Laparoendoscopic Two-Site Myomectomy (LETS-M) Using Conventional Laparoscopic Instruments and The Glove-Port Technique

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Research Article

Keywords: Laparoscopy, two-port, uterine myoma

Posted Date: January 4th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-129591/v1

Abstract

We aim to evaluate the surgical outcome of laparoendoscopic two-site myomectomy (LETS-M). The medical records of 204 women receiving LETS-M in a tertiary referral center, including 183 surgeries performed by the experienced surgeon and 21 surgeries performed by 3 well-supervised trainees were retrospectively reviewed. The age of the participants was 39.3±6.4 years. The mean diameter of the largest myoma was 8.5±2.2 cm. The mean weight of the myomas was 281.1±183.1 g. The operation time was 97.6±40.2 min, and the intraoperative blood loss was 99.3±115.2 mL. There were 3 (1%) cases of excessive blood loss (more than 500 mL) and 2 (1%) of postoperative hematoma. The only significant difference between the experienced surgeon and trainees was the operation time (92.3±32.2 min vs. 141.2±54 min, $p<.001$), while the myoma number, myoma diameter, myoma weight, and intraoperative blood loss were not significantly different. The operation time did not differ among different myoma locations. In multivariate analysis, virginity, myoma number, more than 2 large myomas, and myoma size were independent variables for longer operation times. No patient experienced any major complications. The result revealed that LETS-M is a minimally invasive surgical method that is safe, effective, and easy to learn for managing uterine myoma.

Introduction

For women of reproductive age, uterine myoma is the most common benign uterine tumor(1). Myomas can lead to various symptoms, such as hypermenorrhea, a sensation of pelvic pressure, lower urinary tract symptoms, and infertility(2). Because of the great impacts on life quality, myoma is the most common indication for hysterectomy(2).

Compared to traditional laparotomic surgery, laparoscopic myomectomy (LM) can achieve the goal of minimally invasive intervention and uterine preservation(3), and the operation number increased steadily. However, LM is considered a time-consuming procedure with a relatively long learning curve, requiring more dissection, intracorporeal suturing, and knot-tying skills(1, 3). LM is better performed in women with an appropriate uterine and myoma size by a well-trained surgeon(2). Although suture materials, such as barbed sutures, and laparoscopic equipment were improved day by day, LM was still considered an advanced operation.

There were several publications regarding different approaches of LM, trying to make the surgery more effective and easy to learn. Here, we present laparoendoscopic two-site myomectomy (LETS-M) as a novel setting for LM on a two-port basis, which is performed in our hospital for more than 6 years. We modified the umbilical glove port introduced by Kim and colleagues in 2014(4), using three trocars and conventional laparoscopic equipment only. In addition to the surgical results, we compared the surgical outcomes of an experienced surgeon and those of three trainees.

Materials And Methods

Between January 2015 and September 2019, the medical records of women with uterine myoma managed by LETS-M at a tertiary referral center were retrospectively reviewed. This study received approval from the Research Ethics Committee of National Taiwan University Hospital (ID NO. 202001027RINA). Informed consent was obtained from all participants before surgeries. All methods in this study were performed in accordance with the relevant guidelines and regulations. Additionally, this study was registered on ClinicalTrials.gov (NCT04279626).

We included women who were older than 20 years old and had not reached menopause, with symptomatic uterine myomas, such as hypermenorrhea, infertility, and mass-effect-related urinary frequency and constipation. The exclusion criteria included dominant symptoms with active pelvic or urinary tract infection, a history of pelvic radiotherapy, a preexisting or suspicious malignant pelvic tumor, and pathologies other than uterine myoma noted during the operation. Informed consent for surgery and anesthesia was obtained from all patients.

The review of the chart records consisted of a detailed history, including age, body mass index (BMI), gravidity, parity, marital status, sexual experience, previous abdominal surgery, and hospital stay after the surgery. All women received preoperative ultrasound for their uterine myoma assessment, including the location, type, size, number, and accompanying pathology, such as an ovarian tumor. The myoma locations were identified during the operation and classified into fundal wall myoma, anterior wall myoma, posterior wall myoma and cervical myoma. The myoma type classification was based on the International Federation of Gynecology and Obstetrics (FIGO) leiomyoma subclassification system(29). We measured the weight of the specimen after finishing the surgery. The operation time was defined as the period from the incision to the closure of the skin and was the primary outcome of this study. Any intraoperative blood loss less than 50 mL or minimal blood loss on operation note was recorded as 50 mL in this study. Excessive blood loss was defined as blood loss of 500 mL or more during the operation. The postoperative pain scale was evaluated by a visual analog scale (VAS) on the first and second postoperative days.

