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Original Article

Therapeutic effect of transumbilical single-port laparoscopic surgery versus triple-port laparoscopic surgery for ovarian cyst

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Abstract: Objective: To compare the therapeutic effect of transumbilical single-port laparoscopic surgery (TSPLS) and three-port laparoscopic surgery (TPLS) on ovarian cyst. Methods: Clinical data of 60 patients with ovarian cyst admitted to our hospital were respectively analyzed. The patients were divided into a TPLS group (n=30) and a TSPLS group (n=30) according to surgical methods. Clinical indicators, visual analogue scale (VAS), self-rating anxiety scale (SAS), self-rating depression scale (SDS) and satisfaction regarding aesthetic appearance of the incision were compared between the two groups. Results: The operation time, time to anal exhaust and hospital stay in the TSPLS group were shorter than those in the TPLS group, and lower postoperative VAS, SAS and SDS scores and higher quality-of-life score were seen in the TSPLS group (all $P<0.05$). The incidence of postoperative complications in the TSPLS group was lower than that in the TPLS group ($P<0.05$). The overall satisfaction in the TSPLS group was significantly higher than that in the TPLS group (93.33% vs. 66.67%; $\chi^2=51.526$, $P=0.001$). Conclusion: Compared with TPLS, TSPLS has better therapeutic effect on ovarian cyst. TSPLS can improve the clinical indications of patients with higher safety.

Keywords: Transumbilical single-port laparoscopic surgery, three-port laparoscopic surgery, ovarian cyst, therapeutic effect

Introduction

Ovarian cyst is a common gynecological disease. It has been reported that the incidence of ovarian cyst in women is 5% to 17%, and abdominal mass and pain are typical symptoms of ovarian cyst patients [1]. Clinicians have also been exploring the way to achieve the optimal surgical results for patients within the range of surgical indications. Then total hysterectomy has undergone a revolution from traditional open surgery to laparoscopic surgery. The advent of laparoscopy has been a boon for women. Compared with open surgery, laparoscopic surgery has fewer scars and significantly improves cosmetic outcome. With the continuous development of minimally invasive technology in recent years, it is widely used in the treatment of obstetrics and gynecology. Surgeons pursue to achieve similar therapeutic effect and safety with fewer traumas; Therefore, minimally invasive surgery has gradually become a development direction of surgery [2]. The traditional operation method for ovarian cyst is three-port laparoscopic surgery (TPLS), which requires multiple puncture holes in the umbilical hole, McBurney's point and anti-McBurney's point, resulting in more intraoperative blood loss, longer hospital stay and greater damage to patients [1]. Transumbilical single-port laparoscopic surgery (TSPLS) selects a laparoscope with a flexible front end and a smaller diameter, and it can obtain the same surgical field as the conventional laparoscope, which is more suitable for the surgical operation. In addition, the laparoscope selected for TSPLS can obtain better field light and clearer field image [3, 4]. In addition, the instruments used in TSPLS are more flexible, which is conducive to the anatomical process and accuracy [5]. There are numerous domestic and foreign researches on the application of TSPLS and

porous laparoscopic surgery, but most of them focus on the feasibility of bilateral ovarian chocolate cystectomy in panhysterectomy. Whether transumbilical single-port laparoscopy is really superior to traditional laparoscopy remains to be determined. In this study, we aimed to explore and analyze the therapeutic effect of TSPLS and TPLS in the treatment of ovarian cyst.

Materials and methods

General information

Clinical data of 60 patients with ovarian cyst admitted to our hospital from January 2020 to January 2021 were retrospectively analyzed. The patients were divided into TPLS group (n=30, treated with TPLS) and TSPLS group (n=30, treated with TSPLS) according to the surgical methods. Clinical indicators, postoperative complications, visual analogue scale (VAS), self-rating anxiety scale (SAS), self-rating depression scale (SDS) and satisfaction regarding aesthetic appearance of the incision were compared between the two groups. This study was approved by the Ethics Committee of the hospital (No. 2) and informed consent was signed by the patients or their families.

