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Original Article

A comparison of the costs of laparoscopic myomectomy and open myomectomy at a teaching hospital in southern Taiwan

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Abstract

Objective: To compare the costs of traditional open myomectomy (OM) with laparoscopic myomectomy (LM).
Materials and Methods: A retrospective review was conducted of the medical records of 155 women who underwent traditional open myomectomy (OM) or laparoscopic myomectomy (LM) in a teaching hospital in Taiwan.
Results: The total medical service expense and the patient out-of-pocket expense were significantly higher for women who received LM than for women who received OM. However, the operative time and blood loss during surgery were significantly less in women who received LM than in women who received OM.
Conclusion: The overall expense is higher for LM than for OM; however, the laparoscopic approach has numerous advantages for patients, including shorter operative time, less blood loss, and a more rapid recovery time. No difference existed in the rate of complications or in the recurrence of disease for the two procedures.

Keywords: cost; expense; laparoscopic myomectomy; laparotomy; leiomyomas

Introduction

By the age of 35 years, as many as 40% of Caucasian women will have uterine leiomyomas; by the age of 50 years, the incidence rises to nearly 70% [1]. Approximately 34,000 myomectomies are performed each year in the United States [2]. By contrast, a survey in 2000 by the Department of Health in Taiwan indicated that 6734 myomectomies had been performed the previous year [3]. Although asymptomatic patients with myomas can be followed with periodic ultrasound studies, approximately one-fourth experience menorrhagia, lower abdominal pain and distention, problems with micturition and defecation, and infertility. When these symptoms do not respond to medical therapy, surgery is needed. Abdominal hysterectomy, open myomectomy (OM), laparoscopic myomectomy (LM), and uterine fibroid embolization (UFE) are among the most common surgical procedures [4].

Myomectomy has traditionally been performed by open laparotomy; however, LM has become an attractive option because patients recovery more quickly and have less blood loss during the procedure, and therefore less of a need for blood transfusion. Laparoscopic myomectomy is less invasive, produces less postoperative pain, and offers a shorter recovery time, compared to OM [5–9]. In patients with large and multiple myomas, LM has also been effective [10]. However, the rate of complications or recurrence is the same with both procedures.

Few studies have compared the costs of OM and LM. In 2001, Subramanian et al [11] retrospectively reviewed a database of private insurance claims for 4394 women who had myomectomies between 1995 and 1997. They reported that OM was more expensive than LM ($8,860.00 vs. $8,018.00, respectively) and patients had a longer hospital stay with OM than with LM (2.91 days vs. 2.25 days, respectively); when repeat procedures are required, an additional cost of $1264.00

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per person can be expected in the first 2 years after the initial myomectomy.

In Taiwan, LM has been performed for about 10 years. In 2007, coverage for the procedure was added to Taiwan's universal National Health Insurance (NHI) program.

To compare the total direct and indirect costs of LM and OM, we designed a retrospective study involving Taiwanese women who had undergone either of the procedures at a university center. The initial costs may be higher for LM than for OM; however, we theorized that this should be offset by the shorter hospitalization time and speedier recovery offered by the laparoscopic approach.

Methods

We retrospectively analyzed the clinical data of patients who underwent traditional OM ($n = 74$) and patients who underwent LM ($n = 81$) at a teaching hospital in the Kaohsiung County in southern Taiwan from June 1, 2004 to October 31, 2007. All patients received preoperative ultrasound examinations for determining the size, type, and number of myomas. This study was approved by the Institutional Review Board of the E-Da Hospital (Taiwan, China), and each patient gave written, informed consent.

The recorded data included patient demographic information and clinical characteristics such as age; weight; type and size of myoma; type of deliveries; number of pregnancies; menopausal status; micturition difficulty; hypogastralgia; and menorrhagia; and perioperative data, including the hemoglobin (Hb) level, hematocrit (Hct), platelet (Plt) count, white blood cell (WBC) count, blood loss and blood transfusions, surgical time, complications, postoperative drainage, and follow-up data (e.g., recurrence rate).

