

Comparison of Clinical Effects Between Minimally Invasive Laparoscopic Surgery and Laparotomy in Treating Ovarian Endometriosis Cysts

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Abstract: *Objective:* To compare the clinical effects of laparoscopic minimally invasive surgery and laparotomy in the treatment of ovarian endometriosis cysts. *Methods:* 66 patients with endometriosis cysts admitted to our hospital from December 2022 to December 2023 were selected as the study subjects and randomly divided into a control group ($n = 33$) and an observation group ($n = 33$). The control group was treated with laparotomy, and the observation group was treated with minimally invasive laparoscopic surgery. The surgical indexes, ovarian function indexes, and complications were observed. *Results:* All surgical indexes of the observation group (surgical time, intraoperative blood volume, hospital stay, postoperative antibiotic use time) were significantly better than the control group, ($P_{\text{mean}} < 0.001$). After surgery, the E_2 score of ovarian function indexes in the observation group was higher than that in the control group, while the luteinizing hormone (LH) and follicle-stimulating hormone (FSH) levels were lower than those in the control ($t = 5.246$, $t = 5.173$, $t = 3.535$, $P_{\text{mean}} < 0.001$). Lastly, the overall incidence of complications in the observation group (1/3.03%) was lower than that in the control group (8/24.24%), ($\chi^2 = 4.632$, $P < 0.05$). *Conclusion:* Minimally invasive laparoscopic surgery is more effective than laparotomy in treating ovarian endometriosis.

Keywords: Minimally laparoscopic invasive surgery; Laparotomy; Ovary; Ovarian endometriosis cyst

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1. Introduction

Ovarian endometriosis is a common gynecological disease characterized by the growth of endometrial tissue outside the uterine cavity, often involving the ovaries, pelvis, and other abdominal organs. Among them, endometriosis cyst (also known as chocolate cysts) is one of the most common manifestations of endometriosis, which is caused by the repeated bleeding of endometrial tissue in the menstrual cycle, may cause pain, infertility, and other diseases, which severely impacts one's quality of life and fertility. Surgery is the main treatment method for ovarian endometriotic cysts in clinical practice. Traditional laparotomy has long been the main method for dealing with widespread or complex endometriotic cysts due to its ability to provide a broad operating field and intuitive anatomical structure recognition. However, laparotomy causes significant trauma

and slow postoperative recovery, which puts a significant burden on the patient's physical and psychological well-being. With the continuous advancement of medical technology, minimally invasive laparoscopic surgery has gradually become the preferred method for treating endometriotic cysts due to its advantages of small trauma, fast recovery, and mild postoperative pain ^[1,2]. In recent years, relevant clinical studies have shown that laparoscopy is not only equivalent to traditional laparotomy in terms of therapeutic effect but also superior in terms of postoperative recovery speed, complication rate, and improvement of quality of life. Therefore, the purpose of this study was to compare the effect of traditional laparotomy and laparoscopic minimally invasive surgery in the treatment of ovarian endometriosis cysts to provide more data support for clinical practice, facilitate the selection of surgical methods, and improve the treatment effect.

2. General information and methods

2.1. General information

66 patients with endometriosis cysts admitted to our hospital from December 2022 to December 2023 were randomly divided into a control group and an observation group, with 33 cases in each group. The age range of the control group was 26–45 years, with a mean age of 35.56 ± 6.05 years. The diameter of cysts ranged from 4 to 11 cm, with a mean diameter of 7.16 ± 1.98 cm. For the observation group, ages ranged from 25 to 44 years, with a mean age of 36.31 ± 6.02 years. Cyst diameters ranged from 4 to 13 cm, with a mean diameter of 7.42 ± 1.92 cm.

Inclusion criteria: (1) ovarian endometriosis cyst diagnosed by clinical examination and pathology; (2) clear surgical indications and willing to undergo minimally invasive laparoscopic surgery or laparotomy; (3) no preoperative hormone therapy or other related therapy; (4) no other serious heart, liver, kidney and other systemic diseases, able to tolerate surgery. Exclusion criteria: (1) patients with surgical contraindications, such as coagulation dysfunction, severe cardiopulmonary insufficiency, etc.; (2) preoperative hormone therapy or other related treatments that may affect the surgical effect; (3) presence of a malignant tumor or suspected malignant tumor; and (4) patients who cannot tolerate surgery or refuse surgery.

