Laparoscopic Excision of Very Large Myomas

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Abstract ***(J Am Assoc Gynecol Laparosc 10(4):461–468, 2003)***

Study Objective. *To evaluate the feasibility, complications, and conversion rate of laparoscopic excision of very large myomas.*
Design. *Prospective study (Canadian Task Force classification II-2).*
Setting. *Private endoscopy center.*
Patients. *Fifty-one women with at least one myoma larger than 9 cm.*
Intervention. *Laparoscopic myomectomy.*
Measurements and Results. *We removed 78 myomas laparoscopically in these 51 patients. Three patients had two myomas larger than 9 cm, three had two myomas between 5 and 9 cm (in addition to 1 >9 cm), and one had three myomas between 5 and 9 cm (in addition to 1 >9 cm). Mean number of myomas removed/patient was 1.53 ± 1.17 (range 1–6); 12 women (23.5%) had multiple myomectomy. The largest myoma removed was 21 cm. Mean myoma weight was 698.47 ± 569.13 g (range 210–3400 g). Mean operating time was 136.67 ± 38.28 minutes (range 80–270 min). Mean blood loss was 322.16 ± 328.2 ml (range 100–2000 ml). One patient developed a broad ligament hematoma, two developed postoperative fever, and one underwent open subtotal hysterectomy 9 hours after surgery for dilutional coagulopathy.*
Conclusion. *Myomectomy by laparoscopy is a safe alternative to laparotomy for very large myomas.*

Laparoscopic myomectomy is a controversial procedure, although it is now considered to be feasible.[1] The technique is reputed to be difficult and time consuming and to involve a high risk of conversion to laparotomy.[2] Concerns related to technical difficulty have led to various recommendations based on myoma size, position, and number.[3] It cannot be denied, however, that this procedure has well-known advantages compared with laparotomy.[4] Its most common indication is the patient's desire to avoid hysterectomy and preserve her uterus.[5] Before laparoscopic myomectomy can be recommended as a routine procedure for patients with very large myomas as opposed to laparotomy, its technical feasibility, complication rate, conversion rate, and long-term outcomes must be assessed.

Materials and Methods

We prospectively analyzed 51 healthy nonpregnant women (mean ± SD age 33.7 ± 5.3 yrs, range 23–44 yrs; mean ± SD weight 55.2 ± 8.01 kg, range 40–70 kg) with very large myomas who underwent laparoscopic myomectomy. Inclusion criteria were the presence of at least one myoma in any location, with size of at least 9 cm on preoperative ultrasound examination. Main indications for surgery were abnormal uterine bleeding (33 patients), infertility (17), abdominal pain (8), and abdominal mass (10). No patient had preoperative hormone therapy.

Preoperatively, patients were evaluated for fitness to undergo anesthesia. They all had ultrasound examination to determine the number, position, and size of myomas. Four received blood transfusion for hemoglobin less than 10 g % (1 U in 3 patients, 2 U in 1). Two additional units of blood were cross-matched for postoperative use if required.

Patients kept to a liquid diet for 2 days before the procedure to ensure that bowel loops were empty. They received prophylaxis against possible thromboembolic episodes with a sequential compression device and subcutaneous injection of low-molecular-weight heparin. Antibiotic prophylaxis was cefazolin 2 g administered intramuscularly.

Operative Procedure

Diagnostic hysteroscopy was performed in all patients. Placement of laparoscopic ports is of prime importance as it decides the ease and efficiency of surgery, especially suturing. We perform laparoscopic myomectomy with a 10-mm, 30-degree foreoblique telescope that provides good visualization of large myomas from various angles.

In patients with large myomas, placement of the 10-mm trocar at the usual intraumbilical site could cause the scope to be too close to the suture line. The increased magnification would result in a constantly smaller operative field, making precise manipulation of instruments difficult.[6] In such cases, we prefer to place the optical trocar at an appropriate supraumbilical site depending on the size of the uterus and myomas. To this end, a 5-mm trocar is inserted blindly in the left upper quadrant lateral to inferior epigastric vessels and at the level of or above the upper limit of the uterus. If the lesion is very large (extending beyond the umbilicus), we may place both the Veress needle and 5-mm port at Palmer's point. A 5-mm telescope is inserted through

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this port and the uterus and myomas are evaluated with respect to size and location. The supraumbilical site for insertion of the 10-mm telescope is chosen depending on the size of the lesion, and the 10-mm trocar is inserted under vision of the 5-mm telescope. We prefer to place this 10-mm trocar at the supraumbilical location under direct vision to avoid damaging major vessels that are directly beneath the insertion site.