Surgeries were performed by one of six doctors at the hospital. The author is the only trained laparoscopist and has more than 10 years experience. All patients who were assessed by the author received LMs. The other five doctors did not perform LMs, and had 5−18 years experience in performing OMs. When patients saw one of the five doctors, they received an OM. Patients randomly saw one of the six doctors previously described. Indications for myomectomy were menorrhagia, dysmenorrhea, irregular menses, abdominal pain, abominal swelling, primary infertility, and secondary infertility.

Open myomectomy was performed in a standard manner. In brief, the surgeon made a Pfannenstiel incision or vertical incision in the abdomen. The myomas were removed with a combined sharp and blunt dissection. The uterus was sutured in layers with 1-0 poliglecaprone 25 sutures (Monocryl Plus, Ethicon, Kaohsiung County). The fascia and skin were then closed.

Laparoscopic myomectomy was performed as described by Dubuisson et al [12]. In this procedure, a Verres needle was inserted in the inferior portion of the umbilicus, and a CO_2 pneumoperitoneum was created (pressure, 15 mmHg; gas flow rate, 3−4 L/min). A small vertical or horizontal incision was made on the lower edge of the umbilicus. A trocar sleeve and trocar were inserted. A laparoscope was connected to a high-resolution video monitoring system and the pelvic and abdominal organs were inspected. Laser, electrosurgical instruments, and/or forceps and scissors were used to remove the uterine myomas. When a pedunculated myoma was noted, scissors and bipolar knife were used to remove it. If a subserous myoma or submucous myoma was noted, a wide horizontal incision was made with unipolar above the myoma. Grasping forceps were used to free the myoma from the normal uterine muscle. A PlasmaKinetic bipolar knife (Gyrus, Minneapolis, MN, USA) was used to control bleeding. A morcellator was then used to remove all myomatous material from the abdominal cavity. The uterus was closed in layers with absorbable suture. After the completion of the procedure, the instruments were removed and the skin incisions were closed.

For the purpose of this analysis, the total medical services expense is the total inclusive cost of the procedure and care; the total NHI service expense is the costs paid for by the NHI; and the total patient expense is the expenses that the patient was responsible to pay.

Statistical analysis

In general, the continuous data were expressed as the mean ± the standard deviation (SD), whereas the categorical data were expressed as the number and percentage [n (%)] by group. For the continuous data, differences between groups were analyzed using a two-sample t test. For categorical data, differences between groups were analyzed by using the Pearson Chi-square test. Furthermore, abnormal continuous variables were expressed as the medians with the interquartiles (i.e., Q1−Q3) and were compared by using the nonparametric Mann-Whitney U test.

The medical expenses of distinct surgical types were expressed as the mean ± the SD, and were compared by using the Mann-Whitney U test because of the nonnormal distribution of the data. In addition, univariate and multivariate linear regression models were used to identify the association of medical expenses with the patients' clinical characteristics. An estimated 95% confidence interval (CI) for beta was shown for specific variables in the models. In addition, variables with a statistical significance of $p < 0.2$, observed from the univariate linear regression model, were selected and placed into the multivariate linear regression analysis. The multivariate linear regression analysis was applied after factoring in the multiple variables and adjusting for age. A value of $p < 0.05$ was considered significant. All statistical analyses were performed by using SPSS 15.0 statistics software (SPSS Inc, Chicago, IL, USA).

Results

Table 1 summarizes the demographic and clinical characteristics of the OM and LM groups. The mean age of the patients in the OM group and the LM group was 40.08 ± 6.49 years and 41.14 ± 6.46 years, respectively. The mean patient weight was significantly lower in the LM group (56.47 ± 7.63 kg) than in the OM group (61.79 ± 11.5 kg). The number of births and the frequency of micturition difficulty and hypogastralgia differed significantly between the two groups.

Table 1
Patient demographic and clinical characteristics.

