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Total Hysterectomy: Mini-Laparoscopy *vs*. Single-Port Trans-Umbilical Laparoscopy?

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Abstract

To retrospectively analyze the clinical data of 147 patients underwent laparoscopic total hysterectomies for benign uterine diseases in at our Hospital between January 2017 and May 2018. 78 patients treated with MLS and 69 patients received transumbilical LESS hysterectomy. The operative time, intra-operative blood loss, the time-to-first post-operative flatus, post-operative pain, post-operative hospital stay, and incidence of surgical site infections, incisional hernias, post-operative hospital stay, Body Image Questionnaire (BIQ, including the Body Image Scale [BIS] and Cosmetic Scale [CS]), and the Scar Cosmesis Assessment and Rating (SCAR) score were compared between the patients in the two groups. There were no significant differences between MLS and LESS groups with respect to operative time, intra-operative blood loss, uterine weight, and post-operative hospital stay. No delayed wound healing/infections or incisional hernias occurred in either group. MLS appears to be associated with less post-operative pain and improved cosmesis. With respect to total hysterectomies, MLS and single port trans-umbilical laparoscopy are similarly safe and effective; however, MLS appears to be associated with less post-operative pain and improved cosmesis. MLS is easier for laparoscopic surgeons to master than LESS and does not require a learning curve.

Keywords: Mini-laparoscopy; Single-port Laparoscopy; Total Hysterectomy

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Introduction

A total hysterectomy is one of the most common gynecologic operations. How to choose the surgical approach, such as transabdominal, transvaginal, or laparoscopic, depends on the condition of each patient. Since Reich et al. [1] reported the first case of laparoscopic hysterectomy in 1989, an increasing number of hysterectomies have been performed by laparoscopy. Although the technique of gynecologic laparoscopic surgery has improved and become more sophisticated, surgeons still face issues, such a show to minimize invasiveness and provide more humanistic care. In recent years, trans-umbilical single-port laparoscopic hysterectomy has been mastered by more and more surgeons because this procedure leaves few scars, and therefore has outstanding cosmetic advantages [2-5]. Mini-Laparoscopy (MLS) is also a new addition to the field of minimally invasive surgery. Indeed, it has been reported that MLS hysterectomy is a safe and reliable procedure [6]; however, there are no reports comparing umbilical Laparoendoscopic Single-site Surgery (LESS) with MLS in patients undergoing total hysterectomies. The purpose of this study was to compare the intra- and post-operative status between LESS and MLS and analyze the clinical outcomes.

AJOG at a Glance

A. To analyze and compare Mini-laparoscopic (MLS) and Laparoendoscopic Single-site Surgery (LESS) total hysterectomy with respect to safety, surgical outcomes, post-operative pain, and cosmetic results.

B. There were no significant differences between MLS and LESS groups with respect to operative time, intra-operative blood loss, uterine weight, and post-operative hospital stay. No delayed wound healing/infections or incisional hernias occurred in either group. MLS appears to be associated with less post-operative pain and improved cosmesis.

C. This study reaffirms that MLS and LESS are equally effective in total hysterectomy; but MLS is easier for laparoscopic surgeons to master than LESS and does not require a learning curve.

Materials and Methods

Study population

A retrospective study was adopted. Between January 2017 and May 2018, a total of 147 female patients who underwent laparoscopic hysterectomy for benign uterine disease at Shengjing Hospital of China Medical University were included in this study. The study was approved by the Ethics Committee of Shengjing Hospital. All of the women gave written informed consent to use their data in this study.

All of the patients in this study were adequately informed of the benefits, curative effects, potential risks associated with hysterectomy performed by ML Sorumbilical LESS. Seventy-eight patients agreed to a MLS hysterectomy. The 69 patients who declined a MLS hysterectomy were placed in the LESS group and underwent trans-umbilical single-site laparoscopic total hysterectomies.

Clinical dentitions

All of the patients were between 43 and 55 years of age with no desire for fertility preservation. The pre-operative evaluation, including imaging and gynecologic examinations, confirmed that the uterine sizes were <16 weeks gestation in size, which is suitable for laparoscopic surgery. None of the patients had a contraindication to general anesthesia (American Society of Anesthesiologists Physical Status Classification 1 or 2).