Surgical Techniques for LETS-M

Under endotracheal general anesthesia, the patient was placed in the lithotomy position. After skin disinfection and sterile draping, the uterine manipulator and Foley catheter were inserted. A 1.5 cm skin incision was made over the umbilicus, and the abdominal wall was opened layer by layer with the open method. A wound retractor (Alexis, 2-4 cm; Applied Medical Resources Corp., Rancho Santa Margarita, CA) was placed, and the glove port was set up, with a 10-mm trocar in the thumb over the patient's right side and a 5-mm trocar in the little finger over the left side. The pneumoperitoneum was established. A 10-mm rigid laparoscope was inserted via the 10-mm trocar and controlled by the assistant. The ancillary 5-mm port was made over the left lower abdomen under laparoscope inspection. The surgeon performed the surgery via the two 5-mm trocars (Figure 2A).

After the uterine myoma was identified, we injected diluted vasopressin (20 IU/mL diluted in 100 mL saline) into the layer between the pseudocapsule of the myoma and the myometrium(30). A transverse incision with appropriate length was made on the uterine serosa of the most protruding part of the myoma (Figure 2B). The myoma was then enucleated with the aid of LigaSure (Valleylab, Boulder, CO) and a myoma screw. The operator had to continue dissecting and pulling out the myoma while being careful not to injure the adjacent ureter, bladder, or rectum. The base of the myoma should be clearly visualized to avoid any perforation of the endometrium if the myoma is close or attached to the endometrium on ultrasound. Any perforation of the endometrium was carefully sutured without avulsion. The uterine wound was sutured with 1-0 V-loc barbed sutures (Medtronic, Minneapolis, MN) continuously. We provide a novel method for needle delivery and removal in laparoscopic surgery (Figure 2C to 2H). The suture needle was inserted outside-in through the glove (Figure 2C) and grasped by the needle holder (held by the operator's right hand) inside the glove (Figure 2D), and then the suture was delivered into the pelvis (Figure 2E). The uterine wound was sutured in 2 or more continuous layers (Figure 2F). After the uterine wound was repaired, the needle was removed by direct punching through the glove (Figure 2G, 2H). We irrigated the uterine wound and pelvis and then applied hemostatic agents, such as Tisseel (Baxter, Vienna, Austria) or Floseal (Baxter, Vienna, Austria), and anti-adhesive agents. The specimen was manually morcellated out via the umbilical wound with a scalpel (Figure 3A and 3B). Tissue glue, such as Dermabond (Ethicon, Somerville, NJ), was applied for skin approximation (Figure 3C) after the fascial layer was repaired with 2-0 Vicryl. Typical wound appearance at the 3rd postoperative month is shown in Figure 3D.

Twenty-one operations were performed by three trainees who were residents of the Department of Obstetrics and Gynecology at National Taiwan University Hospital. They were experienced in basic laparoscopic adnexal surgery but had no experience in laparoscopic suture skills. These 21 surgeries were performed under the supervision of the experienced surgeon (WC Chang).

Statistical Analysis

MedCalc Statistical Software version 18.10.2 (MedCalc Software bvba, Ostend, Belgium) was used for statistical analyses. For baseline comparisons, age at operation, gynecological characteristics, details of myoma, and surgical outcomes were statistically examined by Fisher's exact test for categorical variables and the Mann-Whitney U test for continuous variables. Univariate and multivariable linear regression analyses were performed to preoperatively predict longer operation times. The Kruskal-Wallis test was applied for operation time comparison among different myoma locations. A p value less than .05 was considered statistically significant. The multivariable analysis was performed using variables that had a p value <.05 from the univariate analysis.

Data Availability Statement

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Results

A total of 204 women scheduled to receive LETS-M were enrolled in this study, including 183 women with surgeries performed by the experienced surgeon and 21 women with surgeries performed by the 3 trainees under careful supervision. The baseline characteristics of our study population are shown in Table 1. Approximately half of the women were nulliparous (100/204, 49%). Twenty-eight women (14%) had no sexual experience; thus, the uterine manipulator was not applied among these women. No significant difference was found in the demographic data between the experienced surgeon group and the trainee group.

Table 1
Baseline characteristics of women receiving two-port laparoscopic myomectomy (n = 204)

Group	Total (n = 204)	Experienced surgeon (n = 183)	Trainees (n = 21)	p value†
Age (years)	39.3 ± 6.4	39.4 ± 6.5	38.4 ± 6.3	.53
BMI	22.6 ± 3.3	22.5 ± 3.2	23.5 ± 4.0	.22
Nulliparous	100 (49)	87 (48)	13 (62)	.25
Virgin	28 (14)	25 (14)	3 (14)	1.00
Married	128 (63)	119 (65)	9 (43)	.06
Gravida	1.15 ± 1.34	1.19 ± 1.37	0.81 ± 1.03	.28
Para	0.8 ± 0.93	0.82 ± 0.93	0.67 ± 0.91	.45
Previous abdominal surgery	16 (8)	15 (8)	1 (5)	
Cesarean section = 1	15 (7)	13 (7)	2 (10)	
Cesarean section ≥ 2	2 (1)	2 (1)	0	
Myomectomy	2 (1)	2 (1)	0	
Laparotomy	6 (3)	6 (3)	0	
Appendectomy	4 (2)	4 (2)	0	
Adnexectomy				

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ BMI: body mass index.