The 5-mm port inserted initially can serve as an accessory port for the rest of the procedure. This port has to be placed above or at the upper limit of the uterus so that instruments inserted through it will have unobstructed passage above the fundus of the uterus. An additional 5-mm port is inserted in the contralateral midquadrant of the abdomen lateral to inferior epigastric vessels above the level of the upper limit of the uterus.

Although we begin with two accessory ports, we insert an additional port in midline at a variable distance above pubic symphysis for insertion of the myoma screw to manipulate the myoma. Also one of the lateral ports is converted to a 15-mm port for insertion of the morcellator.

Before myomectomy, all pelvic structures and the abdominal cavity are inspected. The number, site, and location of myomas are noted (Figure 1). If other pathologies are seen, they are usually treated before myomectomy. The course of the ureter, especially in the case of broad ligament myomas, is traced.

The technique of myomectomy is as described elsewhere.[7] We infiltrate up to 30 ml of vasopressin at a concentration of 5 to 10 IU/100 ml of saline solution at several points subcapsularly before the hysterotomy incision. Conventionally, that incision is made on the most prominent part of the myoma.[7] It is difficult, however, to enucleate a very large myoma completely from the pseudocapsule if the incision is made on the most prominent part of the convex surface of the myoma. We prefer to make a horizontal incision on the myoma close to its base with bipolar coagulation and laparoscopic scissors, the width of which varies with the size of the lesion. It is not essential to enucleate the myoma completely from the capsule since we do not preserve the entire capsule for closure of the uterine wall. If we separate the myoma from its bed, the excess capsule can be excised together with the myoma.

The incision should be large enough to deliver the myoma through it. It is oriented by the ease it would offer in suturing of the uterine wall. We find that a horizontal incision offers greatest ease in intracorporeal suturing. It is also associated with less bleeding, as intrauterine vessels run in a horizontal direction.[8] Care should be taken to ensure that the incision does not extend to the cornual end of the fallopian tubes. In the case of a large anterior wall or fundal myoma, we make a curvilinear incision that does not extend to the cornual ends of the tubes during the process of enucleating the myoma. Bonney's hood operation can also be done in case of a posterolateral myoma. For intraligamentous leiyomyomata, incision of the broad ligament is large enough to allow spontaneous drainage[9]; that is, large enough to facilitate enucleation of the myoma and allow drainage of blood after surgery. It may be necessary to divide the round ligament to gain access to an intraligamentous myoma.

In women with menorrhagia who have completed childbearing, certain large myomas can be devascularized before myomectomy by either laparoscopic bipolar coagulation of uterine arteries or by laparoscopic intracorporeal suturing of uterine arteries.

Enucleation is made along the cleavage plane separating the myoma and surrounding myometrium.[10] It is facilitated by traction with a 5-mm myoma screw and countertraction on the cervix with a tenaculum held by the

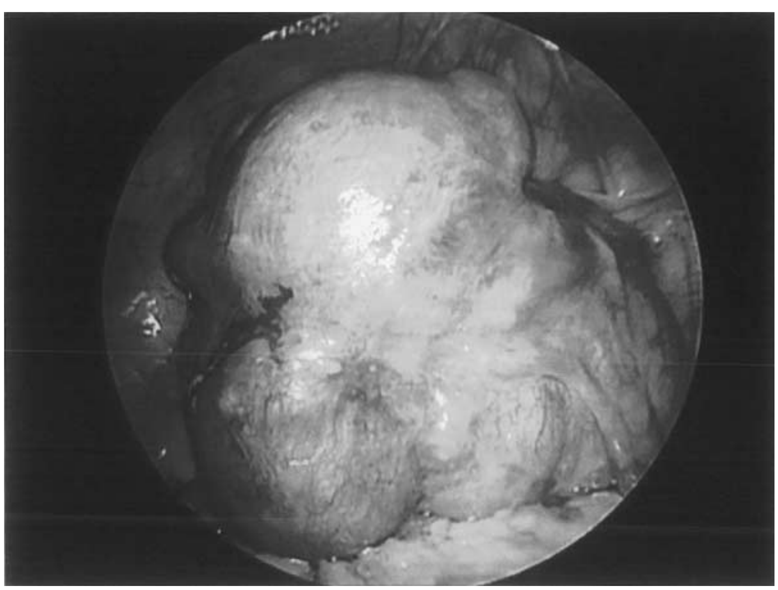

FIGURE 1. Multiple large myomas.

