Original Article

Size, Type, and Location of Myoma as Predictors for Successful Laparoscopic Myomectomy: A Tertiary Government Hospital Experience

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Abstract

Background: Laparoscopic myomectomy (LM) is a preferred alternative to abdominal myomectomy due to shorter hospitalization, faster recovery, and decreased intraoperative adhesions. The criteria, however, which constitute proper selection of patients for LM, are still a matter of debate. Since conversion to either laparoscopic-assisted myomectomy (LAM) or laparotomy (EL) entails longer time and increased costs compared to performing an open procedure from the outset, this research aims to evaluate size, location, and type of myoma as predictors for LM.

Methodology: Inpatient medical records of all women who underwent LM from January 2014 to August 2016 were retrieved and reviewed. Demographic data, intraoperative records, and postoperative course were obtained. The association of size, type, and location of myomas to the procedure performed was analyzed.

Results: There was no significant association between the size of the myoma or its location to the procedure performed. However, intramural and subserous myomas were associated with successful LM, while submucous myomas were associated with conversion to either LAM or EL ($P = 0.010$).

Conclusion: LM is a difficult procedure that challenges even the most skilled laparoscopic surgeon. Proper patient selection lessens complications and decreases the risk of conversion. In this study, type of myoma may be a good predictor for successful LM; however, this conclusion may be limited by the small sample size. A large-scale multicentric prospective study is necessary to validate the role of the proposed predictors to prevent unplanned conversion to an open procedure and reduce cost and increase safety of LM.

Keywords: Conversion, laparoscopy, leiomyoma, myomectomy

Introduction

Myomectomy is the surgical procedure of choice for symptomatic myoma in the reproductive age, especially if future fertility is desired. Myomectomy may also be performed for those who desire to preserve their uterus for social, cultural, and psychological reasons, despite having completed family size. Although myomectomies have traditionally been executed through the abdominal route, advances in technology and modern-day laparoscopic instruments have brought about a rise in laparoscopic myomectomies (LMs).

LM is the surgical removal of uterine myoma through small incisions in the abdomen. It is an appropriate, if not preferred, alternative to abdominal myomectomy in well-selected patients since it offers shorter hospitalization, short recovery period and resumption of activities within 1–2 weeks, reduced risk of blood transfusion, and intraoperative adhesions.[1-3] Most frequent complications independent from surgeon's experience remain to be massive intraoperative bleeding and conversion to hysterectomy.[1] The criteria, however, which constitute proper selection of patients for LM, are still a matter of debate.

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The first reported LM was done in 1979 by a German gynecologist, Dr. Kurt Semm.[4,5] Dr. Semm already utilized intra- and extra-corporeal suturing though he received a lot of criticism for his innovations and novel procedures. Although there have been many new methods and tools that have arisen, the basic technique formulated by Dr. Semm still remains.

LM is performed by insertion of a 10-mm telescope in the umbilicus and using two to three 5-mm accessory ports. An incision is made through the uterine wall to the pseudocapsule of the myoma using a monopolar spatula. The cleavage plane of the myoma is then identified followed by enucleation of the mass using blunt and sharp dissection. The resulting defect is then repaired with continuous intracorporeal sutures using delayed absorbable or barbed sutures. The specimen is retrieved either by placing the specimen in a bag after which it is brought up to the largest port site and then morcellated either using a blade or scissors or with the use of a power morcellator.[5]

Laparoscopic-assisted myomectomy (LAM), on the other hand, is defined as the use of a mini-laparotomy (<5 cm length abdominal incision) to perform enucleation of the myoma, uterine closure, or specimen retrieval. In endoscopy centers where new technology and techniques for specimen retrieval abound, recourse to LAM is considered a conversion to an open procedure. Our institution has been performing LAM since 2012. With the acquisition of a power morcellator in 2014, successful LM has been achieved.

The risks and benefits of LM are controversial due to the procedure being reputably difficult with long operating times, requiring a steeper learning curve, and having a high risk of conversion to laparotomy. Difficulties encountered include identification of the cleavage plane, which may provoke increased blood loss and difficulty in apposition of the resulting defect in the myometrium due to its depth, length, and location.[6]

Conversion to laparotomy is more time- and cost-consuming than deciding on an open procedure from the outset. Hence, being able to identify the characteristics of patients who have a higher probability of having a successful LM can aid in patient selection. This will not only help avoid unnecessary expenses for the patient, but also prevent further complications. This study aims to evaluate if size, location, and type of myoma can be good predictors for a successful LM.

Methodology

This is a retrospective cohort study of healthy, nonpregnant women with symptomatic myomas who underwent LM at our institution from January 2014 to August 2016. No exclusion criteria in terms of size, location, or type of myoma were used and all women who either desired future fertility or wished to retain their uteri were included in the study.