Surgical technique

All 147 surgeries were performed by the same surgical team, which had extensive experience in performing MLS and LESS hysterectomies. After general anesthesia was induced, the patients in the LESS group were placed in the bladder lithotomy position, and a uterine manipulator was inserted through the vagina. A 20 mm to 25 mm vertical incision was then made in the umbilicus, where the LESS Port (Kangji, Ltd., Hangzhou, PRC) was placed. After establishing a carbon dioxide pneumoperitoneum, a 10-mm 30° laparoscope was inserted into the central working channel of the port, and the other surgical instruments (5-mm diameter monopolar hook electrode, bipolar forceps, 5 mm to 37 mm Ligasure™ Blunt Tip Laparoscopic Sealer/Divider [Covidien, Ltd., Norwalk, CT, USA]) were placed through the left and right working channels. After removing the resected uterus from the vagina, the vaginal cuff and the peritoneum were sutured laparoscopically with 1-0 absorbable sutures. The umbilical incision was then closed. In the MLS group, a curved incision was made on the upper edge of the umbilicus, where a 5 mm trocar was placed, and a 5-mm 30° laparoscope (Hopkins, Karl Storz, and Tuttlingen, Germany) was inserted. Thereafter, 3-mm trocars were inserted into the right and left sides of the lower abdomen for the introduction of surgical instruments. The remaining procedures were identical to the procedures performed in the LESS group. After the uterus was removed, the vaginal cuff and the peritoneum were sutured layer-by-layer under laparoscopy, while the incision of the abdominal wall did not require suturing.

Observation indicators and follow-up

The patients were followed for 6 months. The operative time, intra-operative blood loss, the time-to-first post-operative flatus, post-operative pain, post-operative hospital stay, and incidence of surgical site infections and incisional hernias were compared between the patients in the two groups. The Visual Analogue Scale (VAS) for pain (0-10, where 0 = no pain and 10 = worst imaginable pain), was recorded 12, 36, and 72 h after surgery. All patients were given 50 mg of flurbiprofen, a non-steroidal anti-inflammatory analgesic, twice per day intravenously (flurbiprofen axetil injection, Tide Pharm, Ltd., Beijing, PRC). Self-image and cosmetic results were assessed using the Body Image Questionnaire (BIQ) Score and Scar Cosmesis Assessment and Rating (SCAR) Scale [7-10]. The BIQ and SCAR scores were recorded 1, 8, and 24 weeks after surgery. The BIQ consists of two parts (Body Image Scale [BIS] and Cosmetic Scale [CS]). The maximum BIS and CS scores are 20 and 24, respectively. Higher scores represent a better self-image and cosmetic satisfaction. The SCAR scale has a minimum score of 0 (best possible scar) and a maximum score of 15 (worst possible scar).

Statistical analysis

The Statistical Package for the Social Sciences (SPSS, v22.0; IBM, city, New York, USA) was used for statistical analysis. Numerical data are presented as the mean ± SEM. Nominal data are shown as the number of cases and a percentage. Numerical data were compared using t-tests. Nominal data were analyzed by a Pearson chi-square or Fisher's exact test. A P value <0.05 was considered statistically significant.

Results and Discussion

Clinical characteristics of the study population

The patients were divided into two groups, one undergoing MLC and the other LESS with none of our patients required to be converted from MLC to LESS. There was no loss to follow-up in either of the groups. Clinical characteristics of the study population is shown in Table 1. Mean age in the MLC group was 48.4 ± 5.5 years and for the LESS group was 50.1 ± 5.2 years (P=0.066). Body Mass Index (BMI) again being comparable for both the groups; MLC= 25.7 ± 3.2 and LESS= 24.9 ± 3.6 (P=0.126). We found no significant difference in co-morbidities, history of abdominal surgery, pre-existing body surface scar, size of uterus and BIS score between two groups (Table 1).

Main peri- and post-operative outcomes

No complications occurred among the 147 patients. There were no significant differences in operative time, intra-operative blood loss, uterine weight, and post-operative hospital stay between the MLS and LESS groups. No delayed wound healing/infections and incisional hernias were noted in either group. The pain scores in the MLS and

Table 1: Overview of patients.

