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Original Article

Laparoendoscopic single-site surgery improves the surgical outcome and life quality of patients with endometrial carcinoma

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Abstract: Objective: To evaluate the effect of laparoendoscopic single-site surgery (LESS) on the surgical outcome and quality of life (QoL) of patients with endometrial carcinoma (EC). Methods: A total of 120 patients with EC treated in the Shandong Hospital of Traditional Chinese from August 2019 to June 2021 were selected, of which 70 cases treated with LESS were included in the research group and 50 cases treated with traditional laparoscopic surgery were assigned to the control group. The operation indexes, postoperative recovery, incidence of complications and QoL were compared between the two groups. Results: The data identified that the time to anal exhaust, percentage of postoperative analgesics used, time to ambulation and length of stay in the research group were significantly less than those in the control group. The operation time was significantly longer in the research group compared with the control group. There were no significant differences in intraoperative blood loss, number of lymph nodes dissected, catheter indwelling time and total complication rate between the two groups. The QoL was significantly better in the research group compared with the control group. Conclusions: The above results indicate that LESS can improve the surgical outcome and QoL of patients with EC.

Keywords: Laparoendoscopic single-site surgery, endometrial carcinoma, surgical outcome, quality of life

Introduction

Endometrial carcinoma (EC), the fourth most common cancer in women, accounts for 20%-30% of malignant tumors in female reproductive system, with a predilection for perimenopausal and postmenopausal middle-aged and elderly women [1, 2]. According to epidemiological statistics, there are 61,880 new cases of EC and up to 12,160 associated deaths in the United States [3]. EC can be divided into two histological subtypes, type I (endometrioid) and type II (non-endometrioid), with type I accounting for 80-90% of all cases [4]. The disease is characterized by relative indolence and early concealment, which is usually difficult to diagnose at an early stage [5]. The 5-year survival rate can be approximately 80% for patients with early diagnosis, but those at advanced stages are associated with a less favorable prognosis [6]. Currently, surgery is the main effective treatment option for EC [7]. Therefore, further improving the surgical outcome of patients helps to enhance their quality of life (QoL).

Laparoscopic surgery (LS) is one of the most commonly used gynecological surgery techniques [8], while laparoendoscopic single-site surgery (LESS) is a procedure evolved from LS. Compared with traditional LS, LESS enters the pelvic cavity of patients through a single site, with the advantages of less trauma, milder pain and faster recovery [9, 10]. This procedure usually uses the natural scar of the umbilical cord for incision intervention, leaving no other scar except the abdominal wall of the umbilical region, which can meet the beauty needs of women [11, 12]. At present, this surgical technique has been extensively applied to various medical settings such as colon cancer, severe obesity, and tubal pregnancy, which has shown

to improve the surgical outcomes of patients to a certain extent with a favorable safety profile [13-15]. The innovation of this study lies in the analysis and comparison of the clinical effects of LESS and traditional LS in the treatment of EC patients from the dimensions of surgical indicators, postoperative recovery, incidence of complications and QoL score, providing new clinical evidence for the treatment of EC.

Materials and methods

General data

This is a retrospective study, which has been approved by the Ethics Committee of the Shandong Hospital of Traditional Chinese. All the enrolled participants were informed of the purpose of this research and provided informed consent. 120 patients with type I EC admitted consecutively to our hospital between August 2019 and June 2021 were included in this study. Of them, 70 cases, with an average age of (65.51±10.55) years old, were treated by LESS and assigned to the research group, while the rest 50 cases (average age: 64.63±10.70 years old) treated by traditional LS were set as the control group. The patients were included according to following inclusion criteria: Diagnosis of primary EC by pathology; No history of preoperative chemoradiotherapy; Normal cognitive and communication skills; No other internal and surgical complications; Complete medical records. The patients were included according to following exclusion criteria: Malignant tumor(s) or infectious diseases; Severe abdominal adhesion; Intraoperative conversion to laparotomy; Vital organ failure; History of ovarian cancer and/or cervical cancer.

Treatment methods

One to two days before surgery, povidone-iodine disinfectant was used to scrub the vagina of patients in both groups. The night before the operation, a mixture of 250 mL mannitol and 500 mL normal saline was administered orally and the umbilical region was cleaned. Preoperative fasting (8 h) and water deprivation (4 h) were performed in both groups. During the operation, the patient was placed in the lithotomy position with head down and foot elevated and was given general anesthesia.