2.2. Methods

The control group received laparotomy. The patient lied in a supine position and received general anesthesia; vertical and horizontal incisions were made on the abdomen (horizontal or vertical) according to the position and size of the cyst. After opening the abdominal cavity, the size and position of the cyst and the adhesion with surrounding tissues were observed, and the cyst was slowly separated from the surrounding tissues using various instruments. After completely dissociating the cyst, it was removed from the ovary. Hemostasis treatment was performed on the dissected surface and the abdominal cavity was flushed with normal saline. The abdominal cavity was closed and the abdominal incision was sutured layer by layer.

The observation group was treated with minimally invasive laparoscopic surgery. The patient was placed in a supine position and given general anesthesia. A pneumoperitoneum needle was inserted through a small incision in the umbilicus or lower abdomen, and carbon dioxide was injected to establish a pneumoperitoneum to make space for laparoscopic operation. A laparoscope was inserted through an incision in the umbilicus or lower abdomen to observe the situation in the abdominal cavity. Additional operation holes were created in the lower abdomen according to the position of the cyst, and surgical instruments were inserted; under the guidance of laparoscopy, the adhesion between the cyst and surrounding tissues was separated by using instruments, and the cyst was removed from the ovary. After removing the cyst, hemostatic treatment and abdominal irrigation were performed. All surgical instruments were withdrawn, and the incisions in the umbilicus and lower abdomen

were sutured.

2.3. Observation indexes

In this study, surgical indexes were evaluated by surgical time, hospital stay, intraoperative blood volume, and postoperative antibiotic use time; ovarian function was evaluated by estradiol (E_2), luteinizing hormone (LH), and follicle-stimulating hormone (FSH); and five complications such as intestinal obstruction, pelvic inflammatory disease, intestinal adhesion, ovarian dysfunction, and infertility were counted.

2.4. Statistical methods

SPSS20.0 software was used to analyze the study data. Data conforming to the normal distribution were expressed as mean \pm standard deviation and analyzed using a *t*-test. The count data were expressed as percentages and compared using a χ^2 -test. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Surgical indexes

All indexes of the observation group were significantly better than those of the control group ($P_{\text{mean}} < 0.001$), as shown in **Table 1**.

Table 1. Comparison of surgical indexes between two groups of patients

Surgical indexes	Control group ($n = 33$)	Observation group ($n = 33$)	<i>t</i>	<i>P</i>
Duration of surgery (min)	92.35 \pm 12.12	67.89 \pm 10.56	8.741	0.000
Hospital stay (d)	9.34 \pm 1.58	7.16 \pm 1.32	6.083	0.000
Intraoperative blood volume (mL)	100.55 \pm 9.21	56.35 \pm 8.12	20.679	0.000
Duration of postoperative antibiotic use (d)	5.68 \pm 2.16	3.16 \pm 1.22	5.836	0.000

3.2. Ovarian function indexes

The E_2 level of the Observation group was higher than that of the control group, while LH and FSH scores were lower than those of the control group, and the differences were significant ($P_{\text{mean}} < 0.001$), as shown in **Table 2**.

Table 2. Comparison of ovarian function indexes between two groups of patients

Indexes	Time	Control group ($n = 33$)	Observation group ($n = 33$)	<i>t</i>	<i>P</i>
E_2 (mmol/L)	Pre-operative	125.25 \pm 26.58	124.32 \pm 26.48	0.142	0.887
	Post-operative	88.65 \pm 18.45	115.35 \pm 22.68	5.246	0.000
LH (IU/L)	Pre-operative	7.56 \pm 1.52	7.54 \pm 1.50	0.054	0.957
	Post-operative	11.86 \pm 2.43	9.20 \pm 1.68	5.173	0.000
FSH (IU/L)	Pre-operative	6.29 \pm 1.53	6.26 \pm 1.55	0.079	0.937
	Post-operative	7.82 \pm 1.77	6.36 \pm 1.58	3.535	0.001

3.3. Complication rate

After treatment, the overall incidence of complications in the observation group (1/3.03%) was lower than that in the control group (8/24.24%), ($P < 0.05$). See **Table 3**.

Table 3. Comparison of complications between two groups of patients

Complication indexes	Control group (n = 33)	Observation group (n = 33)	χ^2	P
Intestinal obstruction	1 (3.03%)	0	-	-
Pelvic inflammatory disease	2 (6.06%)	1 (3.03%)	-	-
Intestinal adhesion	2 (6.06%)	0	-	-
Ovarian dysfunction	3 (9.09%)	0	-	-
Infertility	0	0	-	-
Overall incidence	8 (24.24%)	1 (3.03%)	4.632	0.031

