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Original Article

Effects of laparoscopic surgery and laparotomy procedures on efficacy and prognosis of patients with endometrial carcinoma

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Abstract: Objective: The present study was designed to investigate the effects of laparoscopic surgery and laparotomy procedures on the efficacy and prognosis of patients with endometrial carcinoma (EC) in stages I-II. Methods: Eighty-one patients with EC, treated from July 2014 to January 2019, were studied retrospectively. According to different surgical methods, 41 patients treated with laparoscopic surgery were included in the observation group. The remaining 40 underwent laparotomy procedures and were assigned to the control group. Operation times, number of intraoperative lymph node dissections, intraoperative blood loss, postoperative hospital stays, postoperative off-bed activity times, drainage tube removal times, total hospitalization costs, postoperative pain, postoperative complications, quality of life one month after the operation, postoperative recurrence, metastasis, and deaths of all patients were recorded, evaluated, and compared. Results: Length of hospital stays, intraoperative blood loss, postoperative off-bed activity times, and drainage tube removal times were all lower in the observation group than the control group ($P<0.05$). Hospitalization costs were higher than those in the control group ($P<0.05$). No significant differences were observed in operation times and number of lymph node dissections between the two groups ($P>0.05$). Pain scores of the observation group were lower than those of the control group at 24 hours, 3 days, and 5 days after surgery, with statistical differences ($P<0.05$). The total number of complications in the observation group was lower than that in the control group, with statistical differences ($P<0.05$). Regarding patient quality of life, the observation group scored higher in physical functioning (PF), role-physical (RP), social functioning (SF), and bodily pain (BP) than the control group ($P<0.05$). The number of patients with recurrence, metastasis, and deaths did not identify any marked differences between the two groups ($P>0.05$). Conclusion: Compared with laparotomy procedures, laparoscopic surgery for EC provides faster postoperative recovery times, shorter hospital stays, less postoperative pain, lower incidence of complications, higher postoperative quality of life, and no increase in recurrence and mortality. Therefore, it is worthy of popularization in clinical practice.

Keywords: Endometrial carcinoma, laparoscopic surgery, laparotomy, curative effect, prognosis

Introduction

Endometrial carcinoma (EC) is a malignant tumor of the female reproductive tract, accounting for 20-30% of all female reproductive tract tumors. Although women over 50 years old are susceptible, with 61,900 new cases in China every year, rising incidence rates of EC have been found at younger ages, even exceeding that of cervical cancer in some areas [1-5]. However, the pathogenesis of EC remains unclear at present [6]. Surgical treatment is mainly applied to patients found in stages I-II, characterized by vaginal bleeding [7]. Laparotomy procedures have shown a long history of application in clinic, proving to be a mature and effective technology. In addition, with the development of science and technology, laparoscopic surgery has been gradually popularized in the treatment of benign and malignant tumors of the abdomen [8]. Despite difficulty in uterine resections and lymph node dissections, laparoscopic surgery has achieved good outcomes for EC [9]. Some researchers believe that laparoscopic surgery has the same effects as laparotomy procedures, while

enjoying the advantages of less trauma, faster recovery times, and shorter hospital stays [10]. However, previous surgical studies have argued that laparoscopic surgery has higher blood loss than laparotomy procedures [11]. Moreover, the latest evidence reveals that laparoscopic surgery for malignant tumors results in a higher recurrence rates and lower overall survival rates than laparotomy procedures [12]. Therefore, the use of laparoscopic surgery for patients with EC remains controversial. Based on these factors, the current study compared the curative effects and long-term follow-ups of laparoscopic surgery and laparotomy procedures in patients with EC, aiming to provide more references for clinical treatment.

Materials and methods

General information

A total of 81 cases of patients with EC, admitted to the Department of Gynecology of Jinhua People's Hospital, from July 2014 to January 2019, aged 31-73 years old, with an average age of 55.4±11.7 years, were collected for the current retrospective study. The patients were grouped according to different surgical methods. The observation group, including 41 patients, with an average age of 55.4±12.6 years, was treated with laparoscopic surgery. The remaining 40 patients, with a mean age of 55.3±10.8 years, in the control group, were treated with laparotomy procedures. All patients were followed-up for a long period after surgery. The present study was approved by the Medical Ethics Committee of Jinhua People's Hospital and all enrolled patients provided informed consent.