	Open myomectomy (n = 74)	Laparoscopic myomectomy (n = 81)	p
Age (y)	40.08 ± 6.49	41.14 ± 6.46	0.312
Weight (kg)	61.79 ± 11.50	56.47 ± 7.63	0.001*
Type of myoma			
Single	55 (74.3%)	51 (63.0%)	0.178
Multiple	19 (25.7%)	30 (37.0%)	
Size of myoma			
≤ 5 cm	13 (17.6%)	23 (28.4%)	0.110
>5 cm	61 (82.4%)	58 (71.6%)	
Previous delivery			
None	24 (32.4%)	24 (29.6%)	0.929
Vaginal	38 (51.4%)	43 (53.1%)	
Cesarean	12 (16.2%)	14 (17.3%)	
Pregnancy			
Never	21 (28.4%)	17 (21.0%)	0.378
One or more times	53 (71.6%)	64 (79.0%)	
Number births			
0 or 1	31 (41.9%)	62 (76.5%)	<0.001*
≥ 2	43 (58.1%)	19 (23.5%)	
Menopause (yes)	3 (4.1%)	2 (2.5%)	0.580
Micturition difficulty (yes)	2 (2.7%)	13 (16.0%)	0.004*
Hypogastralgia (yes)	40 (54.1%)	27 (33.3%)	0.009*
Menorrhagia (yes)	26 (35.1%)	32 (39.5%)	0.577

The data are presented as the mean ± the standard deviation for continuous variables and as number and percentage (%) for categorical variables.
The p is derived by two-sample t test for continuous variables and by Pearson's Chi-square or Fisher's exact test for categorical variables.
*$p < 0.05$.

Table 2
Intraoperative and postoperative data.

Outcomes	Open myomectomy (n = 74)	Laparoscopic myomectomy (n = 81)	p
Surgical time (min)	120 (90–146.3)	100 (73–120)	0.001*
Blood loss (mL)	150 (100–305)	100 (100–200)	0.011*
Received blood transfusion	13 (17.6%)	1 (1.2%)	< 0.001*
Blood transfusion amount (mL)	1000 (500–1000)	1000[a]	–
Postoperative drainage	10 (13.5%)	15 (18.5%)	0.397
Amount of postoperative drainage (mL)	337.5 (233–773.7)	210 (150–435)	0.233
Complications	20 (27.0%)	16 (19.8%)	0.284
Fever	19 (25.7%)	14 (17.3%)	0.202
Rehospitalization within 30 days after surgery	1 (1.4%)	0 (0%)	0.477
Recurrence	4 (5.4%)	2 (2.5%)[b]	0.426

Data are presented as the median with the interquartile range (IQR; Q1–Q3) for continuous variables and as the number and percentage (%) for categorical variables.
The p is derived by using the Mann-Whitney U test for continuous variables and by using the Pearson's Chi-square test for categorical variables.
Blood transfusion and postoperative drainage data are summarized only for subjects who received blood transfusions or exhibited postoperative drainage.
*$p < 0.05$.
[a] Only one patient received a blood transfusion, thus there is no IQR to report
[b] Two subjects with recurrence in the laparoscopic myomectomy group underwent a second surgery.

Table 2 summarizes the intraoperative and postoperative data of the two groups. The median surgical time and blood loss were significantly less in the LM group than in the OM group (surgical time was 100 minutes [73–120 minutes] vs. 120 minutes [90–146 minutes], respectively; blood loss was 100 mL [100–200 mL] vs. 150 mL [100–305 mL], respectively). Furthermore, the number of patients who received a blood transfusion was significantly greater in the OM group (n = 13) than in the LM group (n = 1). There was no difference between the groups in the number of patients with postoperative drainage, complications, fever, rehospitalization within 30 days after surgery, or recurrence.

Table 3 shows the total medical service expense, the total NHI service expense, and the total patient out-of-pocket expense. All were expressed in U.S. dollars (USD) ($1.00 USD = $30.03 New Taiwan dollars). The total medical service expense averaged $1583.52 in the OM group and $1991.40 in the LM group. The total NHI service expense averaged $1239.12 in the OM group and $1295.05 in the LM group. The total patient out-of-pocket expense averaged $344.40 in the OM group and $696.35 in the LM group. The Mann-Whitney U test showed that the patients who received LM may have had a higher total expense, after tallying the total medical expense ($p < 0.001$), total NHI expense ($p < 0.003$), and out-of-pocket expense ($p < 0.001$).

