removed, with the size of the dominant myoma ranging from 2 to 20 cm (Table 2). Most myomas were <5 cm (58.6%). The majority of myomas were intramural (681, 49.52%). Less frequently, subserous (507, 36.87%), submucous (127, 9.23%), and intraligamentous (60, 4.36%) myomas were removed. By location, the myomas were somewhat evenly distributed: anterior 424 (30.83%), fundal 399 (29.01%), and posterior 552 (40.14%). The number of myomas removed from each patient varied from one to 12, with 42.8% of cases requiring removal of multiple myomas (Table 3).

The myomas were most frequently removed by morcellation (72.7%) and the rest by a colpotomy (8.9%) or during a mini-laparotomy performed either as a part of a laparoscopic-assisted myomectomy (8.1%) or for removal of the myomas (10.2%). None of the patients required a formal laparotomy or cancellation of the procedure. An additional 331 procedures were carried out in 264 (34.6%) patients, the most common involving surgical management for endometriosis (Table 4). The mean duration of surgery was 95 min (range 20–280). Vasopressin was used in 24% of the patients. The average blood loss was 250.5 ml (range 20–1,000). The average drop in haemoglobin concentration was 1.43 g%.

Table 1 Indications for surgery

Indication	*n*	%
Infertility	388	50.9
Menstrual symptoms	152	19.9
Pelvic pain	112	14.7
Pressure symptoms	51	6.7
Urinary symptoms	23	3.0
Rapid growth	16	2.1
Recurrent pregnancy losses	11	1.4
Others	9	1.2

Table 2 Size of dominant myoma

Size (cm)	*n*	%
<5	447	58.67
6–10	278	36.48
11–15	35	4.59
16–20	2	0.26

Two patients had intraoperative bladder injuries, in both cases occurring during dissection of myomas in the lower segment. The injuries were repaired in two layers by laparoscopic suturing. Seven patients required blood transfusions to correct anaemia (four before surgery, one intraoperatively, and two postoperatively).

Patients were given one dose of antibiotic (a quinolone or a third-generation cephalosporin) preoperatively and one dose after 12 h. Febrile morbidity was seen in 16 patients (0.02%). One patient required a laparotomy postoperatively. This 29-year-old woman had a laparoscopic-assisted myomectomy. The uterus was enlarged to 22 weeks, and there was a left anterior and a left lateral cervical myoma. Postoperatively, there was excessive bleeding through the drain, and a laparotomy was performed. The source of bleeding was from a vein, which appeared deroofed. This was taken care of with sutures.

Another patient died after surgery for unexplained reasons. This 28-year-old patient had a laparoscopic-assisted myomectomy for a large intramural myoma (uterus enlarged to 20 weeks, the largest myoma measuring 9 cm). Intraoperatively, the uterus was stuck in the pelvis. The patient's early postoperative period was uneventful, her vital signs were stable, and there were no signs of intraperitoneal bleeding. She was transferred to her personal suite after 4 h of postoperative observation. When examined half an hour later, she was found dead. The cause of death could not be ascertained because a postmortem examination was not permitted. There was no evidence to suggest intraperitoneal bleeding. The most likely cause of death in a young healthy patient with no preexisting morbid conditions is pulmonary thromboembolism.

The average hospital stay was 1.3 days (range 1–5), with 84% of patients discharged within 48 h. Fourteen patients had postoperative wound infections.

