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Analysis of the Application of Laparoscopic Surgery in Benign Gynecological Tumors

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Abstract: *Objective:* To explore and analyze the application of laparoscopic surgery in benign gynecological tumors. *Methods:* Forty patients with benign gynecological tumors admitted to the Department of Gynecology in Gaoyou People's Hospital from August 2022 to August 2023 were selected as research subjects. They were divided into a research group (n = 20) and a reference group (n = 20) using the double-blind method. The research group received laparoscopic surgery, while the reference group underwent conventional treatment. Immune indicators, inflammatory factor levels, surgical outcomes, and test indicators were compared between the groups. *Results:* Before surgery, immune indicators such as CD8+, CD4+, CD4+/CD8+, and CD3+ were comparable between the groups ($P > 0.05$). Post-surgery, the research group exhibited better results in immune indicators compared to the reference group ($P < 0.05$). Before treatment, levels of inflammatory factors including IL-4, IL-2, and TNF-α showed no statistically significant difference ($P > 0.05$). However, after surgery, the research group demonstrated significantly better outcomes in terms of inflammatory factors compared to the reference group ($P < 0.05$). Surgical outcomes such as blood loss, postoperative recovery time, hospitalization time, anal exhaust time, and drainage tube removal time in the research group were significantly better than those in the reference group ($P < 0.05$). Before surgery, test indicators such as hemoglobin, C-reactive protein, and albumin were similar between the groups ($P > 0.05$). After surgery, the research group showed significantly better outcomes in test indicators compared to the reference group ($P < 0.05$). *Conclusion:* Laparoscopic surgery demonstrates a notable curative effect on benign gynecological tumors, warranting widespread application and promotion.

Keywords: Laparoscopic surgery; benign gynecological tumors; treatment

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1. Introduction

Gynecological tumors are diseases that affect women. Benign gynecological tumors generally have a favorable prognosis following treatment, while early intervention for malignant gynecological tumors can lead to more favorable outcomes. Unfortunately, when these diseases progress to the middle and late stages, the prognosis tends to be less optimistic [1].

Benign gynecological tumors often manifest with symptoms such as irregular bleeding, changes in leucorrhea, lower abdominal mass, and abnormal urine, among others. In clinical practice, uterine fibroids and

ovarian cysts are commonly benign gynecological tumors [2]. Surgical intervention typically constitutes the primary approach for managing such conditions.

Traditional open-surgical procedures have been employed for many years, but their invasiveness can easily lead to postoperative complications [3]. To mitigate the invasiveness associated with surgery, minimally invasive treatment techniques have been developed, with laparoscopic surgery being a notable example. Currently, this surgical method is extensively utilized in clinical practice. It involves using small incisions instead of large openings, reducing the length of the surgical incision. This approach eliminates the need to expose the abdominal cavity, resulting in quicker postoperative recovery and a significantly lower risk of complications [4]. This article aims to study and analyze the application of laparoscopic surgery in the context of benign gynecological tumor surgery.

2. Materials and methods

2.1. General information

From August 2022 to August 2023, 40 patients with benign gynecological tumors were recruited from the Department of Gynecology in Gaoyou People's Hospital. They were assigned to groups through a double-blind mechanism, forming the research group ($n = 20$) and the reference group ($n = 20$).

In the reference group, the age range was 24–65 years, with an average age of 44.31 ± 1.59 years. This group included 11 cases of benign ovarian tumors and 9 cases of benign uterine tumors. The age range of the research group was 23–65 years, with an average age of 44.25 ± 1.63 years. This group comprised 10 cases of benign ovarian tumors and 10 cases of benign uterine tumors. A comparison of general information, such as age and tumor type, between groups showed no statistically significant difference ($P > 0.05$).

Inclusion criteria included patients clinically diagnosed with benign gynecological tumors and provided informed consent for participation in the research.

Exclusion criteria included patients with mental illness, patients diagnosed with malignant tumors, and patients with organ failure.

2.2. Methods

The reference group underwent conventional treatment, which involved general anesthesia. A 10 cm incision was made in the abdomen, followed by the separation of subcutaneous tissue to expose the abdominal tissue. Upon locating the tumor tissue, it was removed, the abdominal cavity was flushed, a drainage tube was inserted, and the incision was sutured.

