

LAPAROSCOPIC MYOMECTOMY

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SUMMARY

Since the initial description of laparoscopic myomectomy (LM) in 1979, many reports of this technique have been published worldwide. The indications for LM have grown in line with improvements in laparoscopic techniques and instruments over the last decade. LM offers several benefits to patients but remains a challenging technical procedure that is associated with high surgical morbidity and a high incidence of blood transfusion. LM procedures include excision of the myoma(s), repair of myometrium, and removal of the myoma from the abdomen. The control of operative blood loss is crucial, especially in the case of large intramural fibroids. Different studies have found wide variations in the incidence of recurrence after LM. Ultrasound imaging and Doppler velocimetry can be used to assess uterine scars after LM. Uterine rupture during pregnancy is a serious concern after LM, and all published cases report the occurrence of rupture before the start of labor. Surgical strategies are needed to overcome these problems associated with LM. Although LM is minimally invasive in terms of the wound, it remains an advanced and invasive procedure. An appropriate management strategy is required for each patient, and careful discussion and counseling regarding all the issues are necessary. [*Taiwan J Obstet Gynecol* 2009;48(4):335–341]

Key Words: fibroid, laparoscopy, myomectomy

Introduction

At least 20% of women of reproductive age develop clinically detectable uterine fibroids; however, if small, clinically undetectable or microscopic fibroids are included, the incidence is 70–75%. Uterine fibroids are, therefore, the most common female pelvic tumor. Fibroids comprise smooth muscle and extracellular matrix (ECM). ECM is composed of collagen, proteoglycan, and fibronectin. Different tumors have different ratios of smooth muscle to ECM, but fibroids have the highest ratio of ECM. The etiology of fibroids is unclear, but most originate from a single cell. Fibroids generally present with no symptoms, and only 20–50%,

especially of the submucous type, have detectable symptoms such as abnormal uterine bleeding (30%). Other common symptoms include abdominal or pelvic pressure, encompassing back pain, constipation, urinary frequency or urinary retention, and infertility. The indications for treatment of uterine fibroids include metrorrhagia with anemia, pelvic pain or pelvic pressure that interferes with daily life, ureteral compression, rapid tumor growth, tumor growth following menopause, and infertility.

Management of Uterine Fibroids

Watchful waiting is the most common approach to uterine fibroids, followed by medical treatment. However, no long-lasting effects of medical treatment have been reported, and surgery is, therefore, still considered to be the best means of treating symptomatic fibroids. Surgical treatments include hysterectomy and myomectomy. Myomectomy can be accomplished using different approaches, including transabdominal (via



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Accepted: April 10, 2009

laparotomy or laparoscopy) or transvaginal (with or without hysteroscopy) approaches. This review focuses on discussion of the laparoscopic approach.

Key Points of Laparoscopic Myomectomy (LM)

The challenges associated with performing LM are related to the approach angles of the instruments and to uterine defect repair. Problems with the approach angles of the instruments include placement of the trocars; it is difficult to remove large fibroids using traditional trocar positionings because of the relatively limited operating field. Laparoscopic repair of the uterine defect requires not only highly skillful suturing by the surgeon, but also proficient collaboration with the surgical assistant. In addition, the removal of the fibroids from the abdomen and the control of operative blood loss also affect the success of the surgery.

Placement of Trocars

Correct trocar placement is an important factor during surgery. Traditional portal sites are suitable for medium-sized masses. Videolaparoscopy has been performed using 5-mm or 10-mm principal trocars introduced through the umbilicus. Two ancillary cannulas are placed under laparoscopic visualization: one 5-mm cannula in the right lower quadrant lateral to the inferior epigastric arteries and one 5-mm cannula in the left lower quadrant. For patients with uterine sizes greater than 14 weeks' gestation, the principal cannula should be moved to the midpoint between the umbilicus and the xiphoid process (Lee-Huang point) [1]. Two puncture sites, both 5 mm, are made in the lower abdomen at the paramedian line at the level of the umbilicus. If more portal sites are needed, other cannulas can be introduced at the paramedian line, just above the pubic hairline (Figure).