The details of the operated myoma are shown in Table 2. The mean myoma number was 1.7 ± 1.1, and 31 (15%) of the 204 women had more than 2 large myomas (≥ 5 cm) removed during the operation. The mean myoma size was 8.5 ± 2.2 cm. More myomas were located at the posterior wall (84/204, 41%) and the anterior wall (78/204, 38%). Half of the operated myomas were classified as 4 and 6 by FIGO classification (25% and 24%, respectively). No significant difference was found in the details of the myomas between the experienced surgeon group and the trainee group.

Table 2
Details of myoma in women receiving two-port laparoscopic myomectomy (n = 204)

Group	Total (n = 204)	Experienced surgeon (n = 183)	Trainees (n = 21)	p value†
Myoma number	1.7 ± 1.1	1.7 ± 1.1	1.9 ± 1.2	.38
≥ 2 large myoma (≥ 5 cm)	31 (15)	28 (15)	3 (14)	1.00
Myoma size (cm)	8.5 ± 2.2	8.4 ± 2.2	8.6 ± 2.9	.93
Myoma location	25 (12)	23 (13)	2 (10)	
Fundus	78 (38)	72 (39)	6 (29)	
Anterior wall	84 (41)	73 (40)	11 (52)	
Posterior wall	17 (8)	15 (8)	2 (10)	
Cervix	0 (0)	6 (3)	2 (10)	
FIGO classification‡	8 (4)	15 (8)	3 (14)	
1	18 (9)	50 (27)	1 (5)	
2	51 (25)	29 (16)	2 (10)	
3	31 (15)	41 (22)	8 (38)	
4	49 (24)	15 (8)	3 (14)	
5	18 (9)	27 (15)	2 (10)	
6	29 (14)			
7				
8				

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ FIGO classification: 1, submucosal < 50% intramural; 2, submucosal ≥ 50% intramural; 3, 100% intramural with contact to endometrium; 4, intramural; 5, subserosal ≥ 50% intramural; 6, subserosal < 50% intramural; 7, subserosal pedunculated; 8, other (e.g., cervical)

Table 3 shows the operation records and postoperative course. The mean operation time was 97.6 ± 40.2 minutes. Three operations were converted to 3-port laparoscopic surgeries due to severe adhesion. None of the operations were converted to laparotomic surgery. There were 3 excessive blood loss events (≥ 500 mL), and all of them received component therapy intraoperatively. Two postoperative uterine wound hematomas were noted and subsided after conservative treatment without any sequelae. Three-dimensional ultrasound can be applied in the evaluation of uterine perfusion and healing after LM(5). The uterine wounds of the 2 women with postoperative hematoma both healed one month after the surgery. There was no bladder or ureteral injury, bowel injury, umbilical or trocar-site hernia, or other major complications reported in our study. There were 4 successful full-term pregnancies delivered at our hospital. Ninety-five percent (194/204) of the women were discharged within 2 days after the operation. The pain scale after the operation was mild and tolerable. The only significant difference between the experienced surgeon group and the trainee group was the operation time.

Table 3
The operation details and outcomes of two-port laparoscopic myomectomy (n = 204)

Group	Total (n = 204)	Experienced surgeon (n = 183)	Trainees (n = 21)	p value†
Myoma weight (g)	281.1 ± 183.1	285.9 ± 184.3	237.1 ± 170.1	.24
Intraoperative blood loss (mL)	99.3 ± 115.2	98.7 ± 117.7	104.8 ± 92.1	.40
Operation time (minute)	97.6 ± 40.2	92.6 ± 35.2	141.2 ± 54.0	< .001*
Complication	3 (1)	3 (2)	0 (0)	.08
Excessive blood loss (≥ 500 mL)	2 (1)	2 (1)	0 (0)	.43
Postoperative hematoma	0 (0)	2.1 ± 0.7	2.0 ± 0.2	.95
Bladder injury	0 (0)	2.7 ± 0.8	2.9 ± 0.4	
Bowel injury	0 (0)	2.1 ± 0.7	2.1 ± 0.8	
Umbilical hernia	2.1 ± 0.6			
Postoperative hospital stay	2.8 ± 0.8			
POD1 pain score on VAS	2.1 ± 0.7			
POD2 pain score on VAS				

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ POD: postoperative day. VAS: visual analog scale.

* Statistically significant.

In univariate linear regression analysis, virginity (no uterine elevator used in the operation), para, myoma number, more than 2 large myomas, and myoma size were significantly associated with longer operation time. In multivariable linear regression analysis using statistically significant factors of the univariate analysis, only virginity, myoma number, more than 2 large myomas, and myoma size were independent variables (Table 4). Although myoma-related factors, such as myoma number and size, were the main predictors for longer operation time, myomas with different locations did not reveal a statistically significant difference in operation time (Fig. 1).