LESS was performed in the research group. A small incision of 1.5-3.0 cm was longitudinally cut into the navel of the patient. The medical rubber gloves were rolled into a ring composed of suction tubes and flipped to cover tightly. The three middle fingertips of the gloves were cut and placed into Trocar for fixation with silk thread. After the establishment of pneumoperitoneum (CO2 gas pressure: 11-14 mmHg, 1 mmHg = 0.133 kPa), surgical instruments were placed through the operating channel. After that, the ascites or pelvic flushing fluid was collected for exfoliative cytological examination. The pelvic and abdominal cavity were thoroughly probed, and suspicious lesions were sampled for pathological examination. After excision of the whole uterus and double appendages through routine procedures, the uterus was dissected to determine the size of the lesion and the depth of invasion, followed by rapid frozen for pathological examination. Finally, pelvic lymph node dissection was performed, and routine pathological examinations were carried out according to the anatomical order (common iliac, external iliac, internal iliac, obturator foramen and inguinales profundi).

Patients in the control group received traditional LS. A longitudinal incision of about 10 mm was made at the lower edge of the umbilical foramen. Pneumoperitoneum was established with 10 mm Trocar puncture and laparoscopy. Then, two 5 mm Trocar were placed in the patient's left lower abdomen, and a 5 mm Trocar was planted in the McBurney's point of the right lower abdomen, followed by the placement of surgical instruments. The following steps were the same as those of the research group after the implantation of surgical instruments.

Outcome measures

Operation indicators: The intraoperative blood loss (IBL), operation time (OT), time to anal exhaustion, and number of lymph nodes (LNs) dissected were recorded and compared between the two groups.

Postoperative recovery: The postoperative recovery indicators, including percentage of postoperative analgesics used, ambulation time, length of stay (LOS), and catheter indwelling time were investigated. To relieve pain, patients were given nonsteroidal anti-inflammatory drugs such as Ketorolac Tromethamine Capsules (Shandong NewTime Pharmaceutical Co., Ltd., H20052633), 10 mg each time, 1-4 times a day.

Table 1. Baseline data of patients in the two groups [n (%), mean ± SD]

Variables	n	Control group (n = 50)	Research group (n = 70)	χ^2/t	P
Age (years)				1.102	0.294
<65	62	23 (46.00)	39 (55.71)		
≥65	58	27 (54.00)	31 (44.29)		
Average age (years)	120	64.63±10.70	65.51±10.55	0.448	0.655
FIGO staging				1.714	0.190
I	80	30 (60.00)	50 (71.43)		
II	40	20 (40.00)	20 (28.57)		
Differentiation degree				0.145	0.930
Well differentiated	82	35 (70.00)	47 (67.14)		
Moderately differentiated	26	10 (20.00)	16 (22.86)		
Poorly differentiated	12	5 (10.00)	7 (10.00)		
Infiltration degree				1.877	0.171
Superficial myometrial infiltration	83	38 (76.00)	45 (64.29)		
Deep myometrial infiltration	37	12 (24.00)	25 (35.71)		
Education level				0.741	0.390
Below high school	75	29 (58.00)	46 (65.71)		
High school or above	45	21 (42.00)	24 (34.29)		
Residence				0.339	0.560
Urban	78	34 (68.00)	44 (62.86)		
Rural	42	16 (32.00)	26 (37.14)		
Marital status				0.179	0.672
Single	41	16 (32.00)	25 (35.71)		
Married	79	34 (68.00)	45 (64.29)		

Incidence of complications: We mainly investigated the incidence of adverse events such as organ injury, incisional hernia and poor wound healing, as well as postoperative morbidity rate of patients in the two groups.

QoL: The QoL of patients three months after treatment was evaluated using the Functional Assessment of Cancer Therapy-General (FACT-G) [16]. The investigation domains include physical well-being (PWB; score range 0-28), social well-being (SWB; score range 0-28), emotional well-being (EWB; score range 0-24), and functional well-being (FWB; score range 0-28), with a score of 0-108. The score is proportional to the patient's QoL.

Statistical analysis

SPSS 22.0 was used for statistical analysis. Counting data were recorded in the form of number of cases/percentages (n/%), and the difference between groups were analyzed by the Chi-square test. Measurement data, expressed as Mean ± SD, were compared between groups by the independent samples t-test. Image rendering of the collected data was performed by GraphPad Prism 6. The significance level was set at $P<0.05$.

Results

Baseline data of patients

There were no significant differences in baseline data such as age, average age, Federation International of Gynecology and Obstetrics (FIGO) staging, differentiation degree, infiltration degree, educational level, residence and marital status between the two groups ($P>0.05$, **Table 1**).