In our experience, the Lee-Huang point approach seems to provide a safe location for primary trocar placement in patients with previous pelvic surgery, gynecologic malignancies, and large pelvic masses. A median longitudinal incision through the linea alba avoids major blood vessels and nerves and affords wide access to the abdominal cavity. It provides a good visual angle and increases the working distance in cases of resection of large myomas. It also avoids intestinal injury in the umbilical area after previous abdominal surgeries. Lee-Huang point insertion may, therefore, be the point of choice in LM for large fibroids [2–9].

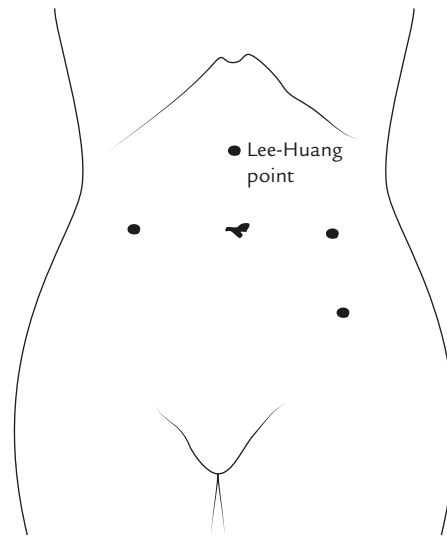


Figure. Abdominal port placements: Lee-Huang point and additional portal sites.

LM Technique

Three major steps are involved in LM: (1) excision of the myoma(s); (2) repair of the uterine defect; and (3) extraction of the myoma specimen(s) [10].

The procedure is conducted with the patient in the dorsal lithotomy and Trendelenburg position, with both legs protected by elastic bandages. A Foley or urethral catheter is inserted for constant urinary drainage. A uterine manipulator is placed into the uterus. Once a laparoscope and video camera are in place, adhesions are lysed as necessary.

After identifying the location of all fibroids, a transverse incision is made in the serosa overlying the largest tumor using a unipolar electrode. The incision is extended into the pseudocapsule down to the characteristically pearly white substance of the tumor. Additional fibroids located at the same area are removed through the same incision. However, for nonadjacent fibroids, it is necessary to create a new incision. A myoma screw or second puncture is then inserted into the fibroid to apply traction, while a probe (or any instrument that functions as a probe) is used to bluntly dissect in the cleavage plane to leverage the tumor against the uterine wall and pry it out of its bed. The unipolar electrode is used to further dissect pseudocapsule attachments. Vessels are electrocoagulated using Kleppinger forceps before being cut. After fibroid removal, the uterine defect is irrigated. Bleeding points are identified and controlled by electrocoagulation.

The uterine surgical defect is closed in layers. If excessive myometrium and serosa are present, these

are trimmed off. A 0 monofilament poliglecaprone 25 (Monocryl; Ethicon Inc., Somerville, NJ) on a large curved needle is used to make a deep and wide (1 cm from the cut edge of the incision) bite. An original 90-cm suture line is trimmed to 30 cm long to freely allow continuous suturing inside the peritoneal cavity. The needle enters the uterus through the serosa to the myoma bed and emerges at the superficial level in a U shape; the needle is then grasped and reapplied in a reverse fashion. Intracorporeal knot tying is then used. A continuous non-running lock suture with 1-cm increments is then applied, with each suture penetrating the full thickness of the myometrium, following a method similar to that applied during laparotomy.

After removal of all fibroids, the peritoneal cavity is irrigated and until the lavage fluid is clear. A suction drain (Jackson-Pratt drain) is introduced through a 5-mm access site, if indicated. All port sites are sutured using 3-0 polyglycolic acid sutures at the level of the fascia to prevent herniation. The skin is approximated using sterile adhesive tape.

