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A Comparative Analysis of the Efficacy of Laparoscopic Myomectomy and Open Myomectomy in the Treatment of Uterine Fibroids

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Abstract: *Objective:* To evaluate the therapeutic efficacy of laparoscopic myomectomy (LM) versus open myomectomy (OM) for uterine fibroids. *Methods:* Sixty patients with uterine fibroids admitted for treatment between January 2023 and December 2025 were selected and randomly assigned using a random number table. The experimental group underwent LM treatment, while the control group underwent OM treatment. Perioperative parameters, sex hormone levels, oxidative stress markers, and complication rates were compared between the groups. *Results:* The experimental group demonstrated superior perioperative outcomes, excellent sex hormone levels at 3 months postoperatively, reduced oxidative stress markers, and a low complication rate; the comparison between the two groups showed $P < 0.05$. *Conclusion:* LM treatment offers superior outcomes for patients with uterine fibroids, shortening postoperative recovery time, preserving patients' sex hormone levels and oxidative stress markers, and demonstrating a high safety profile; it can therefore be considered the procedure of choice for these patients.

Keywords: Laparoscopic myomectomy; Open myomectomy; Uterine fibroids; Perioperative parameters; Complication rate

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1. Introduction

Uterine fibroids are benign tumors with a high incidence rate, caused by the excessive proliferation of uterine smooth muscle cells. They are most common among young and middle-aged women, and risk factors include hormonal imbalances, environmental changes, and unhealthy lifestyles [1]. Symptoms of this condition include prolonged menstrual periods and abnormal menstrual flow, often accompanied by lower back and sacral pain and generalized fatigue, and may even lead to conditions such as palpitations or anemia. As fibroids grow larger, they exert significant pressure on the fallopian tubes, which may cause uterine malformation and

consequently increase the risk of infertility. OM is a commonly used surgical procedure for this condition; it allows for the complete removal of the fibroid lesion and has a high success rate [2]. However, it is highly invasive and associated with a high incidence of postoperative complications, resulting in generally poor overall outcomes. Laparoscopic myomectomy (LM) is a minimally invasive procedure for this condition. It provides a clear surgical field via laparoscopy, is minimally invasive, allows for rapid postoperative recovery, and effectively preserves ovarian function, thereby improving patient outcomes. Based on this, this study selected 60 patients with uterine fibroids to evaluate the differences in treatment outcomes between LM and OM.

2. Materials and methods

2.1. General information

Sixty patients with uterine fibroids who were hospitalized between January 2023 and December 2025 were selected. Using a random number table, they were divided into two groups of equal size, with 30 patients assigned to the experimental group. Their ages ranged from 26 to 48 years, with a mean age of (33.15 ± 2.74) years. The duration of the disease ranged from 1 to 5 years, with a mean of (2.57 ± 0.94) years; the diameter of the fibroids ranged from 3.34 to 5.57 cm, with a mean of (4.42 ± 0.79) cm. The control group consisted of 30 patients, aged 24–47 years, with a mean age of (33.24 ± 2.70) years; the duration of illness ranged from 1 to 6 years, with a mean of (2.81 ± 0.97) years; and the diameter of the fibroids ranged from 3.30 to 5.52 cm, with a mean of (4.39 ± 0.83) cm. Comparisons of data between groups showed $P > 0.05$.

Inclusion Criteria: Diagnosis of uterine fibroids confirmed by laboratory and imaging tests; meets the relevant indications for both surgical procedures; normal communication and cognitive abilities; complete clinical records; fully informed consent regarding the study. Exclusion Criteria: Known contraindications for surgery; inability to tolerate anesthesia; presence of gynecological conditions such as endometriosis; severe pelvic adhesions; pregnancy or lactation; abnormal cardiac, hepatic, or renal function; presence of malignant tumors; withdrawal from the study.