Table 4
Preoperative factors predicting the longer operation time in women receiving laparoendoscopic two-site myomectomy by a single surgeon (n = 183)

Variable	**Univariate regression**		**Multivariate regression**	
	Coefficient	*p* value†	Coefficient	*p* value‡
Age (years)	-0.412	.307	-	-
BMI	1.350	.100	-	-
Nulliparous	8.359	.108	-	-
Virgin	18.210	.016*	14.479	.012*
Married	-12.022	.027*	1.020	.859
Para	-9.689	< .001*	-3.086	.278
Previous abdominal surgery (ref = 0)	-8.938	.350	-	-
Cesarean section = 1	-17.097	.095	-	-
Cesarean section ≥ 2	21.096	.400	-	-
Myomectomy	-5.904	.814	-	-
Laparotomy	11.596	.430	-	-
Appendectomy	-20.404	.254	-	-
Adnexectomy	9.751	< .001*	6.934	.001*
Myoma number	42.351	< .001*	28.017	< .001*
≥ 2 large myoma (≥ 5 cm)	7.635	< .001*	7.034	< .001*
Myoma size (cm)		< .001*		

† Univariate linear regression analysis.

‡ Multivariate linear regression analysis.

* Statistically significant.

** BMI: body mass index.

One nulliparous woman received her third LM via LETS-M, and parasitic myoma was found intraoperatively. A power morcellator was used for her previous two LMs. She received another myomectomy for recurrent parasitic myoma in 2018. No additional recurrence was noted before this study was concluded.

Discussion

LETS-M is a safe, effective, easy-to-learn, minimally invasive surgical method for the management of uterine myoma, and only conventional equipment is required.

There are different settings of LM. Single-port laparoscopic myomectomy (SPLM) using a glove port was first introduced by Kim YW and colleagues in 2010(4), and the surgical procedures have been modified in many aspects during this decade(6–10). Although the motivation to perform SPLM is a more favorable cosmetic outcome(11), the limited range of instruments makes SPLM more difficult than traditional LM(10, 12). Due to the above concerns, the learning curve of SPLM was evaluated, and proficiency in SPLM was achieved after approximately 45 operations(13). This reminds us of the nonignorable learning curve of SPLM. Conventional LM requires three or four ports, including a large port for power morcellation and needle delivery, and reduces patient satisfaction regarding scarring(11).

In LETS-M or other two-port settings of laparoscopic gynecological surgeries(14–17), a 5-mm trocar wound over the lower abdomen is usually applied, which requires no additional cost from the use of conventional laparoscopic instruments and is cosmetically effective(15). The ancillary port over the left lower abdomen in LETS-M is the main operating port for enucleating the myomas and suturing the uterine wounds. Meanwhile, the 5-mm trocar on the glove port is the traction port for manipulating myomas and assisting the suture route. With the assistance of the operating port, the limited angle of the umbilical port will no longer be the restriction, leaving only a minimal 5 mm additional scar. The combination of the ancillary port and the umbilical glove port provides a larger operating range, suture delivery route, and manual morcellation site.

There were different settings of two-port laparoscopic myomectomy reported previously. Kim and colleagues' study revealed that two-port and three-port had comparative surgical outcome with less myoma weight and longer surgical time. In their study, the ancillary port was next to the umbilicus(17). In LETS-M, the ancillary port locates at a more lateral and lower part of left abdomen, avoiding injury to the inferior epigastric artery or rectus abdominis muscle related bleeding, and providing a more comfortable suture angle and wider operation range. Takeda's study used umbilical and suprapubic mini-incisions with hidden scar for two-port LM(18). The suprapubic mini-incision was convenient for suture and remove myomas, but a 5 mm trocar wound in LETS-M may be more cosmetically effective than suprapubic mini-incision. Besides, they used the Subcutaneous Lift System to lift the abdominal wall. In LETS-M, only conventional laparoscopic equipment is required. Kikuchi et al. made their second port in inguinal region and used flexible scope in the surgeries(14). Compared to inguinal wound, a lower abdominal wound may cause less pain, and flexible scope is not necessary in LETS-M.

Myomas located in the anterior wall and subserosal or intraligamentary myomas with limited myoma size are more appropriate for SPLM(19). In contrast, our study revealed that there is no difference in operation time for LETS-M among different locations of the myomas. The surgeon can manage cervical myoma or posterior wall myoma smoothly with favorable surgical outcomes via LETS-M. The diameter and weight of myomas in our study were larger than those in most previous reports, either with multiport (mean diameter ranging from 5.9 to 6.5 cm, mean weight ranging from 126.8 to 195.9 g) (10, 12, 16, 17, 20) or single-port settings (mean diameter ranging from 5.4 to 7.5 cm, mean weight ranging from 131 to 173.9 g) (7–10, 12, 13, 17, 20, 21). The operation time was relatively short (mean 82.4 to 140 minutes in the multiport setting and 115.6 to 196.5 minutes in the single-port setting). A lack of sexual experience (i.e., no uterine elevator used in operation) is a predictor for a longer surgical time, while obesity is not. Although there is a significant difference in operation time between the trainees and the experienced surgeon, it may be overcome by practice, which showed a trend of decreasing operation time. The significant predictors for longer operation time in LETS-M are virginity and the size and number of myomas. These predictors can provide useful information for preoperative consultation.