The medical resources for total NHI and patients' own expenses were further divided into 14 subcategories. Table 3 shows the comparison between the two groups. In regard to the total NHI service expense, patients who received OM had higher overall physicians' consultation fees (OM, $54.99; LM, $47.04; $p < 0.001$); ward fees (OM, $167; LM, $140.73; $p < 0.001$); therapeutic management fees (OM, $12.93; LM, $10.38; $p = 0.022$), blood plasma fees (OM, $12.88; LM, $0.96; $p < 0.001$), and medication fees (OM, $44.08; LM, $26.19; $p = 0.01$). However, patients who received LMs had higher examination fees (OM, $127.49; LM, $155.98; $p = 0.001$) and surgical fees (OM, $521.66; LM, $581.7; $p = 0.004$). In regard to the patients' own expenses, patients who received LM had higher ward fees (OM, $135.65; LM, $183.17; $p = 0.033$), special material fees (e.g., laparoscopic instruments or antiadhesions barrier) (OM, $132.35; LM, $465.82; $p < 0.001$), and fees for other materials such as gauze pads and tape (OM, $4.34; LM, $20.89; $p < 0.001$). However, patients who received OMs had higher anesthesia fees (OM, $25.39; LM, $6.34; $p = 0.011$), and injection fees (OM, $29.7; LM, $6.78, $p = 0.009$).

Based on a level of significance of $p = 0.2$ for potential factors that may affect the medical service expenses, the univariate linear regression model showed that the total medical service expense was associated with the type of surgery, type of myoma, number of births, presence of hypogastralgia, surgical time, need for blood transfusion, care for postoperative drainage, and recurrence of myomas (Table 4). The total NHI service expense was associated with surgical time, blood transfusion, postoperative drainage, and presence of fever. The patient's total out-of-pocket expense was associated with the type of surgery, patient's age, type of myoma,

Table 3
Comparison of the medical expenses of traditional abdominal myomectomy and laparoscopic myomectomy ($N = 155$).

Medical expense (USD)[a]	Open myomectomy ($n = 74$)	Laparoscopic myomectomy ($n = 81$)	p[b]
Total medical service expense	\$1583.52 ± \$594.67	\$1991.4 ± \$606.16	<0.001*
Total NHI service expense	\$1239.12 ± \$392.66	\$1295.05 ± \$392.43	0.003*
Physician consultation fees	\$54.99 ± \$19.06	\$47.04 ± \$25.34	< 0.001*
Ward fees	\$167 ± \$54.96	\$140.73 ± \$84.45	< 0.001*
Examination fees	\$127.49 ± \$68.85	\$155.98 ± \$73.18	0.001*
Radiological procedure fees	\$12.65 ± \$44.02	\$11.31 ± \$30.83	0.192
Therapeutic management fees	\$12.93 ± \$9.15	\$10.38 ± \$5.31	0.022*
Surgery fees	\$521.66 ± \$140.82	\$581.7 ± \$202.55	0.004*
Blood plasma fees	\$12.88 ± \$27.69	\$0.96 ± \$8.66	< 0.001*
Anesthesia fees	\$256.58 ± \$70.42	\$249.81 ± \$74.67	0.999
Special material fees	\$12.55 ± \$31.73	\$55.95 ± \$77.07	0.148
Medication fees	\$44.08 ± \$104.05	\$26.19 ± \$30.92	0.010*
Pharmacy service fees	\$13.38 ± \$4.53	\$12.12 ± \$6.33	< 0.001*
Injection fees	\$2.92 ± \$1.56	\$2.88 ± \$3.46	0.062
Others	NA	NA	–
Agency fees	NA	NA	–
Total patient own expense	\$344.4 ± \$373.57	\$696.35 ± \$381.71	< 0.001*
Physician's consultation fees	NA	\$0.22 ± \$1.98	0.339
Ward fees	\$135.65 ± \$254.55	\$183.17 ± \$202.45	0.033*
Examination fees	NA	NA	–
Radiological procedure fees	NA	NA	–
Therapeutic management fees	\$2.48 ± \$21.29	\$0.18 ± \$1.63	0.942
Surgery fees	\$12.38 ± \$46.28	\$10.28 ± \$41.17	0.866
Blood plasma fees	NA	NA	–
Anesthesia fees	\$25.39 ± \$61.75	\$6.34 ± \$41.73	0.011*
Special material fees	\$132.35 ± \$149.98	\$465.82 ± \$186.56	< 0.001*
Medication fees	\$1.36 ± \$7.36	\$1.2 ± \$6.27	0.992
Pharmacy service fees	NA	NA	–
Injection fees	\$29.7 ± \$67.97	\$6.78 ± \$34.8	0.009*
Others	\$4.34 ± \$4.46	\$20.89 ± \$111.81	< 0.001*
Agency fees	\$0.77 ± \$2.68	\$1.47 ± \$4.54	0.280

USD = U.S. dollars (\$1.00 USD = \$30.03 New Taiwan dollars).
*Indicates a significant difference between groups, $p < 0.05$.
[a] Data are presented as the mean ± the standard deviation
[b] The p is obtained by using the Mann-Whitney U test.

number of births, micturition difficulty, hypogastralgia, and recurrence ($p < 0.2$ for all).