2.2. Methods

The control group received OM treatment: Transvaginal ultrasound was performed to assess for abnormalities in the uterus and adnexa, determine the number and location of fibroids, evaluate their relationship with surrounding tissues, and determine the location and length of the lower abdominal incision. Instruct the patient to lie on her side for the administration of epidural anesthesia. Once anesthesia is established, reposition the patient onto her back. Incise the abdominal wall tissue layer by layer to expose the uterine body. Make a precise incision through the seromuscular layer along the protruding edge of the uterine fibroid, and dissect the lesion using a combination of blunt and sharp dissection techniques. Assess the amount of bleeding and perform electrocoagulation to control it; gelatin sponges may also be used to achieve adequate hemostasis. After excising the fibroid, irrigate the pelvic cavity with 0.9% saline solution, then continuously suture the serosarcoma of the uterus and reinforce the sutures once. Close the abdomen, disinfect the incision, and apply a sterile dressing.

The experimental group received LM treatment: Patients were positioned supine and placed under general anesthesia (with endotracheal intubation). An arc-shaped incision 10 mm in length was made at the umbilicus. After puncture, a pneumoperitoneum was created with a pressure of 10–13 mmHg. A trocar of

the appropriate size was inserted, followed by the laparoscope, to perform a comprehensive examination of the pelvic cavity, determine the location and size of the fibroids, and conduct a thorough assessment of the condition. Make an incision 2 cm below the umbilicus and 5 cm to the left, 5 cm in length. Make a 5-mm incision at McBurney's point in the right lower abdomen and a 10-mm incision at the contralateral McBurney's point in the left lower abdomen. Insert trocars and surgical instruments of appropriate sizes into these incisions, respectively. Gently insert a grasping forceps, gently lift the fibroid tissue, and perform electrocautery hook dissection along the outer capsule of the fibroid. Perform blunt dissection and remove the fibroid. Apply bipolar electrocoagulation to the wound for hemostasis. After complete resection of the fibroid, perform pelvic irrigation as described above. Continuously suture the uterine serosomatosal layer and reinforce the sutures once. Evacuate the gas from the pneumoperitoneum, remove the equipment, and then close the incision layer by layer and apply a dressing.

Antibiotics will be administered postoperatively as a preventive measure. Subcutaneous enoxaparin sodium injections will be given 24 hours after surgery, with a dose of 4,000 IU once daily. The patient should be advised to get out of bed and move around as soon as possible, and will receive symptomatic treatment, including pain management and fluid replacement.

2.3. Key performance indicators

(1) Perioperative indicators: These include intraoperative blood loss, duration of surgery, time to first postoperative flatus, pain scores at 24 hours postoperatively (Visual Analogue Scale, scored from 0 to 10, with higher scores indicating greater pain), and length of hospital stay.
(2) Sex Hormone Levels: Blood samples will be collected before surgery and 3 months after surgery to measure follicle-stimulating hormone (FSH), luteinizing hormone (LH), and estradiol using an enzyme-linked immunosorbent assay (ELISA).
(3) Oxidative stress markers: At the same time point, measure propylene glycol and reactive oxygen species after blood collection.
(4) Complication rate: Assess the incidence of intestinal obstruction, pelvic adhesions, bleeding, bowel injury, and surgical site infection.

2.4. Statistical analysis

Data were analyzed using SPSS 28.0 software. Continuous variables were compared using t-tests, and categorical variables were compared using chi-square tests. A P-value of < 0.05 was considered statistically significant.

3. Results

3.1. Comparison of perioperative parameters between the two groups

The perioperative outcomes were better in the experimental group, with a significant difference between groups ($P < 0.05$).