The right and left arcuate arteries join at the median line in a mutual anastomose formation(22). From these anatomical viewpoints, the transverse incision of the uterine wall is considered a reasonable direction to reduce the amount of bleeding in LM(23). In LETS-M, a transverse uterine incision was always made before enucleating a myoma, which was repaired with barbed sutures in 2 or more layers to enhance wound healing. The ancillary port over the left lower abdomen makes it easy to puncture the needle through in a vertical direction relative to the incision wound with appropriate traction by the right hand from the umbilical wound.

In November 2014, the FDA announced a warning against the use of uterine power morcellation because of the risk for the dissemination of malignant tissue(24). Although the use of morcellation allows us to perform in situ morcellations during minimally invasive surgeries in women with large uteri or large myomas as in previous studies(3, 25–28), we did not use morcellators in our hospital after the date of the announcement. Instead, we performed manual morcellation via the umbilical wound. Yang and colleagues' study revealed that two-port LM with bag-contained manual morcellation were feasible and safe(16).

The retrospective design of this study was a limitation; however, the large sample size makes our data reliable. We did not follow the fertility outcome of all women who wished to conceive. Further learning curve studies and fertility outcomes may be needed for a better understanding of the accessibility and efficacy of LETS-M.

Conclusions

LETS-M using conventional laparoscopic equipment is a minimally invasive surgical method that is safe, effective, and easy to learn for managing uterine myoma. It is useful for a trainee to achieve a favorable surgical outcome with acceptable operation time.

Declarations

Author Contributions Statement

WC Chang developed the protocol and had work in manuscript editing. PC Wu wrote the main manuscript text and statistical analysis. PC Wu, BC Sheu, KJ Huang and SC Huang took part in the data collection and operations. All authors reviewed the manuscript.

Acknowledgments:

The authors acknowledge statistical assistance provided by the Center of Statistical Consultation and Research in the Department of Medical Research, National Taiwan University Hospital.

Competing Interests Statement

The authors declare no competing interests.

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Tables

Table 1. Baseline characteristics of women receiving two-port laparoscopic myomectomy (n = 204)

Group	Total (n=204)	Experienced surgeon (n=183)	Trainees (n=21)	p value[†]
Age (years)	39.3±6.4	39.4±6.5	38.4±6.3	.53
BMI	22.6±3.3	22.5±3.2	23.5±4.0	.22
Nulliparous	100 (49)	87 (48)	13 (62)	.25
Virgin	28 (14)	25 (14)	3 (14)	1.00
Married	128 (63)	119 (65)	9 (43)	.06
Gravida	1.15±1.34	1.19±1.37	0.81±1.03	.28
Para	0.8±0.93	0.82±0.93	0.67±0.91	.45
Previous abdominal surgery				
Cesarean section=1	16 (8)	15 (8)	1 (5)	
Cesarean section≥2	15 (7)	13 (7)	2 (10)	
Myomectomy	2 (1)	2 (1)	0	
Laparotomy	2 (1)	2 (1)	0	
Appendectomy	6 (3)	6 (3)	0	
Adnexectomy	4 (2)	4 (2)	0	

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ BMI: body mass index.

Table 2. Details of myoma in women receiving two-port laparoscopic myomectomy (n = 204)

Group	Total (n=204)	Experienced surgeon (n=183)	Trainees (n=21)	p value†
Myoma number	1.7±1.1	1.7±1.1	1.9±1.2	.38
≥2 large myoma (≥5 cm)	31 (15)	28 (15)	3 (14)	1.00
Myoma size (cm)	8.5±2.2	8.4±2.2	8.6±2.9	.93
Myoma location				
Fundus	25 (12)	23 (13)	2 (10)	
Anterior wall	78 (38)	72 (39)	6 (29)	
Posterior wall	84 (41)	73 (40)	11 (52)	
Cervix	17 (8)	15 (8)	2 (10)	
FIGO classification‡				
1	0 (0)			
2	8 (4)	6 (3)	2 (10)	
3	18 (9)	15 (8)	3 (14)	
4	51 (25)	50 (27)	1 (5)	
5	31 (15)	29 (16)	2 (10)	
6	49 (24)	41 (22)	8 (38)	
7	18 (9)	15 (8)	3 (14)	
8	29 (14)	27 (15)	2 (10)	

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ FIGO classification: 1, submucosal <50% intramural; 2, submucosal ≥50% intramural; 3, 100% intramural with contact to endometrium; 4, intramural; 5, subserosal ≥50% intramural; 6, subserosal <50% intramural; 7, subserosal pedunculated; 8, other (e.g., cervical)

Table 3. The operation details and outcomes of two-port laparoscopic myomectomy (n = 204)

Group	Total (n=204)	Experienced surgeon (n=183)	Trainees (n=21)	p value†
Myoma weight (g)	281.1±183.1	285.9±184.3	237.1±170.1	.24
Intraoperative blood loss (mL)	99.3±115.2	98.7±117.7	104.8±92.1	.40
Operation time (minute)	97.6±40.2	92.6±35.2	141.2±54.0	<.001*
Complication	3 (1)	3 (2)	0 (0)	
Excessive blood loss (≥500 mL)	2 (1)	2 (1)	0 (0)	
Postoperative hematoma	0 (0)			
Bladder injury	0 (0)			
Bowel injury	0 (0)			
Umbilical hernia	2.1±0.6	2.1±0.7	2.0±0.2	.08
Postoperative hospital stay	2.8±0.8	2.7±0.8	2.9±0.4	.43
POD1 pain score on VAS	2.1±0.7	2.1±0.7	2.1±0.8	.95
POD2 pain score on VAS				

† Fisher's exact test was performed for categorical variables. The Mann-Whitney U test was performed for continuous variables.