Diagnostic criteria: The diagnostic criteria of ovarian cyst were formulated by referring to the inflammatory ovarian cyst in the eighth edition of the national medical colleges and universities textbooks *Obstetrics and Gynecology* and *Practical Obstetrics and Gynecology*. (1) Medical history: Patients were with pelvic inflammation, salpingitis or infertility. (2) Age of onset: It could occur at any age, mostly in women of childbearing age, between 20 and 50 years old. (3) Clinical symptoms: Some patients could be asymptomatic. Some patients had lower abdominal pain, lumbar and abdominal pain, increased leucorrhea, menstrual disorder, menstrual breast pain and other manifestations. (4) Gynecological examination: Uterine activity was limited. Ovarian mass and tenderness were touched near the uterus, and mostly are unilateral masses. The mass had smooth surface and varying size. (5) Auxiliary B-ultrasound examination: Unilateral or bilateral ovaries showed cystic enlargement, regular shape, clear and neat boundary, anechoic dark area in the sac, and visible separation. One to two days after menstruation, B ultrasound was performed to rule out physiological cysts. (6) Tumor markers: Serum CA125 and CA199 were in normal range.

Inclusion criteria: Patients who aged between 18 and 60 years old; patients without a history of pelvic inflammatory disease, endometriosis, or complicated pelvic and abdominal surgery; patients with indications for laparoscopic surgery; patients who volunteered to participate in this study.

Exclusion criteria: Patients with hypertension or diabetes and whose blood pressure and blood glucose levels were not effectively controlled; patients who suffered from serious organic diseases; patients with contraindications to laparoscopic surgery; patients with cognitive impairment or mental illness.

Methods

TPLS was performed in the TPLS group of patients. The patients were assisted to lie on their back and a 1.0 cm incision was made at the lower edge of the navel after anesthesia. A conventional laparoscope was then placed in the abdominal cavity, with a 1.0 cm incision made at the McBurney's point, and a 1.0 cm puncture trocar was placed. A 0.5 cm incision was made at the intersection of 2.0 cm above the pubic symphysis and 2.0 cm at the right midline, and a 0.5 cm puncture trocar was then inserted. A pneumoperitoneum of 12 to 14 mm Hg (1 mm Hg =0.133 kPa) was then performed. Laparoscopic exploration of the pelvic and abdominal cavities was conducted, and curved separating forceps were inserted through the other two puncture tubes to remove the ovarian cysts. After the cyst was removed, surgical tools were removed and the incision was closed [6, 7].

TSPLS was carried out in the TSPLS group of patients. The uterine manipulator was applied at the position of stone removal. After anesthesia, an arc incision (about 2.0-4.0 cm) was made at the upper part of the navel chakra. The skin was cut, and the uterine manipulator was inserted into the abdominal cavity. Then, a single-hole multi-channel cannula was inserted into the abdominal cavity, and the cannula was fixed with traction belt and contraction sleeve. Similarly, a 12-14 mm Hg pneumoperitoneum was performed. Then the laparoscopic

probe was inserted into the 0.5 cm channel in the trocar to explore the pelvic cavity and abdominal cavity. After that, the curved separation forceps were inserted into the other two trocar channels to remove the ovarian cyst. After the removal was completed, the surgical instrument was removed and the incision was closed [8, 9].

Outcome measures

Clinical indicators, visual analogue scale (VAS), self-rating anxiety scale (SAS), self-rating depression scale (SDS) and surgical incision satisfaction were compared between the two groups.

(1) SAS: One day before treatment and on the day after treatment, patients were asked to fill the SAS questionnaire. The contents selected by the testers were converted into scores and then the scores were added to get rough scores. The rough scores were multiplied by 1.25 to get standard scores for SAS status grading. The lower score indicates less anxiety tendency. The cut-off value of SAS standard score was 50 points, and anxiety score ≥50 points was diagnosed as positive [10, 11].

(2) SDS: SDS was compiled by Chung WK in 1965. The scale contains 20 items reflecting subjective feelings of depression, and each item is divided into four grades according to the frequency of symptom, of which 10 items are positive scores and the rest are reverse scores [12].