assistant. A degenerated myoma may be too friable to allow a firm grip with a myoma screw. In such cases, it may be necessary to hold the myoma with a 10-mm traumatic grasper inserted through the 15-mm port reduced to a 10-mm port with the help of a reducer. Hemostasis is ensured with precise bipolar coagulation of the small vessels. Refashioning of the excessive capsular tissue is necessary.

The hysterotomy is closed with interrupted intracorporeal sutures with 1-0 polyglyconate in one or two layers depending on the depth of the myoma in the uterine wall. If the uterine cavity is opened, we close the uterine wall in two or three layers excluding endometrium. The 15-mm port is closed with port closure (Reza Granee) needle under vision. The remaining ports are closed with 3-0 polypropylene subcuticular sutures.

Stalks of pedunculated myomas are transected with bipolar coagulation forceps and scissors. Myomas are extracted through the suprapubic route by morcellation with the help of a electromechanical morcellator. Copious lavage of the peritoneal cavity is performed with Ringer's lactate solution, approximately 500 to 1000 ml. Hydroflotation leaving at least 250 ml of lactated Ringer's solution is done.

The ureters are again traced, especially in case of broad ligament myomas. A drain may be placed when considered necessary if dissection has been extensive.

All patients were evaluated 7 days and 1 month after surgery and the following data were recorded: number, size, and location of myomas; operating time and blood loss; intraoperative and postoperative complications; and length of hospital stay. Blood loss was estimated by calculating the difference between volumes of aspirated and irrigated fluids.

Data Analysis

Analysis was done on the SPSS package. Results are expressed as mean ± SD. Pearson's correlation test was used wherever applicable, with probability below 0.05 considered significant.

Results

No case was converted to laparotomy due to difficulties encountered during myomectomy. Bonney's hood operation was done in one woman (1.9%). Laparoscopic bipolar coagulation of uterine arteries was done in one patient and laparoscopic suturing of uterine arteries in another. One patient had bilateral ovarian endometrioma. She underwent cyst drainage and laparoscopic adhesiolysis in addition to laparoscopic myomectomy. All women with infertility underwent chromopertubation to ensure tubal patency. Six patients (11.7%) had a scar from previous surgery: three (5.8%) had transverse scars of cesarean sections; one (1.9%) had three vertical scars of three cesarean sections; two had a vertical scar of previous myomectomy done by laparotomy. Adhesions at the site of the scar were found in the woman with three vertical scars.

Seventy-eight myomas were removed laparoscopically in these 51 patients. Three women had two myomas larger than 9 cm; three had two myomas between 5 and 9 cm (in addition to 1 >9 cm), and one had three myomas between 5 and 9 cm (in addition to 1 >9 cm).

The mean number of myomas removed was 1.53 ± 1.17 (range 1–6). One myoma was removed in 39 patients, two myomas in 5, three in 3, four in 1 patient, five in 2, and six myomas in 1. Thus 12 patients (23.5%) had multiple myomectomy.

The sizes of the myomas removed ranged from 2 to 21 cm (Table 1). A MEDLINE search revealed this to be the largest reported. Table 2 shows the distribution of large myomas according to location. Mean weight of the myomas removed from each patient was 698.47 ± 569.13 (range 210–3400 g; Figure 2). Mean operating time was 136.67 ± 38.28 minutes (range 80–270 min; Figure 3). Mean blood loss was 322.16 ± 328.2 ml (range 100–2000 ml; Table 3). The greatest blood loss was in the woman in whom the weight of myomas was 3.4 kg. Twenty women (39.2%) were given blood transfusion postoperatively; 10 received a single unit, 6 were given 2 U; 3 were given 3 U, and 1 was given 4 U.