‡ POD: postoperative day. VAS: visual analog scale.

* Statistically significant.

Table 4. Preoperative factors predicting the longer operation time in women receiving laparoendoscopic two-site myomectomy by a single surgeon (n = 183)

Variable	Univariate regression		Multivariate regression	
	Coefficient	*p* value†	Coefficient	*p* value‡
Age (years)	-0.412	.307	-	-
BMI	1.350	.100	-	-
Nulliparous	8.359	.108	-	-
Virgin	18.210	.016*	14.479	.012*
Married	-12.022	.027*	1.020	.859
Para	-9.689	<.001*	-3.086	.278
Previous abdominal surgery (ref=0)				
Cesarean section=1	-8.938	.350	-	-
Cesarean section≥2	-17.097	.095	-	-
Myomectomy	21.096	.400	-	-
Laparotomy	-5.904	.814	-	-
Appendectomy	11.596	.430	-	-
Adnexectomy	-20.404	.254	-	-
Myoma number	9.751	<.001*	6.934	.001*
≥2 large myoma (≥5 cm)	42.351	<.001*	28.017	<.001*
Myoma size (cm)	7.635	<.001*	7.034	<.001*

† Univariate linear regression analysis.

‡ Multivariate linear regression analysis.

* Statistically significant.

** BMI: body mass index.

Figures

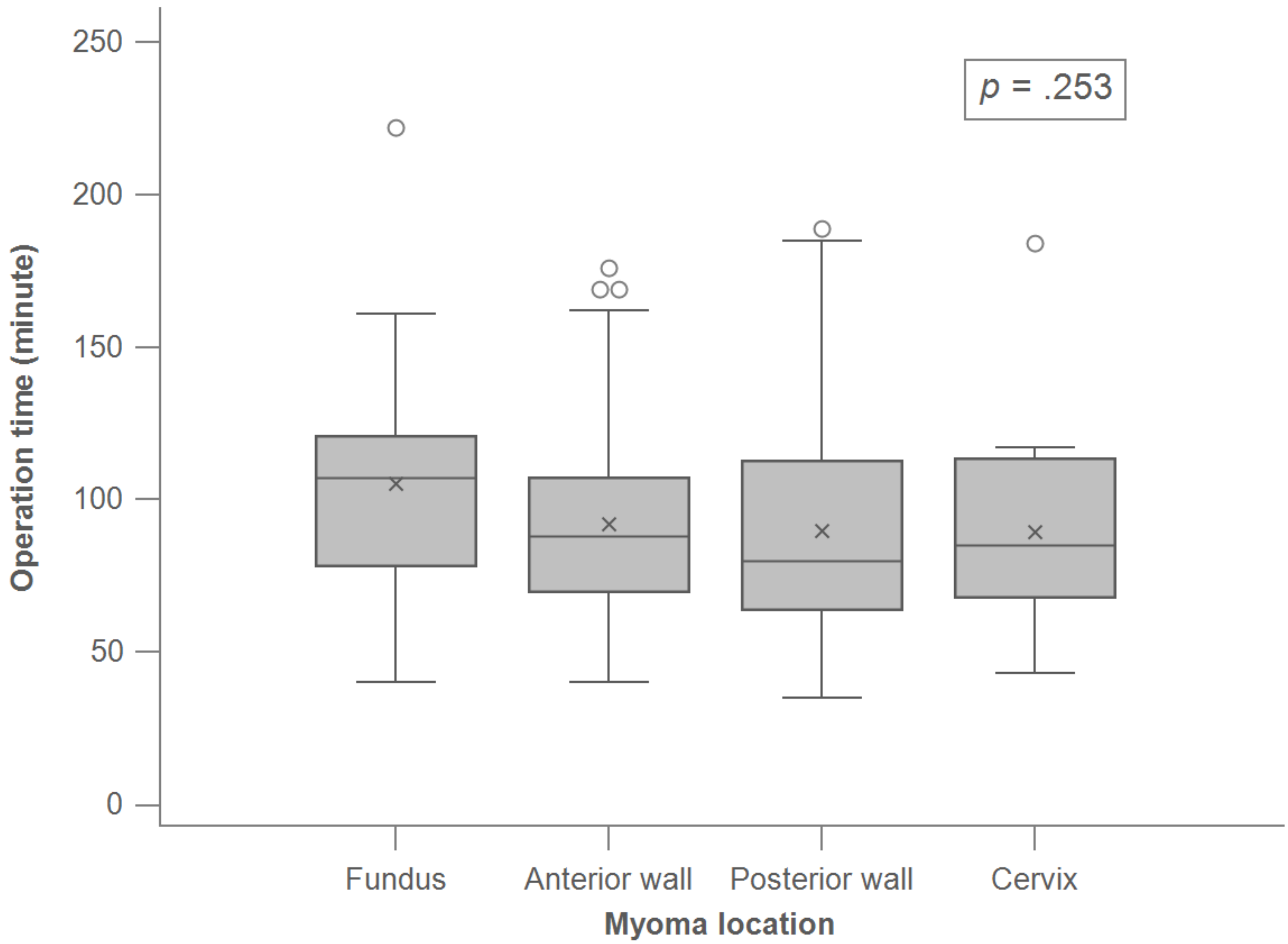

Figure 1

Although the myoma factors were the main predictors for longer operation time on multivariate analysis, the myomas with different locations did not reveal a statistically significant difference in operation time. (p = .253, Kruskal-Wallis test)