4. Discussion

Ovarian endometriotic cysts usually occur in women of childbearing age and are formed through the abnormal growth of endometrial cells (usually located in the uterus) on the ovaries [3]. These ectopic growing endometrial cells, under the influence of hormones, will also experience menstrual bleeding like normal endometrium. Due to the inability of blood to be discharged smoothly, cysts will eventually form. The blood inside the cyst, due to long-term accumulation and oxidation, becomes like chocolate sauce in color, hence it is also known as a “chocolate cyst.” The treatment methods for ovarian endometriotic cysts include drug therapy and surgical treatment. Drug therapy is mainly used to alleviate symptoms, alleviate pain, and control disease progression. Commonly used drugs include nonsteroidal anti-inflammatory drugs (NSAIDs), oral contraceptives, progesterone and gonadotropin-releasing hormone agonists (GnRH-a), etc. Surgical treatment is mainly used for patients with ineffective drug treatment or large cysts. The surgical methods include laparoscopic surgery and laparotomy to remove cysts and ectopic endometrial tissue and preserve fertility [4]. Laparotomy is a traditional surgical method used to diagnose and treat diseases in the abdominal cavity. It usually involves making a larger incision in the abdomen so that doctors can directly see and operate the organs inside the abdominal cavity. This type of surgery is usually used in more complex cases or when laparoscopic surgery is not feasible. Laparotomy usually causes significant surgical trauma and may also damage ovarian tissue [5], leading to complications such as wound infection and intestinal adhesions [6]. Laparoscopic surgery is a minimally invasive surgical method that involves making several small incisions in the abdomen and inserting a camera-equipped instrument (laparoscopy) and other surgical instruments. Doctors can view the abdominal cavity on a television screen and perform surgical operations [7]. There, laparoscopic treatment is superior to laparotomy in terms of treating endometriotic cysts.

In this study, the duration of surgery and hospital stay, the intraoperative blood volume, and the duration of postoperative antibiotic use time of the observation group were all less than those in the control group ($P_{\text{mean}} < 0.001$), indicating that laparoscopic surgery promotes postoperative rehabilitation of patients. This is because laparoscopic surgery provides clear intra-abdominal images through high-definition cameras, enabling doctors to identify and operate target tissues more accurately, thus reducing unnecessary bleeding. The tiny incision under laparoscopy also causes less damage to blood vessels and tissues, reducing postoperative bleeding. Secondly, the clear images help doctors find ectopic cysts quickly, thus shortening the duration of surgery. Thirdly, laparoscopic surgery causes less trauma and postoperative pain, so patients can get out of bed earlier, which in turn promotes physical recovery and shortens hospital stays. Fourthly, because laparoscopic surgery is less invasive and the risk of infection is relatively low, so the duration of antibiotic use after surgery is reduced.

This study showed that the postoperative E_2 level score in the observation group was higher than that in the control group, while the LH and FSH scores were lower than those in the control group ($P_{\text{mean}} < 0.001$). E_2 , LH, and FSH are key hormones in the female reproductive system. E_2 is one of the main estrogens produced by the ovaries. Due to the periodic changes in ectopic endometrial tissue under the action of hormones, it may lead to an increase in local estradiol levels. High levels of estradiol may further promote the growth of ectopic endometrium, and exacerbate the formation and development of cysts. LH is a hormone secreted by the anterior pituitary gland. In patients with ovarian endometriotic cysts, LH levels increase with the formation and development of the cyst. High levels of LH may further promote the growth of endometriosis in the ovary, leading to the enlargement of the cyst. FSH is also a hormone secreted by the anterior pituitary gland, and with the formation and development of cysts, the patient's FSH level will increase. In laparoscopic surgery, doctors can more accurately identify and remove ectopic cysts, preserve normal ovarian tissue as much as possible, and reduce long-term effects on ovarian function. In addition, the interference with ovarian tissue during the surgical process is relatively small, which can effectively reduce the risk of premature ovarian failure^[8].

The overall incidence of complications in the observation group (1/3.03%) was lower than that in the control group (8/24.24%) ($\chi^2 = 4.632$, $P < 0.05$). This is because laparoscopic surgery has less trauma and reduces the risk of infection in the surgical incision. In addition, laparoscopic surgery has less interference with the tissue in the abdominal cavity, thus reducing the incidence of complications such as intestinal adhesion and obstruction.

5. Conclusion

Laparoscopic treatment of ovarian endometriotic cysts has significant advantages in promoting postoperative recovery, minimizing the impact on ovarian function, and reducing complications. These advantages make laparoscopic surgery the preferred treatment method for many doctors and patients because it offers fast recovery, helps preserve fertility, and has fewer surgical risks. In short, minimally invasive laparoscopic surgery is more effective than laparotomy in the treatment of ovarian endometriosis cysts.

Disclosure statement

The author declares no conflict of interest.

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