Analysis of surgical indexes of LESS

We analyzed the surgical indicators of the two groups of patients to assess the surgical advantage of the two treatments. Compared with the control group treated by traditional LS, the OT of the research group treated by LESS was longer, while the time to anal exhaustion was shorter, with statistical significance (all $P<0.05$); However, no significant difference was ob-

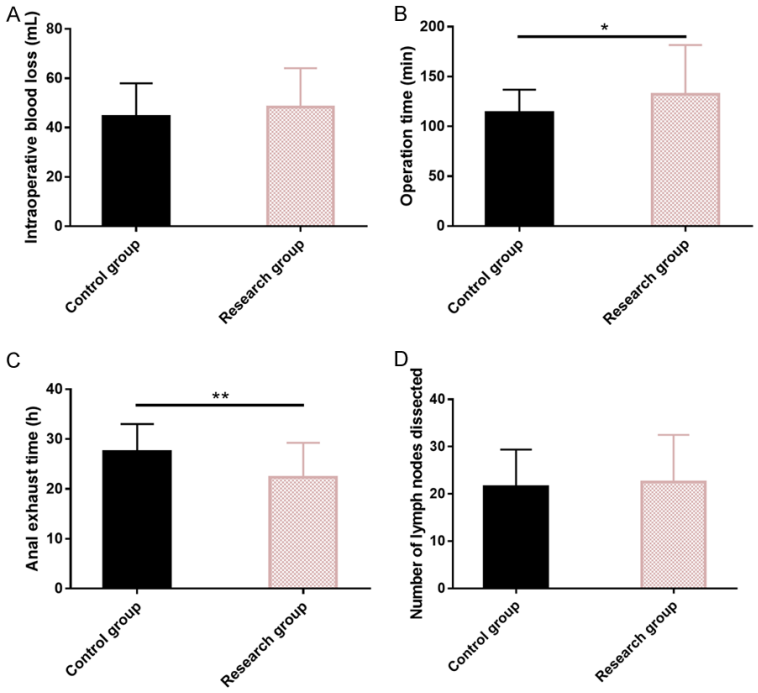

Figure 1. Analysis of surgical indexes of two groups. A. There was no significant difference in intraoperative blood loss between patients undergoing laparoendoscopic single-site surgery and those undergoing conventional laparoscopic surgery. B. The operation time of patients undergoing laparoendoscopic single-site surgery was significantly higher compared with those undergoing traditional laparoscopic surgery. C. The anal exhaust time of patients undergoing laparoendoscopic single-site surgery was significantly lower compared with those undergoing traditional laparoscopic surgery. D. There was no significant difference in the number of lymph nodes dissected between patients undergoing laparoendoscopic single-site surgery and those treated by traditional laparoscopic surgery. Note: ** indicates P<0.01, and * indicates P<0.05.

served in IBL and the number of LNs dissected between the two groups (P>0.05, **Figure 1**).

Analysis of patients' recovery after LESS

We assessed the postoperative recovery of both groups to determine the effect of the two treatment strategies on patients' outcomes. It was found that the percentage of postoperative analgesics used, ambulation time and LOS were significantly less in the research group compared with the control group (P<0.05); However, there was no significant difference in indwelling catheter time between the two groups (P>0.05, **Figure 2**).

Incidence of complications in patients undergoing LESS

We examined the incidence of complications in both groups to assess the impact of the two surgical modalities on patient safety. The results showed no significant difference in organ injury, incisional hernia, poor wound healing and postoperative morbidity between the two groups; In addition, the two groups of patients mainly experienced adverse events such as poor wound healing and postoperative morbidity (**Table 2**).

Analysis of QoL of patients undergoing LESS

We evaluated patients' postoperative QoL in both groups using the FACT-G scale to compare the impact of the two treatments on the QoL of the patients. The data showed that the FACT-G score in the research group was higher than that in the control group, with statistical significance (P<0.05, **Figure 3**).

Discussion

EC is a female malignant tumor that originates from the endometrial epithelium and is associated with localized low-dose estrogen stimulation [17]. The treatment strategy of EC mainly depends on the histological features of patients and the extent of tumor invasion. The current treatment methods are still controversial in improving the overall survival of patients, with no consensus about the best treatment method [18]. This study mainly analyzed the clinical effects of LESS and traditional LS in the treatment of patients with EC, aiming to improve the surgical outcome of patients.