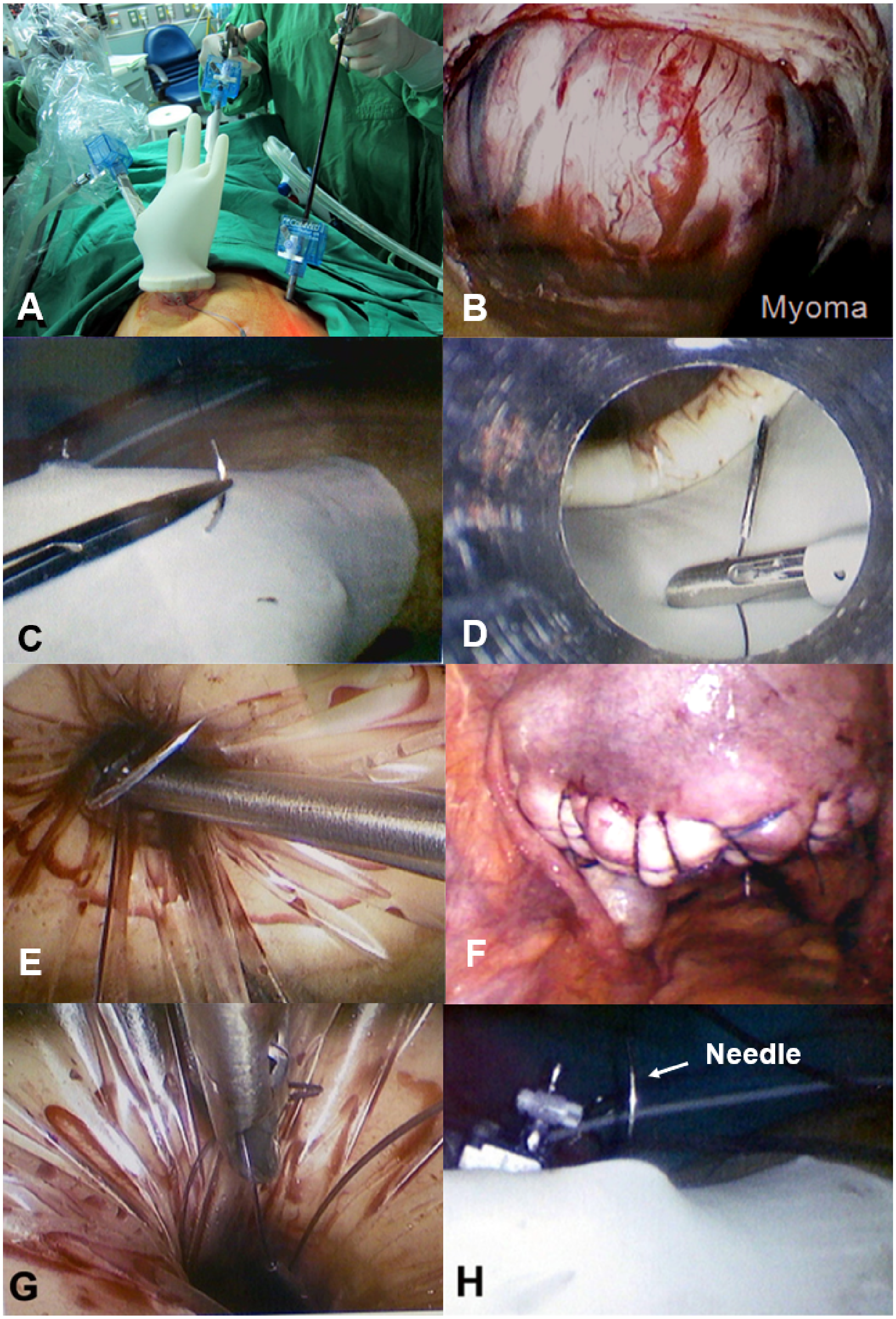

Figure 2

2A. The basic setting of laparoendoscopic two-site myomectomy (LETS-M). A wound retractor was placed in the umbilical wound, and the glove port was set up, with a 10-mm trocar in the thumb over the patient's right side and a 5-mm trocar in the little finger over the left side. A 10-mm rigid laparoscope was inserted via the 10-mm trocar to examine the whole pelvis. The ancillary 5-mm port was made over the left lower abdomen under laparoscope inspection. The laparoscope was operated by the assistant. The operator performed the surgery with 2 5-mm ports. 2B. A transverse incision with appropriate length was made on the serosa of the most protruding part of the myoma. Then, the myoma was removed from the uterus. 