Size of the myoma in centimeters, location of the myoma, and type of myoma were determined through transvaginal sonography and compared to the intraoperative findings. Administration of gonadotropin-releasing hormone (GnRH) agonist prior to operation was also noted. Standard preoperative preparation was performed on all patients. Hemoglobin was ensured to be >10 g/dl prior to LM.

Two expert laparoscopy surgeons performed all surgical procedures.

All LMs were done under general anesthesia with a 10-mm telescope (Karl Storz Endoscope, Tuttlingen, Germany) through one optic trocar located in the umbilicus and three 5-mm accessory trocars: two of which placed two finger breadths above the anterior superior iliac spines and one midline, 4–5 cm above the pubic symphysis. Monopolar and bipolar electrocoagulation were used for enucleation and hemostasis. The uterine wall defect was repaired by two layers using barbed sutures. Prior to specimen retrieval, the right accessory trocar was extended to 10 mm to allow insertion of the tissue morcellator (Rotocut G1 Morcellator, Karl Storz Endoscope, Tuttlingen, Germany).

Data gathered included age, gravidity and parity, body mass index, previous surgeries, size of the myoma, location of the myoma (anterior or posterior), type of myoma (intramural, subserous, or submucous), and surgical outcomes including intraoperative estimated blood loss, operative time from skin cutting to skin closure, drop in hemoglobin, and length of postoperative hospital stay. Complications such as blood transfusion and pelvic organ injuries, as well as reasons for conversion to either LAM or exploratory laparotomy (EL) were also recorded. A successful LM is defined as removal of the myoma through small abdominal incisions without resorting to an open procedure (LAM or EL).

The Fisher's exact test, Chi-square test, and Mann–Whitney U-test were used for statistical analysis to investigate the association of size, location, and type of myoma to surgical outcomes, length of hospital stay, as well as to the final procedure done. $P < 0.05$ was considered statistically significant. Continuous variables were presented as mean ± standard deviation and categorical variables were expressed in counts (percentages). Statistical analysis was performed by the use of Statistical Package for the Social Sciences for Windows version 20 (SPSS Inc., Chicago, IL, USA).

This study was approved by the Ethical Review Board. The data gathered were kept anonymous and confidential.

Results

A total of thirty patients underwent LM during the study period. The main characteristics of the sample population are summarized in Table 1.

Preoperative evaluation results are shown in Table 2. Ultrasound findings underestimate the largest diameter measured at laparoscopy by 5 mm ($P < 0.05$).

Patients who underwent the study had a single large myoma; the mean size of myoma removed was 10.4 ± 3.09 cm in the largest diameter. Majority of the cases had anterior location of myoma (70.34%) and the type of myoma was predominantly intramural (70.37%). The mean operating time was 248.23 ± 84.71 min (range, 160–540 min). The mean blood loss was 763.33 ± 369.28 ml (range, 300–1200 ml), while mean postoperative decrease in hemoglobin was 18.67 ± 8.7 g/dl (range, 2–43 g/dl). A total of two patients required transfusion of 2 units of packed RBC postoperatively. The mean hospital stay was 4.93 ± 1.11 days for 29 patients and 1 patient stayed for 10 days due to postoperative complications. All histopathology results were consistent with myoma uteri.

Based on the Mann–Whitney test, increasing size was associated with increase in operating time (P = 0.05) and greater postoperative drop in hemoglobin (P = 0.039). For location, there was significantly greater volume of blood loss for myoma in the posterior location (P = 0.055). Other variables were not proven significant in determining surgical outcomes.

LM was successfully performed in 12 cases, while 13 cases underwent LAM and 5 cases were converted to EL. To determine if size, location, and type of myoma can predict a successful LM, nonparametric Mann–Whitney test was used to compare the sizes of myoma between LM and conversion to either LAM or EL. Fisher's exact and Chi-square tests were used to determine association between location and the procedure as well as the type of myoma and procedure. For the type of myoma, those that do not involve the endometrium (intramural and subserous) were combined to increase accuracy of the Chi-square test. There was no significant difference between the sizes of myoma for the two groups compared.

There was also no significant association between the location of the myoma and procedure performed. However, there was significant association between the type of myoma and procedure. Intramural and subserous myomas were associated with successful LM, while submucous myomas were associated with conversion to either LAM or EL. Detailed data are summarized in Table 3.

The intraoperative complications encountered include pelvic hemorrhage requiring blood transfusion (2 cases), subcutaneous emphysema with hypercapnea (1 case), and injury to the bladder (1 case).