Although surgery is the main treatment option for EC, it is only effective for the majority of patients at early-stage [19]. LS can not only reduce the invasion, but also ensure a certain degree of safety, in addition to their surgical and cosmetic effects [20]. LESS is the main innovative technology of ultra-minimally invasive surgery recently. Although the number of ports and the size of instruments are small, its surgical effect, curative effect and safety are

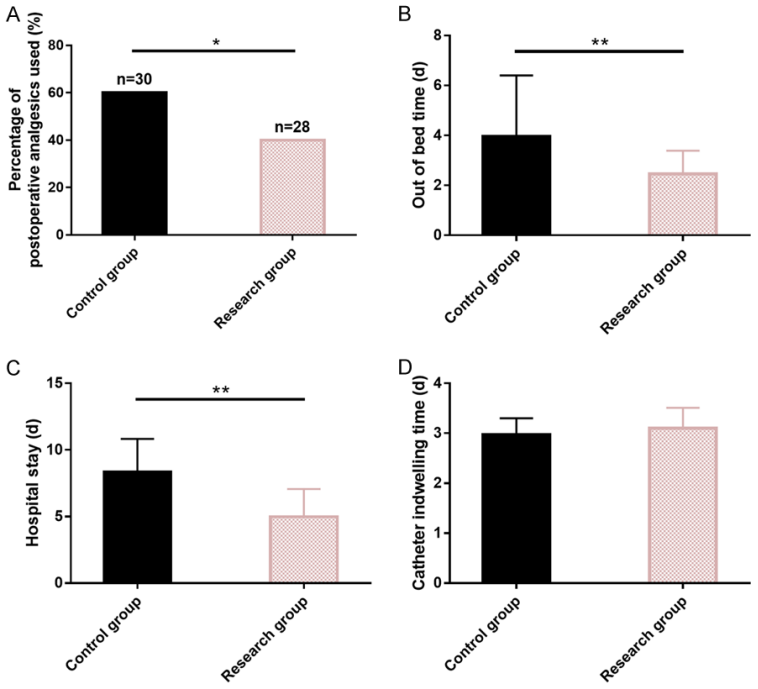

Figure 2. Analysis of patients' recovery after surgery of two groups. A. The percentage of postoperative analgesics used in patients undergoing laparoendoscopic single-site surgery was significantly lower compared with those undergoing traditional laparoscopic surgery. B. The ambulation time of patients undergoing laparoendoscopic single-site surgery was significantly lower compared with those undergoing traditional laparoscopic surgery. C. The hospital stay of patients undergoing laparoendoscopic single-site surgery was significantly lower compared with those undergoing traditional laparoscopic surgery. D. There was no significant difference in catheter indwelling time between patients undergoing laparoendoscopic single-site surgery and those receiving traditional laparoscopic surgery. Note: ** indicates P<0.01, and * indicates P<0.05.

Table 2. Analysis of patients' recovery after laparoendoscopic single-site surgery [n (%)]

Categories	Control group (n = 50)	Research group (n = 70)	χ^2 value	*P* value
Organ injury	0 (0.00)	0 (0.00)	-	-
Incisional hernia	0 (0.00)	0 (0.00)	-	-
Poor wound healing	3 (6.00)	3 (4.29)	-	-
Postoperative morbidity	5 (10.00)	3 (4.29)	-	-
Total	8 (16.00)	6 (8.57)	1.562	0.211

not affected [21]. In this study, we found that although patients in the research group treated with LESS had a significantly longer OT, the time to anal exhaustion was significantly shorter, with no difference in IBL and number of LNs dissected compared with the control group treated by LS. The long OT of LESS is related to the time-consuming self-made surgical access channel and certain visual field limitation of single-site operation [22]. During the operation, both the instruments and the light source pass through a single aperture, which may interfere with each other and affect the stability of the vision, thus affecting the doctor's judgment on the location and distance of lesions and ultimately reducing surgical accuracy and even increasing surgical difficulty [23]. Due to the aforementioned reasons, the IBL and the number of LNs dissected in patients undergoing LESS were not significantly improved, showing no significant difference from traditional LS. In terms of postoperative recovery, LESS can significantly reduce the percentage of postoperative analgesics used, the time to ambulation and the LOS, but has no significant effect on catheter indwelling time. As to safety, the two surgical procedures showed no significant difference in the incidence of organ injury, incisional hernia, poor wound healing and postoperative morbidity. Furthermore, we assessed the QoL of patients under the two different procedures by the FACF-G scale system. The data showed that LESS can significantly improve the FACT-G score of patients and enhance their postoperative QoL. As a minimally invasive operation, LESS involves incision intervention at the edge of the patient's umbilicus only, with basically invisible abdominal scar after healing, which is more acceptable for the majority of female patients both physically and psychologically [24]. Besides, the umbilicus, formed by the healing of the umbilical cord segment after birth, has no distribution of nerves and blood vessels and no coverage of muscle layer. Therefore, the muscle layer injury can be avoided during the surgical incision process, and the damage of porous puncture to the abdominal