Variables with a statistical significance of $p < 0.2$ in the univariate linear regression model were selected and placed into the multivariate linear regression analysis. The multivariate linear regression—controlled for patient age—revealed that the average total medical service expense was significantly associated with surgical type, surgical time, need for blood transfusion, and recurrence of the disease (Table 5). In patients who received LM, the total medical service expense was increased by 528.78 (95% CI 329.03-728.52, $p < 0.001$); surgical time, by 3.01 (95% CI 0.79-5.23, $p = 0.008$); requirement for blood transfusion, by 738.05 (95% CI 411.39-1064.72, $p < 0.001$), and recurrence, by 738.05 (95% CI 287.6-1270.96, $p = 0.002$). For patients who received LM, multivariate linear regression analysis similarly showed that the total NHI service expense was significantly increased by 142.44 (95% CI 27.23-257.64; $p = 0.016$); surgical time, by 2.14 (95% CI 0.71-3.56, $p = 0.004$), and requirement for blood transfusion, by 456.28 (95%CI 248.02-664.53; $p < 0.001$). However, in patients who received LM, the total patient's own expense was only significantly increased by \$357.99 (95% CI 142.73-573.25; $p = 0.001$) and for patients with recurrence, by 700.58 (95% CI 150.46-1250.7; $p = 0.013$).

Discussion

This study compared the costs of OM and LM at a teaching hospital in southern Taiwan. The total medical service expense was significantly higher for patients who received LM than for patients who received OM (\$1991.40 vs. \$1583.52, respectively).

Many studies have compared the costs of hysterectomy and myomectomy for the treatment of uterine myomas [13–15]. However, few studies exist that compare the cost of OM with the cost of LM. In 2001, Subramanian et al [11] analyzed the outcomes and the use of resources associated with myomectomy and found that abdominal myomectomy ($n = 1400$) was more expensive than laparoscopic myomectomy ($n = 24$) (\$8860.00 vs. \$8018.00, respectively) and patients had a longer hospital stay with abdominal myomectomy than with laparoscopic myomectomy (2.91 days vs. 2.25 days, respectively). Stringer et al [16] report that OM is more expensive than LM and that LM is associated with a longer operating time than OM. These conclusions are different than the conclusions of the current study. In the study by Stringer et al, the hospital stay was longer and the wound was larger and required a greater use of analgesics; thus, the charges in the OM group were higher for room, board, pharmacy, and laboratory studies. However, the charges for the operating room time and instrumentation were higher for LM. In the United States, the hospital room charge is very high so that a longer hospital stay results in a much greater total expense. In Taiwan, the NHI pays the charges for room, board, pharmacy, laboratory and radiology. The NHI pays a fixed fee for the operating room time. From 2004 to 2007, the NHI did not cover instruments; therefore, the greatest expense during that period was for instruments.

In our study, we found that the total patient out-of-pocket expense was higher in the laparoscopy group than in the laparotomy group. Laparoscopic myomectomy required less time than OM; however, laparoscopic surgery is more costly

Table 4
Univariate linear regression of the association of medical service expenses in regard to the surgical type and patient clinical characteristics ($N = 155$).