Extraction of Fibroids

The extraction of the excised myomas from the abdomen is one of the major concerns in LM. Transabdominal or transvaginal extraction routes can be used. Removing specimens via the vaginal approach (culdotomy) has advantages in laparoscopic procedures, even though there are risks of infection and bowel and ureteral injuries [11]. Additional instruments need to be prepared for vaginal surgery, and the surgical team members have to change positions, making it a relatively troublesome and time-consuming procedure. Nevertheless, portal extension combined with myoma slicing could be useful for removing the specimens [12], even though the 2- to 4-cm extension is associated with higher postoperative pain and thus reduces its practical use.

Tumors can be easily removed through a culdotomy opening, because the vaginal elasticity enables the passage of masses that are at least twice the size of the incision. However, if a vaginal procedure cannot be performed, e.g. because of an absence of sexual history, a narrow vagina, an obliterated cul-de-sac or large myoma size, then culdotomy could become extremely difficult.

The electric morcellator was first introduced for laparoscopic use in 1993 [13]. Since then, it has been used to remove various types of specimens [14–16]. Uterine myomas were identified by ultrasound during LM in 78 nulliparous women, and we compared their

removal through culdotomy or by use of a power morcellator [17]. The median removal time in the culdotomy group (20 minutes) was significantly longer than that in morcellator group (15 minutes; $p=0.007$). There were no significant differences in tumor size, total specimen weight, patient body weight, total operating time, blood loss, or postoperative stay between the groups. Uterine myomas can thus be removed successfully through either port site in nullipara; however, because of the reduced removal time, use of a power morcellator is preferred.

Myomas can be removed using a power morcellator through a 15-mm port site. The high-speed electrical device is more effective than either a manual one or any sharp scissors or knife. The entire surgical procedure is accomplished abdominally, and the surgical wounds are, therefore, clean, meaning that subsequent antibiotic usage can be reduced. However, laparoscopic morcellator-related injuries have been reported, of which bowel injury is the most commonly reported during myomectomy [18]. A surgeon's experience determines the degree of complications [19], and proper principles for handling the devices should be followed; the moving blade should always remain anteriorly while maintaining an adequate panoramic view, and visualization of the blade is necessary at all times.

Controlling Operative Blood Loss

LM, even though feasible, is considered to be a bloody procedure, especially in the case of large fibroids. The control of operative blood loss is, therefore, crucial, especially in large intramural fibroids. Pretreatment with a gonadotropin-releasing hormone agonist, myometrial infiltration with vasopressin, and uterine artery ligation before myomectomy have been reported to effectively decrease the operative blood loss and blood transfusion rate [20–22]. However, these measures are associated with either increased expense or requiring extra steps to be performed before the actual procedure.

We proposed a simplified method to control operative bleeding that does not require extra time. Two ampoules of oxytocin (10 IU/mL/ampoule) were added to saline solution (1,000 mL), which was run at a rate of 40 mL/min during the course of LM [23]. Oxytocin acts directly on the myometrium via its receptors on the uterine smooth muscle cells, stimulating the contraction of the uterus and reducing uterine perfusion. However, the efficacy of oxytocin in stimulating the contraction of smooth muscles in the nonpregnant uterus is much lower than that of vasopressin [24]. After the application of oxytocin, blood loss decreased significantly in the

study group compared with the control group, but the blood loss (269.5 ± 225.8 mL) was still high when compared with published data [25–27]. Although adverse reactions, such as hypotension, arrhythmias or hyponatremia, can occur after systemic administration of oxytocin, its margin of safety is greater than that for vasopressin, and its convenient administration route (intravenous instead of direct myometrial infiltration) have made oxytocin our preferred choice of medication in LM.