The uterine cavity was opened twice (3.9%). The uterine defect was closed in two layers in 23 cases (45%).

The mean hospital stay was 39.52 ± 10.15 hours (range 18–72 hrs in 50 patients). One patient had a stay of 9 days due to complications.

The correlation coefficient for the weight of myomas versus operating time was 0.769 ($p < 0.001$), for blood loss with respect to operating time it was 0.607 ($p < 0.001$; Figure 4), and for blood loss with respect to weight of myomas it was 0.812 ($p < 0.001$; Figure 5).

There were no anesthetic complications. One woman (1.9%) operated early in the series had a broad ligament hematoma revealed on ultrasound examination on the fourth postoperative day that was managed conservatively. Two patients (3.9%) developed fever (38–39° C) on the second

TABLE 1. Myoma Sizes

Size (cm)	Number of Myomas	% of Total
1–3	5	6.4
3–5	10	12.8
5–7	6	7.7
7–9	3	3.8
9–11	20	25.6
11–13	16	20.5
13–15	7	9.0
15–17	3	3.8
17–19	0	0.0
19–21	7	9.0
21–23	1	1.3
Totals	78	100.0

TABLE 2. Distribution of Large Myomas by Site

Size (cm)	Fundal	Anterior	Posterior	Lateral	Anterior Cervical	Posterior Cervical	Fundal and Pedunculated
9–11	3	4	7	3	1	1	1
11–13	5	1	6	3	0	0	1
13–15	4	0	1	0	0	0	2
15–17	1	2	0	0	0	0	0
17–19	0	0	0	0	0	0	0
19–21	3	2	0	1	1	0	0
21–23	0	0	1	0	0	0	0
Totals	16	9	15	7	2	1	4

FIGURE 2. Weight of the myomas.

postoperative day, most probably due to a reaction to blood transfusion.

One woman (1.9%) underwent laparotomy due to postoperative complications. Her removed myomas had a cumulative weight of 3.4 kg. She was given 4 U of blood intraoperatively as her preoperative hemoglobin was 10 g/dl, and she had blood loss of 2000 ml. She developed intraabdominal bleeding and dilutional coagulopathy 9 hours after surgery and hence a subtotal hysterectomy was done by laparotomy. She was given 3 additional U of blood and 5 U of fresh-frozen plasma postoperatively. She was discharged on the ninth postoperative day and had no additional problems during follow-up.

All patients with history of other than infertility were followed for 1 year. Overall, 50 patients (98%) were satisfied with the procedure and its results. The woman who was

TABLE 3. Frequency Distribution of Blood Loss

Blood Loss (ml)	Number of Patients	% of Total
100–200	18	35.3
200–300	16	31.4
300–400	5	9.8
400–500	3	5.9
500–600	4	7.8
600–700	0	0.0
700–800	1	2.0
800–900	0	0.0
900–1000	0	0.0
>1000	4	7.8