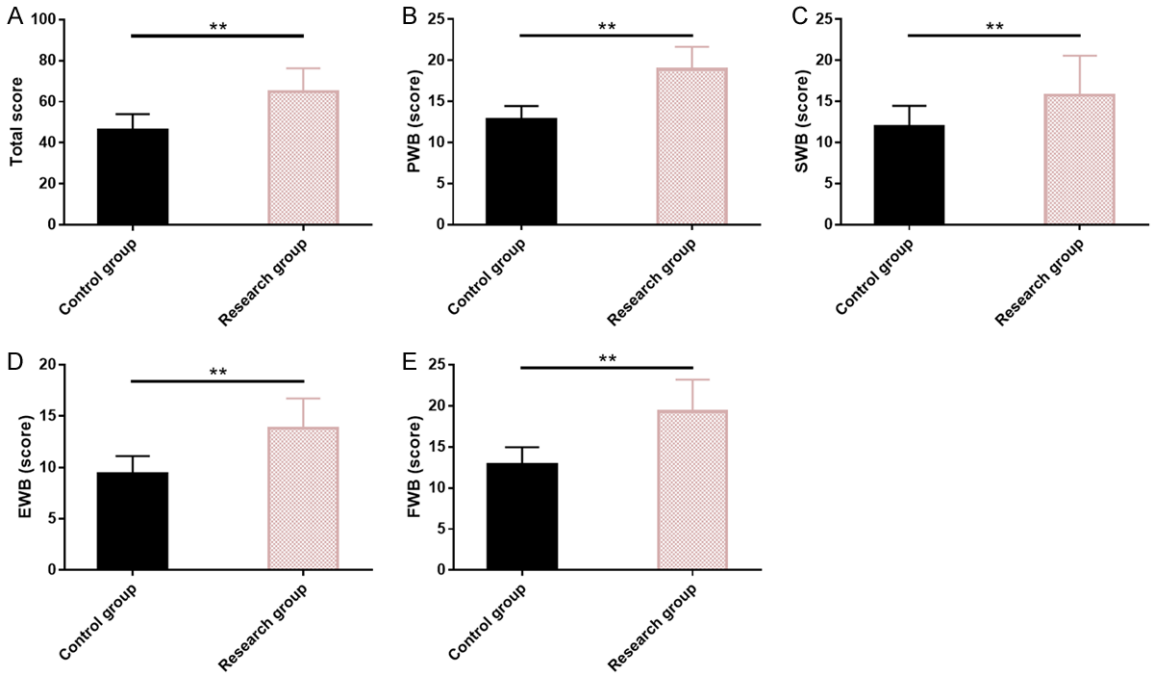

Figure 3. Analysis of quality of life of patients of two groups. A. The total score of the FACT-G scale was significantly higher in patients undergoing laparoendoscopic single-site surgery. B. The score of physical well-being (PWB) of the FACT-G scale was significantly higher in patients undergoing laparoendoscopic single-site surgery. C. The score of social well-being (SWB) of the FACT-G scale was significantly higher in patients undergoing laparoendoscopic single-site surgery. D. The score of emotional well-being (EWB) of the FACT-G scale was significantly higher in patients undergoing laparoendoscopic single-site surgery. E. The score of functional well-being (FWB) of the FACT-G scale was significantly higher in patients undergoing laparoendoscopic single-site surgery. ** indicates $P<0.01$.

muscle layer and organs can be reduced, thus reducing adverse events such as pain stimulation, organ injury, and incisional hernia, and further improving the QoL of patients [25]. It also has a beneficial effect on patients' postoperative recovery, which is manifested by significant reductions in time to anal exhaustion and ambulation, and LOS of patients.

Although this study confirmed that LESS can improve the surgical outcome, promote postoperative recovery, ensure safety and improve the QoL of patients with EC, there is still room for improvement. First, we can increase the comparative analysis of patients' long-term efficacy and aesthetic satisfaction and supplement the clinical effect of LESS in EC in detail. Second, the clinical sample size can be expanded to increase the accuracy and generality of the test results. We will gradually improve this research from the above perspectives in the future.

All in all, LESS can improve the surgical outcome and QoL of patients with EC, with reliability, effectiveness and safety, which is a better alternative worth recommending to patients with early-stage type I EC compared with traditional LS.

Disclosure of conflict of interest

None.

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