Table 1. Comparison of perioperative parameters between the two groups (mean ± SD)

Grouping	Number of examples	Intraoperative blood loss (mL)	Duration of the surgery (min)	Time to first flatus after surgery	Postoperative pain score at 24 hours (points)	Length of hospital stay (days)
Experimental group	30	90.65 ± 12.74	70.19 ± 7.18	23.75 ± 3.94	3.11 ± 0.57	4.22 ± 0.68
Control group	30	99.85 ± 13.61	92.15 ± 7.23	40.19 ± 4.88	4.29 ± 0.76	7.14 ± 1.19
t	-	2.70	11.80	14.36	6.80	11.67
P	-	0.009	0.000	0.000	0.000	0.000

3.2. Two sets of comparative hormone levels

Preoperatively, there were no significant differences in sex hormone levels between the groups ($P > 0.05$); 3 months postoperatively, the sex hormone levels in the experimental group were significantly better ($P < 0.05$).

Table 2. Comparison of sex hormone levels between the two groups (mean ± SD)

Grouping	Number of examples	Follicle-stimulating hormone (U/L)		Luteinizing hormone(U/L)		Estradiol (pmol/L)	
		Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Experimental group	30	7.22 ± 1.74	9.34 ± 1.64	6.86 ± 1.54	9.16 ± 1.78	293.44 ± 19.75	234.92 ± 16.73
Control group	30	7.20 ± 1.83	8.19 ± 1.90	6.90 ± 1.51	8.17 ± 1.66	290.55 ± 20.43	258.41 ± 18.69
t	-	0.04	2.51	0.10	2.23	0.56	5.13
P	-	0.97	0.02	0.92	0.03	0.580	0.000

3.3. Comparison of oxidative stress markers between the two groups

Before surgery, there was no significant difference in oxidative stress markers between the groups ($P > 0.05$); 3 months after surgery, oxidative stress markers were lower in the experimental group ($P < 0.05$).

Table 3. Comparison of oxidative stress markers between the two groups (mean ± SD)

Grouping	Number of examples	Propyleneglycol (μmol/L)		Reactive oxygen species (pmol/L)	
		Before treatment	After treatment	Before treatment	After treatment
Experimental group	30	54.74 ± 7.62	78.15 ± 8.16	37.95 ± 4.11	72.19 ± 6.18
Control group	30	54.81 ± 7.73	92.50 ± 9.14	38.04 ± 4.09	93.11 ± 6.83
t	-	0.06	6.42	0.09	12.44
P	-	0.972	0.000	0.933	0.000

3.4. Comparison of complication rates between the two groups

The incidence of complications was lower in the experimental group ($P < 0.05$).

Table 4. Comparison of complication rates between the two groups (n/%)

Grouping	Number of examples	Intestinal obstruction	Pelvic adhesions	Bleeding	Intestinal injury	Surgical site infection	Incidence rate
Experimental group	30	1	1	0	0	0	6. 67 (2/30)

Control group	30	2	3	1	1	1	26. 67 (8/30)
c^2	-	-	-	-	-	-	4. 32
P	-	-	-	-	-	-	0. 038

4. Discussion

Uterine fibroids are primarily composed of connective tissue and smooth muscle cells, and their development is associated with disruptions in estrogen secretion [3]. Generally, women of childbearing age have higher estrogen levels, which can lead to rapid growth of fibroids. After menopause, however, estrogen levels decrease, causing the fibroids to shrink. The symptoms of this condition depend on the location and size of the fibroids. In the early stages, there are no specific symptoms; however, as the fibroids continue to grow, they can cause abdominal distension, prolonged menstrual periods, and even lead to conditions such as upper urinary tract obstruction and hydronephrosis.

OM is a standard treatment for uterine fibroids. It allows for the complete removal of fibroid tissue while preserving as much of the uterine body as possible, and offers the advantages of being simple to perform, cost-effective, and highly effective [4]. However, this procedure requires an abdominal incision and is performed under direct visualization, allowing for clear visualization of the fibroid margins and precise excision. It offers ample working space and provides full exposure of the surgical field, making it suitable for multiple or deep-seated fibroids. However, the large incision inevitably causes tissue damage, and complications such as infection or pelvic adhesions may occur postoperatively, with a relatively long recovery period [5]. Furthermore, this procedure is associated with severe postoperative pain, requiring patients to take pain medication as prescribed, which directly affects the time it takes for them to get out of bed after surgery, delays the recovery of gastrointestinal function, and consequently reduces their postoperative quality of life.