(3) VAS: VAS was used to evaluate the pain level of patients on the day after surgery and 3 days after surgery. 0 point represents no pain, and 10 points indicate severe pain. Higher score shows more obvious pain level [7].

(4) Satisfaction: A self-made questionnaire (10 points in total) was used to investigate the patients' satisfaction with the aesthetic appearance of the incision. The score over 7 indicates satisfied, 3-7 indicates basically satisfied, and equal or below 3 indicates dissatisfied. Satisfaction rate = Number of cases with (satisfied + basically satisfied)/total number of cases *100%.

(5) Complication: The incidence of complications such as upper limb edema, subcutaneous effusion, infection, limited upper limb movement and skin flap necrosis during postoperative hospitalization was recorded. Incidence of complications = number of cases with complications/total number of cases *100%. Generally, upper limb edema and subcutaneous effusion would disappear 2-3 days later, which don't need to be treated. Incision infection and skin flap necrosis: The laparoscopic surgery incision was small, which could be fixed with band-aid. More attention should be paid to aseptic operation in the dressing changes. Whether the incision is bleeding and oozing, and whether there is allergy should be concerned. The patients were required not to scratch the wound to avoid infection.

(6) The quality of life (QOL) of patients was recorded before and after the treatment, including psychological function, physical function and material life. The total score is 100 points. Higher score takes higher quality of life [13].

Statistical analysis

All data were analyzed by SPSS 22.0 statistical software. The measurement data in accordance with normal distribution were represented as mean ± standard deviation ($\bar{x}$±sd); independent samples t-test was used for intergroup comparison, and paired samples t-test was used for intra-group comparison. Count data were expressed as the number of cases/percentage (n/%) and tested by chi-square test. $P<0.05$ was regarded a statistically significant difference.

Results

Comparison of general information

In order to ensure the reliability of this study, a comparative analysis was made on the general clinical data of patients after obtaining the consent of the patients and their families. It was found that there was no significant difference between the two groups (all $P>0.05$); therefore, the two groups were comparable. The details are shown in **Table 1**.

Comparisons of VAS, SAS and SDS scores

Before surgery, there was no significant difference in the VAS score between TSPLS group and TPLS group (5.06±0.99 vs. 5.07±0.92; $P<0.05$). After surgery, the VAS score of TSPLS group was significantly lower than that of TPLS

Table 1. Comparison of general information ($\bar{x}$±sd)

Item	TPLS group (n=30)	TSPLS group (n=30)	t/χ^2	P
Age (year old)	65.17±10.62	66.84±9.68	0.864	0.596
Weight (kg)	68.4±8.3	70.3±9.1	1.325	0.892
Time of operation (min)	138.22±16.37	134.93±13.25	0.621	0.674
Anesthesia time (min)	148.68±13.09	151.37±14.83	1.735	0.846
BMI (kg/m^2)	20.93±3.24	21.26±3.87	1.527	0.663
Way of pain relief (n)			0.381	0.674
Drug remedial analgesia	25	22		
Epidural analgesic tube	5	8		
Preoperative complications (n)			0.918	0.506
Yes	2	1		
No	28	29		

Note: BMI: Body Mass Index; TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

Table 2. Comparison of VAS score ($\bar{x}$±sd)

Group	Case	Before surgery (score)	After surgery (score)	t	P
TSPLS group	30	5.06±0.99	1.25±0.21	18.824	0.000
TPLS group	30	5.07±0.92	2.99±0.34	10.603	0.000
t		0.0370	21.7704	--	--
P		0.971	0.000	--	--

Note: TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery; VAS: visual analogue scale.