	Total medical service expense		Total NHI service expense		Total patient own expense	
	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Surgical type (LM vs. OM)	404.21 (215.09, 593.33)	< 0.001*	55.43 (−68.15, 179.01)	0.377	348.78 (229.82, 467.74)	< 0.001*
Age (yr)	5.96 (−9.48, 21.4)	0.447	−1.21 (−10.8, 8.38)	0.804	7.17 (−2.94, 17.28)	0.163*
Type of myoma (multiple vs. single)	152.16 (−64.24, 368.55)	0.167*	50.86 (−84.55, 186.28)	0.459	101.29 (−39.97, 242.55)	0.159*
Size of myoma (> 5 cm vs. ≤ 5 cm)	92.23 (−143.69, 328.15)	0.441	77.6 (−68.43, 223.63)	0.295	14.63 (140.73, 169.99)	0.853
Type of delivery						
Vaginal vs. none	−107.24 (−333.7, 119.22)	0.351	−89.48 (−229.5, 50.55)	0.209	−17.77 (−167, 131.47)	0.814
Cesarean vs. none	−58.32 (−361.05, 244.42)	0.704	−26.61 (−213.79, 160.58)	0.779	−31.71 (−231.2, 167.79)	0.754
Pregnancy						
≥1 vs. none	−30.08 (−262.06, 201.9)	0.798	−67.48 (−210.94, 75.98)	0.354	37.4 (−115, 189.8)	0.628
Number of births						
≥2 vs. ≤1	−207.46 (−408.49, −6.42)	0.043*	21.46 (−104.82, 147.73)	0.738	−229.01 (−357.75, −100.08)	0.001*
Menopause	−277.8 (−840.99, 285.39)	0.331	−40.61 (−390.82, 309.59)	0.819	−237.18 (−606.59, 132.22)	0.207
Micturition difficulty	212.57 (−123.33, 548.48)	0.213	0.29 (−209.03, 209.61)	0.998	212.28 (−7.03, 431.59)	0.058*
Hypogastralgia	−261.81 (−458.91, −64.71)	0.010*	−77.02 (−201.33, 47.3)	0.223	−184.8 (−313.91, −55.69)	0.005*
Menorrhagia	88.9 (−116.88, 294.68)	0.395	68.45 (−58.97, 195.86)	0.290	20.46 (−115.08, 156)	0.766
Surgical time (min)	4.26 (2.04, 6.48)	< 0.001*	3.29 (1.95, 4.63)	< 0.001*	0.97 (−0.55, 2.49)	0.210
Blood loss (mL)	−35.76 (−235.41, 163.89)	0.724	47.43 (−76.17, 171.04)	0.450	−83.19 (−213.8, 47.43)	0.210
Received blood transfusion	590.89 (253.42, 928.36)	0.001*	520.67 (320.52, 720.81)	<.001*	70.23 (−159.63, 300.08)	0.547
Postoperative drainage	365.17 (100.13, 630.21)	0.007*	309.14 (148.29, 470)	< 0.001*	56.03 (−122.13, 234.19)	0.535
Complications	−110.54 (−336.15, 15.07)	0.335	−20.91 (−161.17, 119.36)	0.769	−89.64 (−237.7, 58.42)	0.234
Fever	107.38 (−135.85, 350.61)	0.384	122.14 (−27.77, 272.06)	0.110*	−14.77 (−175.02, 145.49)	0.856
Recurrence	505.26 (−5.85, 1016.37)	0.053*	43.34 (−277.4, 364.09)	0.790	461.92 (129.9, 793.94)	0.007*

Abbreviations: OM, open myomectomy ($n = 74$); LM, laparoscopicmyomectomy ($n = 81$); NHI, National Health Insurance.
The data show the estimated β and the 95% confidence interval (CI) for β. Specific variables in models are shown.
*$p < 0.02$.

because of the specialized instruments, many of which are not reusable. Special material fees include fees for antiadhesive materials (which were not used in all patients), hemostatic forceps, and hemostatic cotton. In LM, some special instruments and aspiration devices are also required. Of course, there are factors other than cost to consider. In our study, the median blood loss and surgical time were less in the LM group than in the OM group, and the number of patients who required blood transfusions was significantly higher in the OM group. Multivariate analysis indicated that LM was associated with a shorter surgical time and less blood loss.

Many reports have confirmed the advantages of LM such as rapid postoperative recovery, a shorter hospital stay, less postoperative pain, and greater patient satisfaction.[5,7,9,17] However, LM requires a longer surgical time, compared to OM [10]. In a meta-analysis of randomized controlled trials of LM versus OM, Jin et al [5] found that LM was associated with a longer operation time, but reduced operative blood loss.

Table 5
Multivariate linear regression of the association of medical service expenses with surgical type and with patient clinical characteristics (adjusted for patient age).