Group	MLS (n=78)	LESS (n=69)	P value
Age (y)	48.4 ± 5.5	50.1 ± 5.2	0.066
Body Mass Index (BMI)	25.7 ± 3.2	24.9 ± 3.6	0.126
Co-morbidities			0.414
No	72 (92.0)	60 (87.0)	
Yes	6 (8.0)	9 (13.0)	
History of abdominal surgery			0.861
No	51 (65.4)	47 (68.1)	
Yes	27 (34.6)	22 (31.9)	
Pre-existing body surface scar			0.74
No	44 (56.4)	41 (59.4)	
Yes	34 (43.6)	28 (40.6)	
Size of uterus (cm)			
Longitudinal diameter	10.6 ± 2.0	9.9 ± 2.1	0.059
Antero-posterior diameter	7.0 ± 1.6	6.8 ± 1.4	0.312
BIS score	16.1 ± 2.8	16.7 ± 2.2	0.204

Table 2: Main peri- and post-operative outcomes.

Group	MLS (n=78)	LESS (n=69)	P value
Variable			
Operation time (min)	83.3 ± 18.5	78.6 ± 16.6	0.108
Intra-operative blood loss (mL)	66.0 ± 19.2	64.7 ± 19.2	0.673
Uterine weight (g)	363.8 ± 111.7	354.7 ± 114.7	0.626
Post-operative hospital stay(d)	2.4 ± 0.5	2.5 ± 0.6	0.187
Delayed wound healing/infection	0	0	
Incisional hernia	0	0	
Post-operative pain			
VAS score			
12 h[a]	4.0 ± 1.0	4.3 ± 1.3	0.084
36 h[b]	3.1 ± 1.0	3.7 ± 1.1	0
72 h[c]	2.0 ± 0.7	2.4 ± 0.8	0
BIQ scale			
BIS score			
1 week	15.2 ± 2.2	15.7 ± 1.8	0.082
8 weeks	15.6 ± 1.8	16.0 ± 1.5	0.115
24 weeks	17.1 ± 1.4	16.4 ± 1.4	0.002
CS score			
1 week	18.9 ± 2.2	18.6 ± 2.1	0.369
8 weeks	19.6 ± 1.7	18.9 ± 2.0	0.014
24 weeks	20.9 ± 1.2	19.5 ± 1.5	0
SCAR (24 weeks)	4.1 ± 1.4	5.1 ± 1.4	0

LESS groups were not significantly different 12 h after surgery, but the pain score was lower in the MLS group than the LESS group 36 and 72 h post-surgery (P<0.05). There were no significant differences in the BIS score between the MLS and LESS groups 1 and 8 weeks after surgery, but the BIS score in the MLS group was higher than the LESS group 24 weeks post-surgery (P<0.05). The CS scores were not statistically different between the 2 groups 1 week after surgery, but the CS score was significantly higher in the MLS group than the LESS group 8 and 24 weeks after surgery (P<0.05). The SCAR score was significantly lower in the MLS group when compared with LESS group 24 weeks after surgery (P<0.05; Table 2).

Principal findings of the study

The principal findings of the study are as follows. First, total hysterectomy can be performed by mini-laparoscopy, the operative time, intra-operative blood loss and uterine weight is similar to transumbilical single-port laparoscope. Second, the MLS group had significantly lower pain scores than the LESS group 36 h after surgery. Third, patients in the MLS group had better cosmetic results than the LESS group 8 weeks after surgery, which were independent of the patients' subjective or objective assessments of the scars.

Compared with LESS, total hysterectomy can be performed by mini-laparoscopy as well

The surgical incision is concealed within the umbilicus or periumbilical region during LESS. LESS leaves a very small scar, has outstanding cosmetic advantages, and has emerged as an improvement and beneficial addition to traditional laparoscopic techniques. Therefore, LESS has become the fastest growing and most widely used technique in endoscopic surgery. Reviewing the development of LESS in gynecology, Wheelless et al. [11] reported the first gynecologic surgical procedure using a single-port laparoscope in 1969. After 50 years of development, nearly all of the gynecologic surgical procedures performed using traditional laparoscopic techniques can now be performed by single-port laparoscopy, including the treatment of gynecologic malignant tumors [12,13]. The safety and effectiveness of LESS surgery is undeniable. LESS mainly involves adnexal procedures. Indeed, reports involving LESS total hysterectomies are relatively rare. A gynecologic malignancy treated with LESS has been reported and there is a focus on robotic surgery due to the lack of large-scale prospective studies [14]. Therefore, the advantages of LESS with respect to post-operative recovery, cosmetic satisfaction, and pain have not been well-documented [15-19]. There are many unfavorable factors regarding single-port laparoscopic surgery. Because all of the instruments are introduced via the umbilicus, the surgical instruments are nearly parallel to the light source and endoscope. The traditional triangular operating fashion and field of view may affect a surgeon's judgment on depth and distance. The crowding and clashing of instruments during surgery further increases the difficulty of the procedure. Therefore, even a skilled endoscopic surgeon needs a learning curve when first using LESS, including robotic-assisted LESS [20-22].