Inclusion and exclusion criteria

Inclusion criteria: Patients that met the diagnostic criteria for EC [13]; Patients aged 18-75 years. Exclusion criteria: Patients unable to tolerate the operation; Patients with severe heart, liver, kidney, or other diseases; Patients with mental disorders or cerebrovascular diseases leading to a decline in life quality; Patients with severe coagulation disorders; Patients with difficulty or inconvenience regarding follow-ups, as well as those not suitable for surgery.

Surgical methods

Laparoscopic surgery was performed in the observation group. Patients were given general anesthesia. Methods: patients were first given oxygen at 6-8 L/min through a mask. This was followed by intravenous injections of midazolam (Jiangsu Nhwa Pharmaceutical Co., Ltd., China; 0.05-0.10 mg/kg), propofol (Xi'an Libang Pharmaceutical Co., Ltd., China; 1-1.5 mg/kg), Sufentanil citrate (Yichang Humanwell Pharmaceutical Co., Ltd., China; 0.2-0.3 μg/kg), and cisatracurium (Shanghai Hengrui Pharmaceutical Co., Ltd., China; 0.15-0.20 mg/kg), according to patient weights. Tracheal intubation was performed during general anesthesia, with induction 3 minutes after assisted respiration. Sufentanil citrate 10-20 μg was injected 5 minutes before skin incision. After anesthesia, the patients were placed in the lithotomy position. A catheter was inserted and retained in the urethra. The uterine manipulator was placed in the vagina and the bandage and gauze were placed in the anterior and posterior domes of the uterus. A 1 cm incision was made at the umbilical hole and the pneumoperitoneum pressure was maintained at 12-15 mmHg at this incision. Next, 5 mm trocars were inserted at the left and right McBurney's point, respectively, and another 5 mm trocar was inserted through a 5 mm incision on the position 2 cm above the symphysis pubis. The pelvic cavity and abdominal cavity were rinsed and probed. Flushing fluid or ascites were retained for humoral examination. Sections of suspicious combination were examined by pathology. An ultrasonic scalpel (FEN11, Johnson, USA) was used to close the isthmus of the fallopian tube and an electrocoagulation scalpel was applied to cut open the bilateral funnel ligament at about 3 cm outside the fallopian tube. The lobar peritoneum and rectouterine peritoneum reflection at the lateral 3 cm of sacral ligament and round ligament were cut, respectively. After the incision, the two were obtuse separated from the gap between the vagina and rectum. Afterward, the ligamentum teres outside the uterine horn was cut open with the electrocoagulation scalpel and the peritoneal reflection of bladder and uterus was cut open to separate the bladder from the uterus. Next, the uterine artery was incised with the electrocoagulation scalpel and the ureter was freed and peeled outward. The cervical bladder ligament and medial ureter capsule were further incised by the electrocoagulation scalpel. Afterward,

the exposed main and uterine sacral ligaments were cut 3 cm laterally and a 5 mm horizontal incision was made at the upper 3 cm of the vagina. The uterine appendages were then stripped and removed. Pelvic and para-aortic lymph nodes were dissected after removal. Finally, the anterior and posterior position of the vagina was sutured. A drainage tube was then placed.

Laparotomy procedures were performed in the control group. Anesthesia and the posture were the same as those in the laparoscopic surgery group. A 15-20 cm longitudinal incision was made from the middle of the abdomen to 3 cm above the umbilicus. The procedure and scope of surgery were the same as those in the laparoscopic surgery group.

Aiming to ensure surgical quality, the following schemes were adopted: (1) All operations were performed by experienced surgeons; (2) For the same operation, the same patch and suture materials were used; (3) Unified treatment and nursing plans were applied before and after the operation to stop bleeding; (4) Intraoperative bleeding was stopped by corresponding methods and postoperative incisions were routinely treated to prevent infections; and (5) The same follow-up plan was implemented for the two groups.