Table 3. Comparisons of SAS and SDS scores ($\bar{x}$±sd)

Group	SAS (score)		SDS (score)	
	Before surgery	After surgery	Before surgery	After surgery
TSPLS group (n=30)	65.36±11.64	47.22±7.36*	61.36±10.69	45.36±8.05*
TPLS group (n=30)	66.21±11.93	59.63±8.44*	61.14±10.97	52.47±9.34*
t	0.334	7.267	0.094	3.781
P	0.739	0.000	0.925	0.000

Note: Compared with before surgery, *P<0.05. SAS: self-rating anxiety scale; SDS: self-rating depression scale; TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

Table 4. Comparison of complications (n, %)

Group	Skin flap necrosis	Upper limb edema	Subcutaneous effusion	Total incidence
TSPLS group (n=30)	1 (3.33%)	2 (6.67%)	0 (0.00%)	3 (10.00%)
TPLS group (n=30)	2 (6.67%)	5 (16.67%)	2 (6.67%)	9 (30.01%)
χ^2	5.623	3.677	5.322	8.091
P	0.004	0.027	0.006	0.004

Note: TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

group (1.25±0.21 vs. 2.99±0.34; P<0.001). The VAS scores after surgery in both groups were significantly lower than those before surgery (P<0.001). See **Table 2**. Similar trends were found in the SAS and SDS scores. See **Table 3**.

Comparison of complications

The incidence of complications in the TSPLS group (3 cases, 10.00%) was significantly lower than that in the TPLS group (9 cases, 30.01%; P<0.05). See **Table 4**.

Table 5. Comparison of quality-of-QOL scores ($\bar{x}$±sd)

Group	Psychological function		Physical function		Material life	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
TSPLS group (n=30)	44.8±4.11	59.9±6.41*	43.8±4.06	59.3±7.24*	45.8±4.27	60.8±8.05*
TPLS group (n=30)	45.2±4.23	46.8±5.64*	42.4±4.58	46.9±5.47*	45.7±5.39	52.8±4.44*
t	0.445	0.061	1.500	8.961	0.095	4.942
P	0.658	0.000	0.137	0.000	0.924	0.000

Note: Compared with before treatment, *P<0.05. TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

Table 6. Comparison of clinical indicator ($\bar{x}$±sd)

Group	Amount of intraoperative blood loss (ml)	Operation time (min)	Time to postoperative anal exhaust (h)	Hospital stay (d)
TSPLS group (n=30)	23.05±12.10	58.45±6.39*	2.37±1.33*	2.54±1.31*
TPLS group (n=30)	26.17±13.25	62.58±6.74	5.86±1.93	4.41±2.49
t	0.951	2.443	8.160	3.641
P	0.352	0.021	0.000	0.000

Note: Compared with before treatment, *P<0.05. TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

Table 7. Comparison of satisfaction

Group	Satisfied	Basically satisfied	Dissatisfied	Total satisfaction
TSPLS group (n=30)	18 (60.00%)	10 (33.33%)	2 (6.67%)	28 (93.33%)
TPLS group (n=30)	12 (40.00%)	8 (26.67%)	10 (33.33%)	20 (66.67%)
χ^2				51.526
P				0.001

Note: TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

Comparison of quality-of-QOL scores

Before surgery, there was no statistically significant difference in the QOL scores between the two groups (P>0.05). After surgery, the QOL scores in in both groups were significantly higher than those before surgery (P<0.05), and the TSPLS group were better than those in the TPLS group (P<0.001). See **Table 5**.

Comparison of clinical indicator

The operation time, time to anal exhaust and hospital stay of TSPLS group were shorter than those of TPLS group (all P<0.05). There was no significant difference in the amount of intraoperative blood loss between both group (P>0.05). See **Table 6**.

Comparison of satisfaction

The satisfaction regarding aesthetic appearance of the incision in the TSPLS group was significantly higher than that in the TPLS group (93.33% vs. 66.67%; P<0.05). See **Table 7** and **Figure 1**.