2C. (Outside-the-glove view) The suture needle was inserted outside-in via the glove. 2D. (Inside-the-glove view) The suture was grasped by the needle holder. 2E. (Inside-the-glove view) The needle was delivered into the pelvis via the umbilical port. 2F. The uterine wound was sutured with 2 or more layers continuously. 2G. (Inside-the-glove view) The needle was pulled out from the abdomen. 2H. (Outside-the-glove view) The needle was removed by direct punching through the glove.

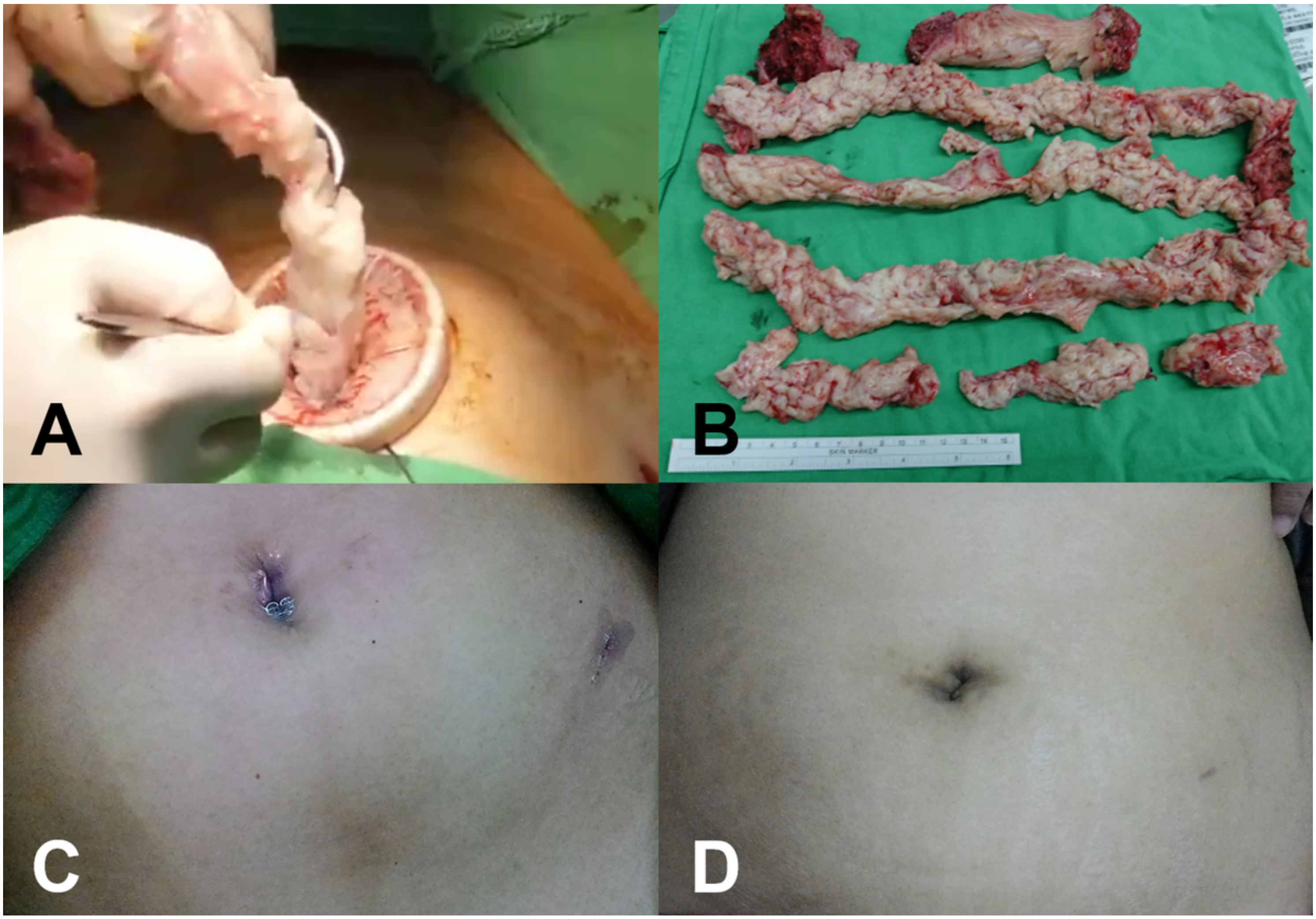

Figure 3

3A. The specimen was morcellated out via the umbilical wound with a scalpel. 3B. The specimen. 3C. Dermabond was applied for skin approximation. 3D. Wound appearance at the 3rd postoperative month.