Laparoscopy is a widely used minimally invasive surgical technique that involves making a small incision in the abdominal wall to insert surgical instruments. Under laparoscopic guidance, a series of surgical procedures are performed. This method offers high precision, minimizes tissue damage, and helps prevent postoperative complications such as pain and infection [6]. In addition, this procedure involves minimal blood loss, which significantly enhances treatment safety and reduces the incidence of postoperative complications.

The results showed that the perioperative indicators in the experimental group were superior to those in the control group ($P < 0.05$). Analysis of the reasons revealed that the smaller incision associated with LM reduces tissue trauma, prevents damage to nerves and abdominal wall tissues, stabilizes the internal environment, shortens the time to first postoperative flatus, and alleviates the severity of postoperative pain [7]. In addition, laparoscopy allows for a comprehensive examination of the pelvic and abdominal cavities. It provides a clear surgical field, protects vital organs surrounding the fibroids, and enables patients to get out of bed early after surgery, thereby shortening the length of hospital stay. Three months postoperatively, the sex hormone levels in the experimental group were superior to those in the control group ($P < 0.05$). The reason is that follicle-stimulating hormone (FSH) and luteinizing hormone (LH) are secreted by the pituitary gland and play a significant role in regulating ovarian function. If ovarian function is impaired, pituitary secretion decreases significantly, leading to a marked increase in the levels of these hormones [8]. Estradiol

reflects follicular development and thus provides a sensitive measure of ovarian function. Its levels are positively correlated with ovarian function. Following LM therapy, damage to the uterine body is minimal, and the negative impact on endocrine hormones is limited. At the same time, this approach helps preserve the anastomotic branches of the ovarian arteries, thereby preventing premature ovarian failure and stabilizing hormone levels.

Furthermore, LM allows for clear visualization of intrauterine lesions, enabling the removal of fibroids while preserving abdominal tissues and maintaining normal hormone secretion. Three months postoperatively, oxidative stress markers in the experimental group were lower than those in the control group ($P < 0.05$). Oxidative stress refers to an imbalance between the body's defense mechanisms and free radicals, caused by tissue damage. Patients who undergo LM surgery exhibit only mild oxidative stress. This is attributed to the fact that the precise nature of the LM procedure inhibits the release of inflammatory cells, such as neutrophils, thereby preventing oxidative stress. Furthermore, this surgical technique preserves normal blood circulation at the surgical site, accelerates tissue oxygenation, and prevents oxidative stress caused by tissue hypoxia, which in turn reduces the production of markers such as malondialdehyde [9]. The complication rate in the experimental group was lower than that in the control group ($P < 0.05$). Analysis suggests that the small incision used in LM prevents prolonged, extensive tissue exposure, thereby reducing the likelihood of bacterial growth. Intraoperative procedures such as precise cutting and electrocoagulation for hemostasis can mitigate the inflammatory response, thereby preventing complications such as pelvic adhesions and infections. The LM procedure causes minimal disruption to surrounding tissues, maximizes the preservation of fallopian tube and ovarian tissue, and is less likely to result in intestinal injury or significant bleeding. Additionally, the small incision allows for a shorter recovery time, and the procedure is highly safe.

5. Conclusion

In summary, LM is a more viable treatment option for uterine fibroids than OM. It reduces intraoperative blood loss, shortens surgical duration and postoperative recovery time, improves patients' sex hormone levels, prevents oxidative stress, and is associated with fewer postoperative complications. However, LM requires a high level of technical skill from the surgeon, who must have extensive clinical experience. If the patient has multiple, deep-seated, or large fibroids, the OM procedure is recommended to simplify the surgical technique, reduce the likelihood of converting to open surgery, and minimize the burden on the patient.

Disclosure statement

The author declares no conflict of interest.

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