	Total medical service expense		Total NHI service expense		Total patients own expense	
	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Surgical type (LM vs. OM)	528.78 (329.03, 728.52)	< 0.001*	142.44 (27.23, 257.64)	0.016*	357.99 (142.73, 573.25)	0.001*
Age (y)	5.65 (−9.1, 20.41)	0.450	2.31 (−6.31, 10.93)	0.597	−1.21 (−17.46, 15.04)	0.883
Type of myoma (multiple vs. single)	32.32 (−161.21, 225.85)	0.742	–		63.66 (−151.48, 278.79)	0.560
Number of births						
≥ 2 vs. ≤ 1	7.76 (−188.09, 203.61)	0.938	–		−10.82 (−231.95, 210.3)	0.923
Micturition difficulty	–		–		95.76 (−236.19, 42.77)	0.569
Hypogastralgia	−73.98 (−260.03, 111.97)	0.433	–		−136.02 (−344.68, 72.64)	0.200
Surgical time (min)	3.01 (0.79, 5.23)	0.008*	2.14 (0.71, 3.56)	0.004*	–	
Received blood transfusion	738.05 (411.39, 1064.72)	<0.001*	456.28 (248.02, 664.53)	< 0.001*	–	
Postoperative drainage	45.06 (−212.68, 302.79)	0.730	114.37 (−47.31, 276.05)	0.164	–	
Fever	–		74.85 (−58.62, 208.32)	0.270	–	
Recurrence	779.28 (287.6, 1270.96)	0.002*	–	–	700.58 (150.46, 1250.7)	0.013*

LM = laparoscopic myomectomy; NHI = National Health Insurance; OM = open myomectomy.
The data show the estimated β and the 95% confidence interval for β. Specific variables in models are shown.
The total patient number is 155 with 81 patients in the LM group and 74 patients in the OM group.
*$p < 0.05$.

Other authors have noted comparable surgical times between LM and OM. Paul et al [9] reviewed a single surgeon's experience with LMs during a 16-year period, and found that the procedure was comparable to OM with respect to the duration of surgery, blood loss, and complication rate. With OM, a greater amount of time is required to suture the large abdominal wound, compared to the time required to close the 3 or 4 small incisions in LM.

Recent studies have indicated that LM and OM have similar or low complication rates [5,8]. In our study, we found that OM and LM had similar complication rates (27% vs. 19.8%, respectively), which is consistent with the results of previous studies. In addition, the recurrence rate between the two groups (5.4% [OM] vs. 2.5% [LM]) was not different; this is also similar to previous reports [18].

In Taiwan before 2007, the NHI did not pay for LM because performing LM requires advanced training and the surgeon's skill is critical and because only a few well-trained surgeons were able and willing to perform LM in that period. Most surgeons still prefer performing OM. After 2007, the NHI began paying for LM and thus the medical expense was no longer a concern. More surgeons were willing to be trained to perform LM because of its effectiveness, shorter hospital stay, less wound pain, and faster recovery than OM. As a surgeon gains experience in performing LM, the operative time should shorten, and thus it should become more popular in Taiwan.

There are some limitations to this study such as its retrospective nature and the fact that the study data are limited to a single institution. The follow-up period was relatively short, and pregnancy data were not analyzed. Therefore, no conclusions can be made about fertility after the two procedures. The weight of the fibroid tissue was not examined or compared between the groups. However, the weight of the fibroid tissue will not alter the difficulty of the surgery and is not necessarily correlated with the myoma size. Data were included from only one experienced laparoscopic surgeon, whereas data from five surgeons experienced in performing OM were included. In essence, this study compared one well-trained, experienced laparoscopist with well-trained surgeons who were experienced in performing open myomectomy. This should not have affected the results; however, studies with data from other well-trained laparoscopic surgeons would have been desirable to assist in confirming the results. In addition, studies would be useful that compare data from surgeons who are experienced in performing both LM and OM. We did not calculate values such as the cost-performance ratio or the cost value.

In conclusion, the overall cost is higher for laparoscopic myomectomy than for traditional open myomectomy. For patients, however, the laparoscopic approach has numerous advantages such as a shorter operative time, less blood loss, and a more rapid recovery time. The complication rate and recurrence rate were the same for both procedures.

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