The research group employed laparoscopic surgical treatment with thorough preoperative preparations. The Veress needle was inserted to establish pneumoperitoneum, maintaining a pressure range between 12 and 14 mmHg. Operating and observation holes were created, allowing the insertion of the laparoscope for abdominal exploration and tumor tissue removal. Bleeding was managed using electrocoagulation, followed by abdominal cavity flushing, drainage tube placement, and incision suturing.

2.3. Observation indicators

(1) Compare immune indicators between groups, including CD8+, CD4+, CD4+/CD8+, and CD3+.
(2) Compare the levels of inflammatory factors between groups, including IL-4, IL-2, and TNF-α.
(3) Compare surgical indicators between groups, such as surgical blood loss, postoperative recovery time, hospitalization time, anal exhaust time, and drainage tube removal time.
(4) Compare test indicators between groups, including hemoglobin, C-reactive protein, and albumin.

2.4. Statistical analysis

SPSS 21.0 statistical software was selected to process and analyze the data. Count data were expressed as the number of cases (n) and percentage (%), with the implementation of the χ^2 test. Measurement data were expressed as the mean ± standard deviation (SD), and the t-test was employed. A significance level of $P < 0.05$ was considered as indicating a statistically significant difference.

3. Results

3.1. Comparison of immune indicators between the two groups

Table 1 shows that the immune indicators between the two groups before surgery were comparable ($P > 0.05$), and the research group showed significant improvement after surgery as compared to the reference group ($P < 0.05$).

Table 1. Comparison of immune indicators between groups before and after surgery (mean ± SD)

Group	CD8+		CD4+		CD4+/CD8+		CD3+	
	Before	After	Before	After	Before	After	Before	After
Research group (n = 20)	26.57 ± 5.84	27.58 ± 5.31	43.87 ± 6.55	44.58 ± 6.24	1.47 ± 0.64	1.72 ± 0.45	64.28 ± 8.54	68.27 ± 7.54
Reference group (n = 20)	26.62 ± 5.41	20.27 ± 5.36	43.15 ± 6.23	35.87 ± 5.44	1.49 ± 0.66	1.41 ± 0.43	64.38 ± 8.15	55.21 ± 7.68
t	0.0281	4.3329	0.3562	4.7053	0.0973	2.2274	0.0379	5.4268
P	0.9777	0.0001	0.7237	0.0000	0.9230	0.0319	0.9700	0.0000

3.2. Comparison of the levels of inflammatory factors between the two groups

The inflammatory factors between the two groups before surgery showed no statistically significant difference ($P > 0.05$). However, the research group showed better indicators after surgery as compared to the reference group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of inflammatory factor levels between groups before and after surgery (mean ± SD, ng/L)

Group	IL-4		IL-2		TNF-α	
	Before	After	Before	After	Before	After
Research group (n = 20)	42.58 ± 5.29	43.15 ± 5.98	50.27 ± 8.54	49.27 ± 8.51	33.24 ± 11.58	42.58 ± 15.96
Reference group (n = 20)	42.68 ± 5.12	48.96 ± 5.42	50.69 ± 8.14	44.21 ± 7.36	33.98 ± 11.24	55.27 ± 18.35
t	0.0607	3.2194	0.1592	2.0113	0.2051	2.3336
P	0.9519	0.0026	0.8744	0.0514	0.8386	0.0250

3.3. Comparison of surgical indicators between the two groups

Table 3 shows that the research group has better surgical indicators such as surgical blood loss, postoperative recovery time, hospitalization time, anal exhaust time, and drainage tube removal time as compared to those in the reference group ($P < 0.05$).

Table 3. Comparison of surgical indicators between groups (mean ± SD)

Group	Surgical blood loss (mL)	Postoperative recovery time (d)	Hospitalization time (d)	Anal exhaust time (h)	Drainage tube removal time (d)
Research group (n = 20)	53.21 ± 10.56	4.52 ± 1.25	5.41 ± 1.56	33.27 ± 3.59	4.21 ± 1.56
Reference group (n = 20)	102.58 ± 20.58	9.57 ± 2.65	11.38 ± 1.96	39.57 ± 3.56	7.85 ± 1.63
t	9.5451	7.7079	10.6580	5.5726	7.2150
P	0.0000	0.0000	0.0000	0.0000	0.0000

3.4. Comparison of the test indicators between the two groups

Before surgery, test indicators including hemoglobin, C-reactive protein, and albumin were comparable between the groups ($P > 0.05$). After surgery, the research group had significantly better test indicators than those in the reference group ($P < 0.05$), as shown in **Table 4**.