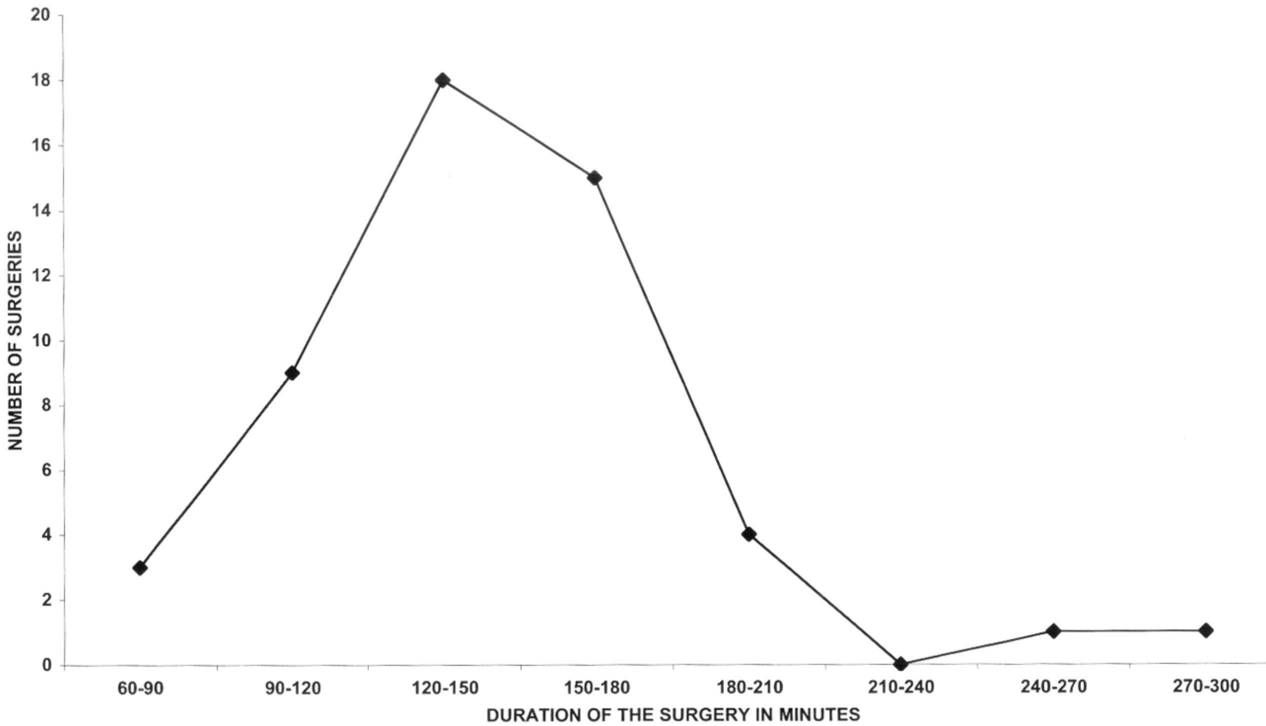

FIGURE 3. Duration of surgery.

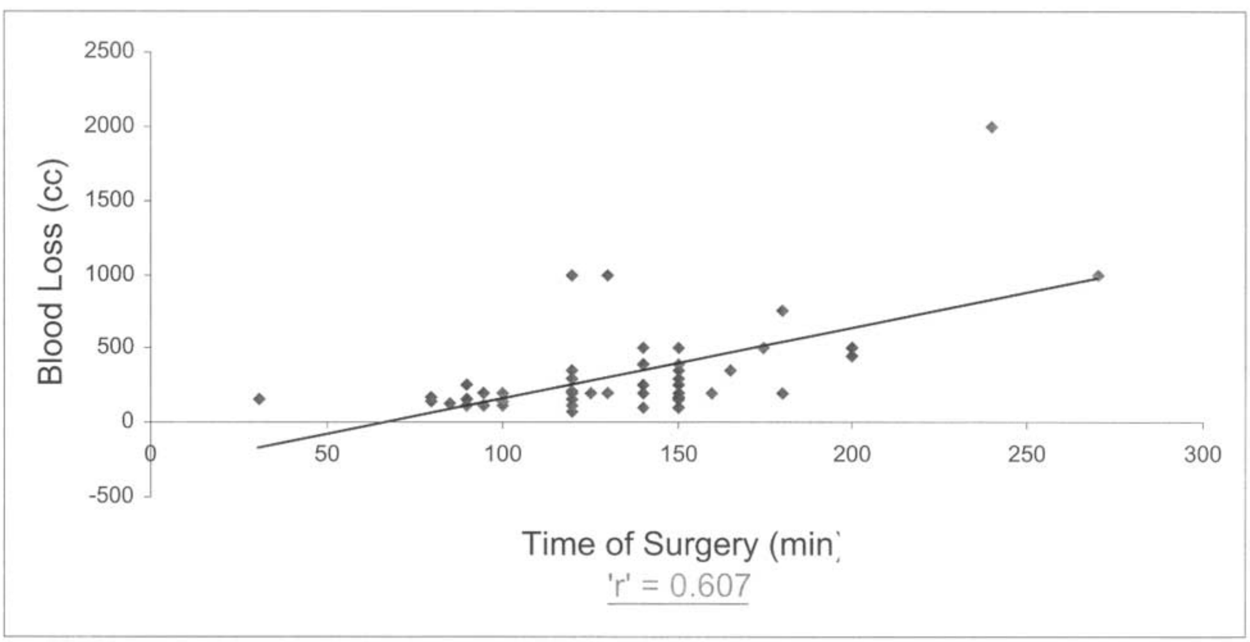

FIGURE 4. Blood loss vs duration of surgery.