Discussion

The debate regarding the performance of myomectomy using endoscopic techniques has been evaluated in a

Table 3 Number of myomas

Number of myomas	*n*	%
1	436	57.2
2	122	16.0
3	101	13.2
4	47	6.2
5	13	1.7
6	18	2.4
7	10	1.3
8	9	1.2
9	1	0.1
10	4	0.5
11	0	0.0
12	1	0.1

number of studies. The procedure's feasibility and especially the ability to perform it with the same meticulous quality of open surgery has been questioned. The endoscopic surgeon, though hampered by the loss of tactile sensation and facing the task of intracorporeal suturing, has the advantage of better endoscopic visualisation both inside and outside the uterus and the additional benefit of a thorough evaluation of the peritoneal cavity. This loss of tactile sensation has been to a certain extent blamed for the surgeon's inability to feel for the smaller myomas that are missed and are thus responsible for the higher recurrence rates, although this issue has not been settled by studies [12, 13]. The endoscopic surgeon has also been blamed for indiscriminately performing—because of the low morbidity associated with the procedure—myomectomies for fibroids that are too small to be responsible for causing infertility [14].

Such controversies have not been resolved despite many studies. The question that probably is more important and of more practical value is whether myomectomy is feasible and safe when performed endoscopically.

Preoperative ultrasound done by the surgeons themselves helps in planning the route and technique of surgery and reduces the possibility of incomplete surgical treatment. We agree with other authors against using preoperative GnRH analogues, because of their high cost and the difficulty in enucleation following their use [4, 15].

Infertility was the most common reason for a woman to undergo myomectomy in our study, accounting for nearly the same number of cases as all other indications put together. This is quite high compared with other studies [4, 16], but this could be explained by the fact that hysterectomy is commonly performed for these indications in women not desiring fertility, and our patient selection could be biased because the centre treats a large number of patients for infertility.

Myomectomy was performed by a variety of approaches, with 3.8% of cases requiring hysteroscopic resection along with the laparoscopic approach. We routinely perform hysteroscopy before laparoscopic myomectomy to exclude submucous myomas that can be easily missed during ultrasound examination when there are large or multiple fibroids. Ninety-three patients could be managed by a primary hysteroscopic approach alone (and were not included in the study). In difficult cases, which can be due to a large number of myomas, difficult enucleation, uncontrollable haemorrhage, or difficulty in suturing the myometrium, a laparoscopic-assisted myomectomy is a useful option. Aided by good handling of the uterus with the uterine manipulator, it is possible to bring the area of interest to the site of mini-laparotomy. The majority of laparoscopic-assisted myomectomies in our series were done when a good morcellator was not available. The postoperative recovery for patients with this small incision was quite satisfactory. This has been corroborated by other authors, and they have mentioned fewer days of hospital isation, fewer days until resumption of normal activity, and less postoperative use of analgaesics [17–19].

Vasopressin was used in just 24% of the patients because it became freely available in this country only in 2003. Vasopressin was well tolerated, and the reduction of blood loss and the ease of surgery following its use were significant.

Many recommendations have been made regarding the limits of the size and number of myomas for which laparoscopic myomectomy can be attempted. A commonly agreed dictum is that the presence of more than four large myomas (>4 cm in diameter) or of any tumour >10 cm in diameter is a contraindication to laparoscopic surgery [20] and requires medical treatment before surgery to reduce the size and vascularity of the lesions. Of our patients, 57.2% required myomectomy for a solitary myoma. Fifty-six (7.34%) patients had more than four myomas, and 37 (4.8%) had at least one myoma measuring >10 cm. Use of medical treatment prior to surgery makes the myomas soft and difficult to enucleate. Sinha et al. [21] and Litta et al. [22] have shown that large myomas can be removed by laparoscopic and hysteroscopic routes, respectively.

Table 4 Additional procedures during myomectomy

Procedure	*n*
Surgery for endometriosis	169
Adhesiolysis	49
Sterilisation	28
Ovarian drilling for polycystic ovaries	16
Salpingectomy	12
Transcervical resection of endometrium	11
Hysteroscopic cannulation for cornual block	9
Hysteroscopic incision of septum	9
Ovarian cystectomy	9
Paraovarian cystectomy	5
Adenexectomy	4
Presacral neurectomy	3
Appendicectomy	2
Resection of adenomyosis	2
Umbilical hernia repair	1
Microtubal reanastomosis	1
Tension-free vaginal tape (obturator) application	1

Trocar placement is critical for proper performance of surgery. A panoramic view of the operating area is necessary for two important parts of surgery: intracorporeal suturing and safe morcellation of the enucleated myomas. The laparoscope is generally introduced through the umbilical port. In a patient with a large uterus, it may be introduced through a midline incision cephalad to the umbilicus. The ancillary ports are usually 5 mm, and one of them is enlarged to 12/15 mm to introduce the morcellator.