Table 4. Comparison of test indicators between groups before and after surgery (mean ± SD)

Group	Hemoglobin (g/L)		C-reactive protein (mg/L)		Albumin (g/L)	
	Before	After	Before	After	Before	After
Research group (n = 20)	105.68 ± 8.54	124.86 ± 8.54	28.87 ± 3.21	50.27 ± 4.56	30.27 ± 2.59	38.74 ± 3.24
Reference group (n = 20)	105.97 ± 8.21	104.35 ± 8.69	28.41 ± 3.66	56.87 ± 4.69	30.85 ± 2.96	33.21 ± 3.58
t	0.1095	7.5282	0.4226	4.5122	0.6595	5.1219
P	0.9134	0.0000	0.6750	0.0001	0.5136	0.0000

4. Discussion

Gynecologic tumors affecting the female reproductive system are categorized as benign or malignant [5]. Benign tumors, while usually small and asymptomatic, may require treatment if symptoms arise or if their size exceeds 5 cm [6]. Benign gynecological tumors are organic lesions, thus conservative treatment is of little significance. Surgical intervention is often the most effective treatment for those tumors [7], allowing complete removal and symptom improvement [8].

However, open surgery for benign gynecological tumors poses challenges due to the special nature of the female reproductive system. The female reproductive system contains a large number of blood vessels and anastomotic branches. The reproductive organs have many adhesions and are easily irritated during the operation, which in turn leads to tissue damage, postoperative complications, and increases risks of surgical treatment [9]. When open surgery is used to treat benign gynecological tumors, the surgical incision is about one centimeter long. The pelvic cavity needs to be opened throughout the operation, which leads to the exposure of the pelvic organs and their contact with the air for a long time [10]. Open surgery can effectively remove tumor tissue, but it is very invasive and the surgical operation can easily damage other tissues, leading to a higher risk of postoperative complications and a longer recovery period [11]. To mitigate these challenges, minimally invasive treatments such as laparoscopic surgery technology have gained prominence [12].

Laparoscopic surgery, performed in a closed environment, avoids the need for open incisions or prolonged exposure of the pelvic cavity. It employs small holes (observation holes, operating holes, pneumoperitoneum holes) on the body surface for instrument insertion. The surgical operation can be completed by using the laparoscope and operating equipment [13]. The laparoscope carries a camera, and the angle of the camera can be

adjusted to explore the pelvic cavity with a clearer view field. Electrocoagulation is used during the operation to control bleeding effectively [14]. The pneumoperitoneum ensures a controlled operating space, avoiding stimulation of other surrounding organs or tissues and further reducing the risk of operation. Laparoscopic surgery enables rapid recovery, improving prognosis and showing promising prospects in treating benign gynecological tumors [15].

In this study, both groups before the surgery had comparable immune indicators (CD8+, CD4+, CD4+/CD8+, and CD3+), inflammatory indicators (IL-4, IL-2, and TNF-α), and test indicators (hemoglobin, C-reactive protein, albumin; $P > 0.05$). Post-surgery, the research group showed significantly better immune indicators, inflammatory indicators, and test indicators compared to the reference group ($P > 0.05$). Moreover, the research group also exhibited better surgical outcomes such as surgical blood loss, postoperative recovery time, hospitalization time, anal exhaust time, and drainage tube removal time, as compared to those in the reference group ($P < 0.05$). Laparoscopic surgery has little impact on immune indicators and does not significantly change their levels, thus suggesting that this surgical method can protect the immune system. This surgical method requires carbon dioxide to be injected. Carbon dioxide affects the acid-base balance, thereby inhibiting the activity of macrophages. The increase in TNF-α is not significant, and serum factors and white blood cell functions are not greatly affected, proving its excellent safety. Following laparoscopic surgery, the patient's physical indicators return to normal within a short period of time, hence the levels of hemoglobin, C-reactive protein, and albumin showed insignificant changes. The immune function and inflammatory response of the patients are not strongly stimulated. Postoperative complications generally do not occur, and the patients return to normal physical condition swiftly.

In summary, laparoscopic surgery proves effective in treating benign gynecological tumors, with favorable clinical value, warranting widespread use and promotion.

Disclosure statement

The author declares no conflict of interest.

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