Outcome measures

Main outcome measures: 1) Operation times: the time from skin incision to the end of suture was recorded; 2) Intraoperative bleeding: the amount of bleeding from the beginning of the operation to the end of the surgical suture was recorded; 3) Postoperative hospitalization days: the number of days from hospitalization in the ward to discharge after the operation was included; 4) Hospitalization expenses: all expenses incurred during hospitalization were included; 5) Drainage tube removal times: the time from postoperative to drainage tube removal was recorded; 6) Postoperative off-bed activity times: the time for postoperative patients to freely get out of bed in the ward for more than 30 minutes without any discomfort was recorded (in hours); 7) Number of lymph node dissection: the number of lymph nodes dissection during the operation was recorded; and 8) Postoperative pain: visual analogy scores (VAS) were employed to quantify subjective pain. A 10 cm scale was used, with two stops of 0 and 10, respectively, where 0 represented no pain and 10 denoted the most severe pain experienced by the patient. The patients could select a point between 0-10, according to their degree of pain. This very point was the patient's VAS score. Pain scores were assessed and recorded at 24 hours, 3 days, and 5 days after surgery [14].

Secondary outcome measures: 1) Postoperative complications: postoperative complications, including intestinal obstructions, intra-abdominal cavity adhesion, urinary retention, bleeding, urinary tract infections and incision infections, and the number of cases was recorded. Complication rate = number of patients with complications/total number of patients * 100%; 2) Quality of life evaluation one month after surgery: scores were evaluated according to the MOS item short-from health survey (SF-36) [15]. With a score ranging from 1 to 100 points, the scores were positively correlated with the quality of life of patients. Basic formula: Conversion score = ((actual score - the lowest possible score in this area)/(highest possible score in this area - the lowest score)) * 100%.

Patients included in this study were followed-up one month after surgery. Patients in a stable condition were followed up every three months. Colposcopy procedures were performed in re-examinations. Vaginal biopsies, abdominal CTs, and chest CTs, were re-examined when necessary. The follow-up deadline was October 2019. Recurrence, metastasis, and deaths of the patients were monitored.

Statistical analysis

SPSS 17.0 statistical software was used for statistical analysis. Continuous variables are expressed as mean ± standard deviation ($\bar{x}$ ± sd). Variables in line with normal distribution and homogeneity were tested using Student's t-tests, expressed as t. Data inconsistent with normal distribution and homogeneity were tested using rank sum tests, expressed as Z. Count data were tested using Pearson's Chi-square tests and Fisher's exact probability

Table 1. Comparison of general information and baseline information ($\bar{x}$ ± sd, n (%))

	Observation group (n=41)	Control group (n=40)	χ^2/t	P
Age (year)	55.4±12.6	55.3±10.8	0.136	0.892
Types of cancer			0.001	0.971
Non-endometrioid carcinoma	4	3		
Endometrioid carcinoma	37	37		
cTNM stage (case)			0.005	0.998
Ia stage	30	29		
Ib stage	8	8		
II stage	3	3		
Differentiation degree (case)			0.176	0.916
High	28	27		
Middle	8	9		
Low	5	4		
Type 2 diabetes				
Yes	7	8	0.115	0.715
No	34	32		
Hypertension			0.018	0.893
Yes	17	16		
No	24	24		
Hyperlipidemia				
Yes	11	12	0.100	0.752
No	30	28		
Obesity			0.105	0.746
Yes	9	10		
No	32	30		
Smoke			0.136	0.713
Yes	5	6		
No	36	34		
Average follow-up time (months)	41.2±7.5	40.2±8.3	0.141	0.888

method. P<0.05 indicates statistically significant differences.

Results

Comparison of general information

There were no statistical differences between the two groups in terms of age, cancer type, cTMN stage, differentiation degree, comorbid disease, smoking, or average follow-up times. Thus, they were comparable (P>0.05; **Table 1**).

Comparison of related indicators after surgery

The observation group had shorter hospital stays, less intraoperative blood loss, shorter off-bed activity times, and shorter drainage tube removal times than the control group. However, the hospitalization costs were higher (P< 0.05). There were no significant differences in operation times and number of lymph node dissections (P>0.05; **Table 2**).

Comparison of postoperative pain scores

Pain scores of the observation group were lower than those of the control group at 24 hours, 3 days, and 5 days after surgery, with statistical differences (P<0.05; **Table 3**).

Comparison of postoperative complications

Inter-group comparisons revealed that the total number of complications in the observation group was notably lower than that in the control group (P<0.05; **Table 4**).