dissatisfied was the one in whom laparotomy was done for postoperative complications. Two women complained of pelvic pain at the end of 1 month. All patients reported resolution of symptoms of hypermenorrhea, abdominal pain, and dyspareunia at the end of 1-year follow-up. They all reported good cosmetic results. Long-term follow-up of these women as well as extended follow-up of those with infertility is being conducted.

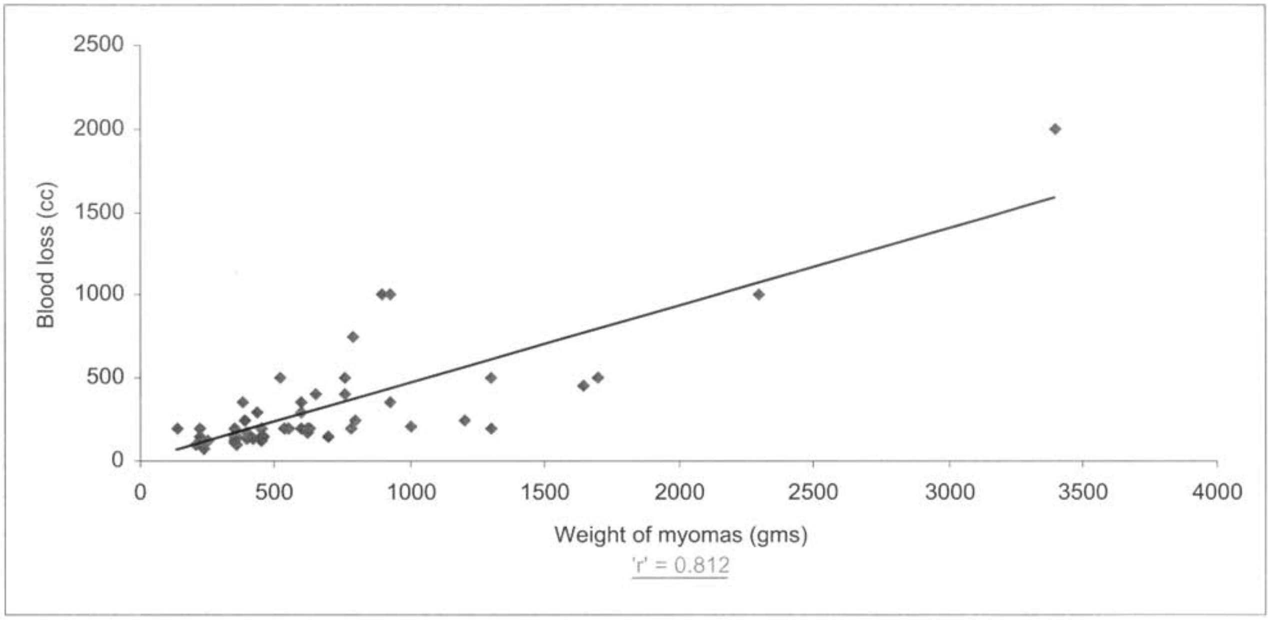

FIGURE 5. Blood loss vs weight of myomas.

Discussion

Two issues when dealing with uterine myomas are which ones should be removed and which procedure should be performed to remove them.[10] In cases of large myomas, those beyond 9 cm in diameter on ultrasound, the second issue is a matter of debate. Laparoscopic myomectomy is an attractive alternative to laparotomy myomectomy, although it is technically demanding.[11,12] For large myomas, technical requirements for manipulation of needles and suture make the procedure difficult to perform.[13] As no two myomas are alike, technical difficulties can never be predicted until the telescope is inside the patient. Many experts concur on the need to limit laparoscopic myomectomy to women with myomas of a particular size, number, or location, because of inherent technical problems, namely, hemostasis, uterine closure, and tissue removal.[14]

A critical issue is the skill necessary for the operating surgeon. Each surgeon has to determine selection criteria based on personal proficiency in laparoscopic surgery, especially intracorporeal suturing. The procedure demands optimal efficiency, not only on the part of the surgeon, but also on part of assistants and instruments. We believe, however, that with requisite skills and good support, the size and location of myomas need not be limiting factors for the procedure. Basic principles of myomectomy would still apply regardless of route—laparoscopy or laparotomy.