Locating the myomas is facilitated by palpation with a probe, preoperative ultrasound findings, and, occasionally, the use of intraoperative ultrasound. The aim of surgery through an open or endoscopic route should be the same; the endoscopic approach should not be the reason for an incomplete job. A laparoscopic-assisted myomectomy or a formal laparotomy should be performed whenever required. This series had only one laparotomy.

Use of the Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, USA) is comparable to the conventional instruments without a major difference in operating ease or duration of surgery but with a marked difference in costs, though Ou et al. reported a shorter duration of surgery and less blood loss with it [23].

The strength of the uterine scar after repair depends on correct approximation of the myometrial incision without haematoma formation. The recommendations by some for a two- or three-layer closure require further evaluation. The shift from multiple-layer closure of the uterus after caesarean section to a single-layer approach has been validated by many studies [24, 25]. Though this is not the same as closure during a myomectomy, the emphasis should be on adequate closure with the optimum number of sutures. More layers do not directly imply better healing. In fact, ischaemia due to excessive sutures may impair healing. We have found the use of Dexon II to be quite suitable for myometrial closure. The 40-mm, half-circle, tapered round body needle is much sturdier and more surgeon-friendly than those of other commonly used sutures. Two-layer closure is performed only when either the endometrium is opened or the myometrial thickness is greater.

The average duration of surgery was comparable to that found in other studies [4–6]. Blood loss was high compared with that reported by Adamian et al. [6] and Seinera et al. [7] but comparable to that reported by Landi et al. [4] and Ou et al. [23]. The above observations are to be taken in light of the fact that 34.6% of our patients required additional surgical procedures other than myomectomy. The requirement for blood transfusions was low (0.9%) and was mainly for preoperative correction of anaemia. Postoperative blood transfusion was used rarely and only when the intraoperative blood loss was quite significant or when the postoperative haemoglobin was <7 g%.

The incidence of intraoperative and postoperative complications was low (major complications 0.5%, minor complications 3.8%), and these were not serious except for a case of unexplained postoperative death. Patients with fever were given antibiotics until 24 h after remission of the fever.

The most common postoperative complaint was pain at the site of the lateral port through which the morcellation was performed. This was probably due to the pain associated with the fascial closure by means of a suture.

The duration of hospital stay (1.3 days) was less than in other studies [4, 20, 26]. The following important factors were responsible for the short stay: Preoperative counselling given to both the patient and her relatives about the procedure and about the duration of hospital stay prepares them mentally for an early return to normal activity and return to home. Active mobilisation by small steps, such as encouraging the patient to empty her bladder herself by going to the toilet and making her walk back from the postoperative room to her private suite, will give her the confidence to ego home the day after surgery.

Long-term complications associated with laparoscopic myomectomy include the rare one of scar dehiscence/rupture during a subsequent pregnancy and the more common but less recognised one of adhesions following surgery. Although many studies have shown fewer adhesions following laparoscopic myomectomy [9, 27, 28], there is some worrying evidence to the contrary [29]. Still, the advantages of the laparoscopic route far outweigh the risks and costs involved.

Though laparoscopic myomectomy is a challenging surgery with technical difficulties, a longer operating time, and limitations related to the size of myomas, it has its inherent advantages in the form of early recovery and less morbidity. With endoscopy beginning to become part of the armamentarium of more and more gynaecologists and with advances in instruments, techniques, and training, the endoscopic approach to myomectomy is here to stay.

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