Discussion

At present, there were an increasing number of patients with ovarian cyst in China, who need surgical treatment. However, there are some deficiencies in current clinical surgical methods [14]. In recent years, minimally invasive surgery has been gradually promoted in clinical practice. Compared with open surgery for ovarian cyst patients, TPLS can reduce surgical trauma and shorten postoperative recovery time. On the basis of TPLS, a less invasive surgical technique-TSPLS has emerged [15, 16]. When TSPLS is performed on patients with gynecological diseases, only a small incision is made in the umbilical region without scars leaving in the abdominal wall. This may effectively satisfy women's devotion for physi-

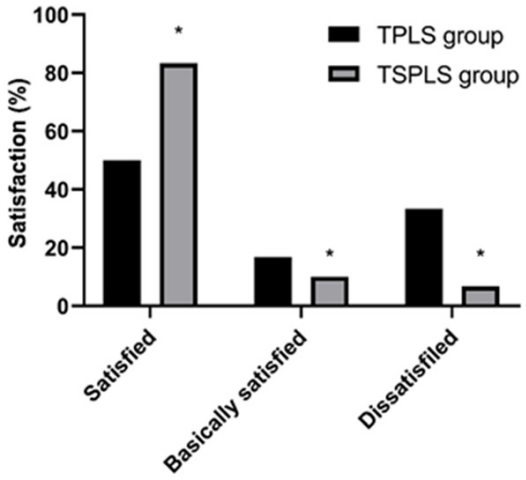

Figure 1. Comparison of satisfaction between the two groups. Compared with the TPLS group, *P<0.05. TSPLS: transumbilical single-port laparoscopic surgery; TPLS: three-port laparoscopic surgery.

cal beauty. In addition, patients suffer less pain after surgery and usually do not need analgesics, so it has been valued by numerous medical staff and widely accepted by patients as well [17].

Clinically, ovarian cyst has become a very common disease. A large number of clinical trials and survey data show that most patients have poor understanding and mastery of the rehabilitation knowledge of this disease, leading to negative psychological emotions in many patients. Studies have found that in the process of surgery, TSPLS can guarantee patients' increasingly active cooperation with treatment and promote patients' early recovery [18, 19]. In this study, the SAS and SDS scores in the TSPLS group of patients were obviously better than those in the TPLS group of patients. Traditional TPLS needs to puncture multiple incisions in the patient's abdomen, resulting in more postoperative scars and a longer recovery period; however, TSPLS has only one incision, which can reduce the degree of abdominal wall injury, and reduce the amount of intraoperative anesthetic drugs, so as to reduce the anxiety of patients. Previous studies have indicated that after TSPLS, the patients can recover more quickly due to its fewer traumas and less damage to the patient, thereby improving the prognosis and quality of life of the patients [20, 21]. This study found that the application of TSPLS could significantly improve the quality of life of patients. When TSPLS is performed on patients with gynecological diseases, only a small incision is made in patients' umbilical region, and the abdominal wall will not leave scars. A lot of clinical practices show that many patients who receive ovarian cyst surgery usually have pain. This study found that the postoperative pain of the patients in the TSPLS group was significantly lower than that of the patients in the TPLS group, indicating that the postoperative vital signs of the patients after TSPLS could be kept stable significantly. Compared with the traditional TPLS, TSPLS has fewer channels and smaller lens openings, which not only reduces the occurrence of infection and systemic infection, but also reduces the potential risk of complications caused by incisions, thereby reducing the postoperative pain of patients and helping postoperative rehabilitation [22]. In this study, patients in the TSPLS group showed significant improvement in the incidence of complications. Studies have proved that TSPLS also has cosmetic benefits; it can effectively cover the navel skin with a 2.0-4.0 cm of incision, so it can bring satisfactory cosmetic results to patients, which can relieve the pressure caused by umbilical cord folds [23, 24]. Therefore, TSPLS is called "scar free surgery" and it can improve patient satisfaction. In this study, patient satisfaction in the TSPLS group was significantly higher than that in the TPLS group.

This study also has some limitations. In this study, only patients in our hospital were selected for the questionnaire survey, with a limited survey scope. Moreover, this study was a small sample survey, which needs to be expaned in future studies.

In conclusion, compared with TPLS, TSPLS has better therapeutic effects on ovarian cyst, with improved clinical indications and higher safety.

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Disclosure of conflict of interest

None.

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