Although preoperative use of a gonadotropin-releasing hormone agonist, temporary or permanent hemostasis of the uterus, and the use of uterine myometrial contraction agents during myomectomy have been reported to decrease operative blood loss and blood transfusion rates [25,28], skilled surgical technique remains the most important factor in reducing intraoperative blood loss.

Types of LM

Three different LM approaches can be used: (1) laparoscopic-assisted abdominal myomectomy (LAAM); (2) laparoscopic-assisted vaginal myomectomy (LAVM); and (3) total LM (TLM).

Laparoscopic-assisted abdominal myomectomy

Nezhat et al [12] advocated this method in 1994. Laparoscopic isolation of the largest fibroid is performed, followed by minilaparotomy. This technique allows simultaneous enucleation and removal of fibroids from the abdomen and conventional multilayer suturing. The rationale behind this technique is the belief that laparoscopy is unable to achieve the same approximation of the suturing site as laparotomy; therefore, hematomas might develop owing to the poor approximation and hemostasis of the wound site. In addition, the general use of electrocauterization for hemostasis in laparoscopy could damage the uterine tissues. LAAM can thus provide multilayer suturing, reduce technical complexity, save valuable operative time, and achieve a similar recovery period, compared with pure LM.

Laparoscopic-assisted vaginal myomectomy

After laparoscopic identification of the location of all fibroids, a guide suture is placed in the largest tumor for identification. A grasper is used to pull the guide suture into the vagina through the culdotomy incision. Enucleation and removal of the fibroid, repair of the uterine defect and hemostasis are performed vaginally using conventional instruments [29–31].

The advantages of LAVM are similar to those of LAAM. However, LAAM is mainly used to manage anterior and fundal fibroids, while LAVM is better suited for posterior and fundal masses. Vaginal capacity determines the difficulty of this procedure. LAVM is contraindicated in nulliparous women or those with a narrow pelvis.

Total LM

To date, the only indications for TLM are pedunculated and subserosal lesions [32]. Laparoscopic management of large or deep intramural lesions remains controversial. According to our study [10], the mean operation time for TLM for normal-sized fibroids (diameter, <7 cm) was 79.1 ± 28.6 minutes, and the operative blood loss was 123.0 ± 89.7 mL. The operation time and blood loss both increased significantly in the case of large intramural lesions (121.5 ± 58.9 minutes, and 346.3 ± 299.6 mL, respectively). The rate of blood transfusion was also significantly higher in the group with large fibroids (22.1% vs. 3.2%; $p < 0.001$). However, there were no differences in the length of hospital stay or overall incidence of operative complications associated with the tumor size.

Repair of the uterine defect is a relatively difficult task during TLM, and is considered the most crucial stage. A skillful laparoscopic suturing technique is indispensable for the close reapproximation of the uterine defect. However, this procedure depends not only on the highly skilled suturing technique of the surgeon, but also on the proficient collaboration of the surgical assistant. Hence, TLM is still considered to be a relatively difficult laparoscopic procedure.

To overcome this issue, we proposed a modified laparoscopic suturing technique involving controlling the tail of the suture with the surgeon's hand while sewing laparoscopically [33]. This technique can achieve a good approximation of the uterine defect and is an acceptable alternative that allows laparoscopic surgeons to perform the surgery assisted by an assistant under training. However, for the skilled laparoscopist or one teamed with an experienced assistant, this modified suturing technique would be of little value for the repair of uterine defects, because the technique can result in leakage of air and an extra long suture line pulling in and out of the peritoneum.