Comparison of quality of life scores between the two groups at one month after surgery

No significant differences were found in quality of life scores between the two groups before surgery. However, one month after surgery, there were marked differences in scores of physical functioning, role-physical, social functioning, and bodily pain between the two groups. Scores of the four dimensions mentioned above in the observation group were superior to those in the control group. No marked differences were observed in general health, mental health, and vitality between the two groups (P>0.05; **Table 5** and **Figure 1**).

Comparison of postoperative follow-up prognosis

Two patients in the observation group were lost to follow-up. Three patients in the control

Table 2. Comparison of related indicators after surgery ($\bar{x} \pm sd$)

	Observation group (n=41)	Control group (n=40)	t	P
Length of stay (d)	8.9±2.4	12.0±4.0	4.282	<0.001
Operation time (min)	178.23±80.89	183.09±69.32	0.290	0.773
Intraoperative bleeding volume (ml)	198.89±102.23	285.78±125.30	3.424	0.001
Activity time out of bed (h)	24.63±2.20	29.54±3.07	8.289	<0.001
Drainage tube removal time (d)	2.91±0.33	5.50±0.63	33.193	<0.001
Number of lymphadenectomy (case)	20.09±6.59	19.26±5.53	0.614	0.541
Total hospitalization expenses (yuan)	8425.27±473.71	5457.64±400.98	30.396	<0.001

Table 3. Comparison of VAS postoperative pain scores

	Observation group (n=41)	Control group (n=40)	F	P
After operation			344.893	<0.001
24 hours	2.64±0.52[a]	4.81±0.65		
3 days	1.02±0.27[a,*]	2.05±0.27[*]		
5 days	0.35±0.36[a,*,#]	1.23±0.38[*,#]		
F	1087.347	321.895		
P	<0.001	<0.001		

Note: compared with 24 h after operation, [*]P<0.05; compared with 3 days after operation, [#]P<0.05; compared with control group at the same time after operation, [a]P<0.05. VAS, visual analog scale.

Table 4. Comparison of postoperative complications (n, %)

	Observation group (n=41)	Control group (n=40)	χ^2	P
Lymphatic cyst	1 (2.44%)	3 (7.50%)	1.105	0.293
Intestinal obstruction	0 (0.00%)	1 (2.50%)	1.038	0.308
Urinary retention	3 (7.32%)	3 (7.50%)	0.001	0.975
Hemorrhage	1 (2.44%)	3 (7.50%)	1.105	0.293
Urinary tract infection	1 (2.44%)	2 (5.00%)	2.372	0.542
Incisional infection	1 (2.44%)	3 (7.50%)	1.105	0.293
Total cases	7 (17.07%)	15 (37.50%)	4.270	0.039

Table 5. Comparison of quality of life scores one month after surgery ($\bar{x} \pm sd$)

	Observation group (n=41)	Control group (n=40)	χ^2	P
General health	75.10±3.28	75.19±3.29	0.743	0.902
Mental health	91.50±3.34	90.22±2.85	1.853	0.068
Physical function	90.05±2.81	74.19±3.17	23.843	<0.001
Role physical	76.73±6.46	65.85±6.15	8.331	<0.001
Social function	85.35±5.46	73.35±5.46	9.889	<0.001
Role emotional	79.65±6.22	79.23±6.87	0.289	0.774
Bodily pain	67.18±4.03	62.14±4.28	5.458	<0.001
Vitality	91.50±3.34	90.22±2.85	1.853	0.068

group were lost to follow-up. The remaining participants were successfully followed-up, for 10-61 months in the observation group and 11-60 months in the control group. Results exhibited that the number of cases of recurrence, metastasis, and deaths did not differ statistically between the two groups (P>0.05; **Table 6**).