Fifteen cases were converted to an open procedure due to technical difficulty; difficulty in suturing (11 cases), difficulty in achieving cleavage of the myoma due to limited space (3 cases), and difficulty due to dense adhesions (3 cases). In one case, conversion to an open procedure was related to subcutaneous emphysema with hypercapnea.

Table 1: Demographic profile of the study population (n=30)

Particulars	Mean +/- SD
Age	35.7±4.1 (20, 44)
Gravidity (%)	
Nulligravid	13 (43.33)
Multigravid	17 (56.67)
Parity	
Nullipara	19 (63.33)
Multipara	11 (36.66)
Body mass index	22.51±2.48 (19.02, 27.9)
With previous abdominal surgeries	1 (3.33)

Table 2: Preoperative characteristics of the study population (n=30)

Characteristics	Mean +/- SD
Preoperative GnRH agonist therapy (%)	
Yes	1 (3.33)
No	29 (96.67)
Ultrasound findings	
Size (cm) (%)	10.28±3.26 (3.2-15)
<4	1 (3.33)
4-7	4 (13.33)
8-11	13 (43.33)
12-15	12 (40)
Location (%)	
Posterior	8 (29.63)
Anterior	22 (81.48)
Type of myoma (%)	
Intramural	19 (70.37)
Subserous	5 (18.52)
Submucous	6 (22.22)

GnRH: Gonadotropin-releasing hormone

Table 3: Comparison of size, location, and type of myoma based on surgery performed

	Laparoscopic myomectomy (n=12)	Converted to open procedure (LAM/EL) (n=18)	P
Size of myoma (cm) (%)	11.25±2.01 (8-15)	9.64±3.81 (3-15)	
<4	0	1 (5.56)	0.232
4-7	0	4 (22.22)	
8-11	6 (50)	7 (38.89)	
12-15	6 (50)	6 (33.33)	
Location (%)			
Posterior	5 (41.67)	6 (33.33)	0.712
Anterior	7 (58.33)	12 (66.67)	
Type of myoma (%)			
Intramural/subserous	12 (100)	10 (55.56)	0.010
Intramural	7 (58.33)	9 (90)	
Subserous	5 (41.67)	1 (1)	
Submucous (Grade 2)	0	8 (44.44)	

LAM/EL: Laparoscopic-assisted myomectomy or exploratory laparotomy

Discussion

In this retrospective cohort study, successful LM was shown to be associated with the type of myoma, particularly subserous and intramural myoma (P = 0.01), while the risk of conversion to LAM or EL was shown to be higher for submucous myoma (Grade 2). There was no significant difference in terms of size and location of myoma in patients who underwent LM, LAM, or EL. Hence, size and location may not be good predictors in determining successful LM.

However, results showed that size of myoma was significantly associated with operative time and postoperative hemoglobin drop.[1,7] It is likely for a large myoma to be associated with increased operative time since a large mass would take a longer time to cleave and enucleate. Greater hemoglobin drop can also be explained by the highly distended perimyomatous vasculature brought about by bulk compression of the mass, thus increasing the risk of intraoperative hemorrhage. In addition, increase in size would cause reorganization of the adjacent myometrium, making the cleavage plane difficult to recognize and dissect,[6] thus leading to more blood loss and longer surgical time. Furthermore, a large myoma may leave a wider and deeper uterine defect requiring a multilayer repair that would entail more time even for the experienced endoscopist.

Posterior location was associated with greater volume of estimated blood loss in this study. A possible explanation is the technical difficulty in accessing and visualizing the surgical site, which may also lead to conversion to an open procedure. In contrast, Dubuisson *et al*.[6] stated that an anterior location, rather, has a higher risk for conversion due to the anterior wall of the uterus being less accessible to the operating trocars, especially during repair of the uterine defect. Conversely, Sinha *et al*.[8] reported that location was not a limiting factor for LM. They were able to repair anterior horizontal incisions by cutting close to the base of the myoma instead of incising the most accessible convex surface. Ergonomically logical port geometry was enabled with a 180° angle of separation between needle holders and the needle holder was held parallel to the suture line. The needle was then easily passed perpendicular to the suture line.