Outcome

Careful attention should be paid to the postoperative integrity of the uterus. Ultrasound imaging and Doppler velocimetry can be used to assess the uterine scar after

Table. Spontaneous uterine rupture after laparoscopic myomectomy (LM)

Reference	Age (yr)	Gestation (wk)	G and P	Infant outcome	Interval from LM (mo)	Myoma location	Myoma type	Myoma size	Myoma removed, n	Cavity opened	Hysterotomy sutured
Harris [36]	24	24	G1, P0	Live birth	3	Posterior	NR	3 × 2 cm	1	NR	Yes
Mecke et al [37]	41	28	NR	Live birth	NR	NR	Intramural	NR	NR	Yes	NR
Dubuisson et al [38]	31	32	G1, P0	Live birth	15	Posterior	Intramural	3 cm	1	Yes	No
Friedmann et al [39]	39	28	G1, P0	Live birth	12	Fundal	Intramural	5 cm	1	Yes	NR
Pelosi and Pelosi [40]	39	33	G1, P0	Still born	36	Posterior	Subserous	5 cm	1	No	No
Oktem et al [41]	39	17	G1, P0	IUFD	96	Right cornu	Subserous	4 × 3 cm	1	No	No
Hasbargen et al [42]	36	29	G1, P0	Live birth	11	Posterior	Pedunculated	1.2 × 0.7 cm	2	No	No
Asakura et al [43]	31	35	G1, P0	Live birth	5	Fundal	Intramural	50 g	1	No	NR
Lieng et al [44]	36	35	G1, P0	Live birth	1.5	Posterior	Pedunculated	5 × 4 cm	1	No	No
Malberti et al [45]	34	26	NR	Live birth	NR	NR	NR	NR	NR	NR	NR
Grande et al [46]	35	27	NR	IUFD	8	Posterior	Intramural	4.5 cm	1	NR	NR

G = gravidity; P = parity; NR = not reported; IUFD = intrauterine fetal death.

LM [34,35]. On postoperative day 30, uterine scars were reduced by 44.1–71.7%. Uterine rupture during pregnancy, however, remains a considerable concern after LM. All the published cases report rupture before the start of labor (Table) [36–46]. Uterine rupture can occur irrespective of the type of removed fibroid (intramural or subserosal), the number of fibroids removed (single or multiple), and the postoperative interval (short-term or long-term). It is, therefore, difficult to draw any definite conclusions from these cases.

Four methods can be used to assess fibroid recurrence after LM: (1) clinical signs or symptoms, (2) ultrasound investigation, (3) clinical examination with oriented ultrasound investigation, or (4) self-reported diagnosis based on questionnaires. Regular ultrasound investigations result in the highest reported recurrence rates. Nezhat et al [47] reported a cumulative risk of recurrence of 10.6% after 1 year, 31.7% after 3 years, and 51.4% after 5 years. Rossetti et al [48] reported a crude rate of recurrence of 27%, and most recurrences were detected by sonography between 10 and 30 months postoperatively. If these results are reliable, then women with symptomatic uterine fibroids undergoing LM should be advised of the high rate of recurrence.

Contraindications for LM

The surgical techniques involved in LM present a challenge to gynecologists. Location, size and number of fibroids should be taken into consideration when choosing patients as surgical candidates. The following conditions should be regarded as relative contraindications for LM: (1) diffuse leiomyomata; (2) existence of more than three fibroids > 7 cm; (3) uterine size greater than 20 weeks' gestation; (4) one fibroid > 15 cm; (5) women who have completed childbearing and who desire hysterectomy; and (6) any medical condition that is not suitable for anesthesia or prolonged laparoscopic surgery.

Conclusion

LM was first described by Semm [49] in 1979. Since then, many reports of this technique have been published worldwide. The indications for LM have increased in line with the improvements in laparoscopic techniques and instruments that have taken place during the last decade. This technique offers several benefits to patients, but remains a challenging technical procedure potentially associated with high surgical morbidity and incidence of blood transfusion. Surgical strategies are

needed to overcome these problems associated with LM. Since the surgery presents a challenging task for gynecologists, appropriate management strategies need to be selected for each patient, and careful discussion and counseling regarding all the issues are necessary. Although LM is minimally invasive in terms of the wound, it remains an advanced and invasive procedure. It is important that surgeons should be aware of their own abilities and the limitations of laparoscopy, and should take care in patient selection.

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