Variables such as operating time and hospital stay in our study were comparable to those in other studies.[11,15–17] Our conversion rate to laparotomy was zero. The literature reports conversion rates varying from zero to 28.7%,[11] with most conversions largely because of intraoperative bleeding.[11]

Some authors stated that the biggest myomas will have highly distended perimyomatous vascularization due to compression,[18] thus increasing the risk of perioperative hemorrhage. However, in one study, vascularity decreased with the increasing size of myomas, and none of five myomas with diameters of 20 cm or more had rich vascularity.[19] We found a positive correlation between blood loss and myoma weight ($r = 0.812$, $p < 0.001$). Mean blood loss in our study is comparable with that in other studies,[11,15–17] although myomas in our study were larger. In 42 patients (82.4%), blood loss was less than or equal to 500 ml. It was more than 1000 ml in four women (7.8%). However, in the patient who underwent subtotal hysterectomy, intraoperative blood loss was an unacceptable 2000 ml.

Hemostasis during myomectomy is achieved fundamentally with intracorporeal suturing aided by vasoconstrictive agents and bipolar coagulation. Many advantages are attributed to a preoperative course of GnRH analogs, including a significant reduction in dimensions of myomas.[20] Another possible advantage is that treatment softens uterine myomas, thus facilitating morcellation.[21] In our experience, softening caused by administration of GnRH analogs makes it difficult to identify cleavage planes. It may also delay the diagnosis of leiyomyosarcomas[22] and extend operating time.[21] Hence, none of our patients was treated with GnRH analogs despite the large sizes of myomas.

Injection of a vasoconstrictor agent, vasopressin (10–30 ml of 5–10%) infracapsularly and at the base of the myoma induces vasoconstriction and reduces blood loss.[10] Although doubts have been raised about the possibility of postoperative bleeding after vasoconstriction has worn off, we did not encounter such an event. Also if bleeders are treated effectively by bipolar coagulation and the uterine wall is closed with effective hemostatic sutures, the chances of postoperative bleeding are considerably reduced.

The issue of laparoscopic suturing is important not only because it is a method of hemostasis but also because it determines the strength of the uterine wall during subsequent pregnancies. Adherence to closure principles of laparotomy myomectomy will reduce the frequency of uterine wound dehiscence. It is essential to ensure that myometrial edges are approximated without tension and that no hematoma forms deep within myometrium. This precaution is necessary to reduce the likelihood of healing by secondary intent, which could make the uterine wall fragile during pregnancy.[23] Also it is necessary to invert the edges of myometrium to prevent growth of endometrial glands in the uterine scar.[23]

Other important issues related to conversion rate are the size and location of myomas. Anterior location was reported as an important predictor of conversion and is considered to be poorly accessible to operating trocars, in particular when suturing.[24] Suturing of an anterior hysterotomy is considered difficult, as curved needles must be taken through myometrium perpendicular to the serosal incision to provide accurate closure.[24] In our experience, a horizontal incision on the anterior myoma as close to the base of the myoma as possible, coupled with retroversion of the uterus, helps to overcome this problem. As stated earlier, we find it easier to suture a horizontal hysterotomy wound with sutures perpendicular to the serosa incision with the help of two laparoscopic needle holders inserted through the two lateral accessory ports. The angle of separation between the needle holders is approximately 180 degrees[9] and the needle holder is parallel to the suture line. This relationship is logical and helps in proper suturing of the wound, as the needle is held in the jaws of the needle holder in a perpendicular fashion and the needle is passed perpendicular to the suture line.[6]

In our study, five myomas were larger than 9 cm and two were between 5 and 8 cm in the anterior location. In all, 14 patients (25%) had myomas in the anterior position, 1 of whom had two myomas in that location.

The challenge of developing an efficient method of laparoscopically directed morcellation is largely answered with the introduction of electromechanical morcellators, which reduce operating time compared with traditional mechanical methods.[25]

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