The type of myoma was not significant in terms of blood loss, hemoglobin drop, and operative time. Nevertheless, there was significant association between the type of myoma and procedure performed [Table 3]. Subserous and intramural myomas were associated with successful LM as compared to submucous myomas, which were shown to have higher risk for conversion to EL (P = 0.01). Subserous myomas are the ideal type for LM because they are located outside the uterus and are easily accessible. Such myomas can be enucleated easily and the shallow defect can be adequately repaired by 1–2 layers of suturing. Intramural myomas can be removed laparoscopically depending on their depth of invasion. For large intramural myomas that span the entire myometrium, especially those with submucous component, difficulty may be encountered in suturing the deep hysterotomy since several layers may be required. This may result in inadequate uterine repair leading to either hematoma formation immediately after the operation or uterine rupture in subsequent pregnancies.[2,6,8] Although experienced surgeons may perform the suturing laparoscopically, concerns about uterine closure are still a matter of debate, with certain authors emphasizing that LM does not provide adequate uterine repair for myomas with deep invasion.[6]

In general, submucous myomas up to 4 or 5 cm in diameter can be removed by hysteroscopy if done by experienced surgeons, with Grade 2 myomas usually requiring a multistage procedure. Larger submucous myomas, as in the sample population, are best removed laparoscopically or abdominally. It is important to note that not all submucous myomas are appropriate for transcervical resection, especially those that traverse a majority of the myometrium and extend to the uterine serosa. In such cases, hysteroscopy is no longer feasible or safe. Hysteroscopic myomectomy of large myomas might also result in the removal or destruction of a significant proportion of endometrial surface, a vital concern for women who still desire future fertility. Since there are no current guidelines as to the proportion of endometrial cavity involvement to help decide surgical approach, the decision would rely on the surgeon's judgment.[9]

Differences in sizes of myoma in both LM and LAM/EL groups were not statistically significant, and hence the association to either procedure cannot be made. Possible reasons for which include the small sample size of this study. Other limitations include a selection bias in cases of large myomas when the surgeon decided to push through with the LM since other characteristics suggested an easy enucleation. Hence, our data did not allow us to draw any conclusion about the maximum size of myoma to be removed by LM. Studies by Dubuisson[2] and Dubuisson *et al*.[6] stated that LM can be performed for myoma no larger than 8 cm, while others extended this limit up to 15 cm. Current studies suggest that characteristics other than size should be taken into account.

Common intraoperative complications encountered include pelvic hemorrhage requiring blood transfusion, subcutaneous emphysema with hypercapnea, and injury to the bladder.

Surgeon experience remains to be an important aspect in LM since its success is highly dependent on the skill of the operator. This was not a variable factor in this study since two surgeons with adequate experience in LM performed the surgeries. Difficulties encountered by the surgeons were similar to those mentioned in literature: difficulty in achieving hemostasis, technical difficulties in enucleation, multilayer suturing to achieve adequate uterine repair, and specimen retrieval in cases of large myomas.[2,6,8-10]

A number of methods have been proposed to minimize blood loss such as vasoconstrictors, uterine artery ligation, and embolization. Preoperative GnRH agonist therapy may reduce bleeding; however, some authors recommend its use to be limited to selected cases because it increases the difficulty in identifying and dissecting the cleavage plane between myoma and pseudocapsule.[1,6] Moreover, softening of the myoma makes it difficult to grasp with myoma screw or forceps.[8]

Technical difficulties in enucleation of large myomas are primarily related to the limited space in which push and pull maneuvers can be done. Recent studies recommend modifying the incision site to the base of the myoma, enabling the surgeon to separate the myoma from its bed in the uterine corpus first. Once this is achieved, dissection of the myoma from its pseudocapsule is no longer necessary since the excess capsule may be excised together with the myoma. Sinha *et al*.[8] successfully performed enucleation by morcellation while the myoma is still attached to the uterine corpus with or without prior devascularization. Other studies employed internal crushing and retrieval through colpotomy, but this was shown to increase recuperation time.[10]

Uterine closure can be achieved by multilayer suturing that requires a skilled and experienced surgeon. The innovation of self-locking, barbed sutures allows the process to be performed with greater ease. Judicious use of bipolar coagulation is important to maintain the integrity of the tissue to be repaired and avoid tissue necrosis, thus ensuring proper wound healing. Best results are achieved when suturing is done in multiple layers without excess tension.[2,8] Specimen retrieval is preferably done by power morcellation through a trocar site, with the myoma placed inside a bag. Transumbilical retrieval using an endobag and colpotomy are the other options for specimen retrieval.

Conclusion

LM is regarded as a difficult procedure that challenges even the most skilled laparoscopic surgeons. Proper patient selection is advised to lessen complications and the risk of conversion to an open procedure. In this study, type of myoma may be a good predictor for successful LM. Size and location were not shown to be associated with either LM or open procedure; however, this conclusion may be limited by the small sample size. A large-scale multicentric prospective study may be necessary to validate the role of the proposed predictors to prevent unplanned conversion to an open procedure and reduce cost and increase the safety of LM.

Recommendation

A large-scale multicentric prospective study may be necessary to validate the role of the proposed predictors to prevent unplanned conversion to an open procedure and reduce cost and increase the safety of LM.

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Conflicts of interest

There are no conflicts of interest.

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