Discussion

For patients with early endometrial carcinoma (EC), surgery is the mainstream treatment method. Surgery can significantly improve patient prognosis [7]. With the rise of minimally invasive surgical techniques, laparoscopic gynecological surgery has become a new research direction. Previous studies have shown that laparoscopic surgery for EC has the advantages of faster recovery times, shorter hospital stays, and fewer complications. However, using laparoscopic surgery is more difficult in lymph node dissections and extensive hysterectomies, compared with laparotomy procedures. According to some literature, laparoscopic surgery is more likely to cause massive bleeding and may need to be converted to a laparotomy [16-18]. In terms of operation times, there is evidence showing that laparoscopic surgery takes a long time. This is due to the difficulty of operation and the need to establish pneumoperitoneum. Thanks to the advancement of technology and equipment, operation times of laparoscopic surgery have been greatly reduced, which is roughly equivalent to the time of open surgery [19, 20]. The present study found that hospital stays, off-bed activity times, and drainage tube re-

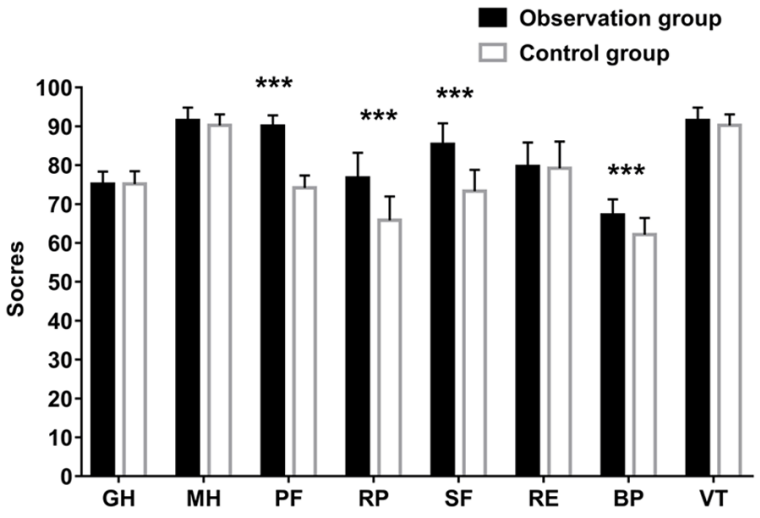

Figure 1. Comparison of quality of life scores between the two groups at one month after surgery. ***P<0.001, compared between the observation group and control group.

Table 6. Comparison of postoperative follow-up prognosis (n, %)

	Observation group (n=39)	Control group (n=37)	χ^2	P
Recurrence	2 (5.13)	2 (5.41)	0.003	0.957
Metastasis	1 (2.56)	2 (5.41)	0.404	0.525
Death	2 (5.13)	3 (8.11)	0.274	0.600
Total case	5 (12.82)	7 (18.92)	0.531	0.466

moval times of the observation group were lower than those of the control group. Results suggest that laparoscopic surgery brought about faster postoperative recovery and shorter hospital stays, in accord with preceding results. Blood loss in the observation group was less than that in the control group, which may be related to the routine use of an ultrasonic scalpel and electric coagulation scalpel in laparoscopic surgery for effective intraoperative hemostasis [21]. Regarding operation times and lymph node dissections, there were no marked differences between the two groups. This suggests that laparoscopic surgery did not increase operation times and that the number of surgical lymph node dissections was equivalent to that of laparotomy procedures. However, the total cost of hospitalization in the observation group was higher than that in the control group, associated with the use of consumables during laparoscopic surgery. This deficiency will be addressed in the future. Some studies have suggested that the cost may decline with the development of technology [22].

Regarding postoperative pain, previous studies have demonstrated that surgical trauma can significantly increase the secretion of many potassium ions. This, in turn, may lead to the generation of sensory peripheral nerve pain [23]. Thus, the greater the surgical trauma, the more obvious the postoperative pain was. In the current study, pain scores of the observation group of laparoscopic surgery were lower than those of the control group of laparotomy surgery at 24 hours, 3 days, and 5 days after surgery, showing statistical differences. Compared with laparotomy procedures, postoperative pain was significantly reduced. This may be due to the small amount of trauma with laparoscopic surgery, as well as the use of an ultrasonic scalpel and electric coagulation scalpel. These help to avoid injuries to adjacent tissues, reducing intraoperative and postoperative bleeding.

Concerning postoperative complications, metastasis, recurrence, and death, incidence rates of complications of laparoscopic surgery were lower than those of laparotomy procedures. For patients with early EC treated by laparotomy, the most common postoperative complications are lymphatic cysts and infections at the incision. These are associated with large incisions, slow healing, and lymphocysts induced by secondary lymph node infections caused by loosening or poor fluid drainage after lymph node ligation. Laparoscopic surgery can completely close the lymphatic vessels due to the improvement of equipment and the use of ultrasonic scalpels combined with instruments. In addition, laparoscopic surgery causes smaller wounds. Thus, incidence of incision infections is lower. In this study, incidence rates of complications in the observation group were lower than those in the con-

trol group, with statistical differences. Present results are in accord with previous studies [24]. Postoperative metastatic recurrence and death are also important indicators in evaluating surgical efficacy. Patients with EC have higher recurrence rates after surgery, resulting in increased mortality [25]. The disease usually recurs within 3 years, while the cure rate of patients who relapse after treatment of EC is merely 10% [26-29]. A recent study in 2018 revealed that the recurrence rate of malignant tumors after laparoscopic surgery was higher and the overall survival rate was lower than that of laparotomy procedures, suggesting that the laparoscopic field of vision was more limited than that of laparotomy, affecting surgical effects. Moreover, it is supported that the high recurrence rate is related to the lack of comprehensive lymph node dissection around the surgical site during laparoscopic surgery. The incomplete removal of residual cancer tissues at the surgical margin leads to the recurrence of cancer [12]. According to *in vitro* studies, it is believed that the cancer cells were injected with CO_2 when the pneumoperitoneum was established by laparoscopic surgery. After the stimulation of CO_2 pneumoperitoneum, the proliferation capacity was enhanced after a short period of inhibition. However, infiltration, adhesion, and migration capacities were weakened. Furthermore, the study also found that CO_2 pneumoperitoneum caused diffuse damage and changes in the whole peritoneum, which may increase the probability of tumor cell implantation [30]. Therefore, controversy remains about the efficacy of laparoscopic surgery in the treatment of EC. Many studies and reviews all support that laparoscopic gynecological tumor surgery outweighs laparotomy, suggesting fewer intraoperative complications, less bleeding, fewer postoperative complications, faster recovery times, and shorter hospital stays. Regarding tumor outcome, the risk of death from recurrence and metastasis is not increased and the survival rate of patients is not decreased. Thus, it is believed that laparoscopic surgery is not inferior to laparotomy [31]. In the current study, patients were followed up for as long as 5 years. No statistical differences were found between the number of patients with recurrence, metastasis, and deaths after laparoscopic surgery and those undergoing laparotomy. Present results suggest that laparoscopic surgery for EC does not increase the incidence of recurrence, metastasis, or mortality. The present study also found significant differences in quality of life-related parameters, such as physical functioning, role-physical, social functioning, and bodily pain, between the two groups one month after surgery. However, there were no significant differences in general health, mental health, vitality, or role emotional. It is possible that the observation group with laparoscopic surgery had less trauma and a more rapid recovery, while the control group with laparotomy had a certain impact on the physiological, psychological and social function of the patients, due to greater trauma and a slower recovery. Postoperative guidance for patients undergoing laparotomy procedures should be strengthened, aiming to eliminate physical and psychological obstacles [32].

There were several limitations to the current study. First, this study was conducted using a single source and a small sample size. Thus, it is necessary to expand the sample size and adopt multi-center samples for future clinical research. Second, for laparoscopic surgery, protection of surgical incision should be strengthened. Specimens after lymph node dissections should be placed in the specimen bag in time to reduce the contact time with the abdominal cavity. Third, the use of a cup-type uterine manipulator should be avoided, as far as possible, during laparoscopic surgery. The reason is that the lifting cup can crush the tumor. This could cause the tumor to break up and increase the spread of tumor cells. Fourth, frequent changes in abdominal pressure (such as frequent entry and exit of trocar) should be avoided during the operation. This will reduce the diffuse injury and changes of the whole peritoneum caused by CO_2 pneumoperitoneum, as well as reduce the probability of tumor cells being implanted into the peritoneum.

In summary, compared with laparotomy procedures, laparoscopic surgery for EC brings faster postoperative recovery times, shorter hospital stays, less postoperative pain, lower incidence of complications, and higher postoperative quality of life, without increasing recurrence and mortality. Thus, it is worthy of promotion and application in clinical practice.

Disclosure of conflict of interest

None.

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