It has been 20 years since the emergence of mini-laparoscopy [23]. Compared to the number of reports involving cholecystectomies, reports pertaining to mini-laparoscopes in gynecologic procedures are limited [24-31]. Moreover, reports of mini-laparoscopic hysterectomies are confined to case reports [6]. Previous studies have demonstrated that the mini-laparoscope yields good cosmetic results, less post-operative pain and trauma, and does not increase post-operative complications. Compared with single-port laparoscopy, mini-laparoscopy shares similar manipulation and field of view features with conventional laparoscopy, and does not have drawbacks, such as a small operating space, clashing of instruments, a small operating angle, and a long distance to target organ. For surgeons proficient in conventional laparoscopic surgery, a learning curve for mini-laparoscopy is not required. Mini-laparoscope scan also reduce the physical discomfort for surgeons. The results of the current study also showed no significant differences in the operative time (83.3 ± 18.5 min *vs.* 78.6 ± 16.6 min, P=0.108), intra-operative blood loss (66.0 ± 19.2 ml *vs.* 64.7 ± 19.2 ml, P=0.673) and uterine weight (363.8 ± 111.7 g *vs.* 354.7 ± 114.7 g, P=0.626) between the MLS and LESS groups. During LESS, resection of the uterus was performed with a 5-mm Ligasure™ Blunt Tip Laparoscopic Sealer/Divider, which can quickly occlude the uterine vessels, ligaments, and para-uterine tissues. In contrast, the mini-laparoscope only uses 3-mm bipolar forceps and scissors, thus significantly increasing the resection time; however, MLS significantly shortened the time of suturing the vagina. If a 3-mm instrument similar to the Ligasure™ Blunt Tip Laparoscopic Sealer/Divider is developed in the future, MLS surgery time will be shortened.

Mini-laparoscopic total hysterectomy has mild pain and good cosmetic effect

It is unknown whether or not single-port laparoscopic surgery can alleviate post-operative pain. It has been reported that pain following single-port laparoscopic hysterectomy or adnexectomy is similar to the pain which occurs following traditional procedures [32-34]. Pier et al. [35] concluded that patients who underwent laparoscopic surgery presented with severe hypochondriac and shoulder pain that was more severe than incisional pain. In the current study, there was

no significant difference in pain scores between the MLS and LESS groups 12 h after surgery; however, the MLS group had significantly lower pain scores than the LESS group 36 and 72 h after surgery ($P<0.05$). Based on VAS scores, the patients could not distinguish hypochondriac and shoulder pain from incisional pain; the former types of pain usually resolves within 24 h after surgery. Therefore, we believe that the VAS score 24 h after surgery better reflects the degree of incision pain. Mc Malon et al. [36] showed that the post-operative pain arising from two 5-mm incisions is less than one 10-mm incision. Fanfani et al. [37] also concluded that reducing the number and length of incisions significantly reduces post-operative pain and analgesic requirements. In the present study, the umbilical incision length was 20 mm to 25 mm in LESS patients, while there was one 5-mm incision and two 3-mm incisions in the MLS group. The incisions in the MLS group were separated, and significantly smaller than the incisions in the LESS group. This finding may explain the reason why patients in the MLS group had less pain than the patients in the LESS group 36 and 72 h after surgery.

Due to the lack of perfect evaluation criteria, the assessment of skin scars is relatively difficult. Therefore, this study chose the BIQ (including BIS and CS scores) and SCAR scores to comprehensively evaluate the post-operative cosmetic results. The formers core attaches more weight to the patient's subjective and psychological states, while the latter score processes outstanding feasibility. A clinical physician can complete the entire SCAR scale within 20 sec and the SCAR includes objective measures for each clinical finding. Studies have reported that MLS procedures result in a better cosmetic outcome than conventional laparoscopic procedures [38,39]. In the present study, patients in the MLS group had 3 mm to 5 mm incisions and better cosmetic results than the LESS group 8 weeks after surgery, which were independent of the patients' subjective or objective assessments of the scars. Both conventional laparoscopy and LESS are associated with trocar hernias, although the incidence is low [40,41]. Approximately 86.3% of trocar hernias occur following punctures >12 mm in diameter, while only 2.7% of trocar hernias occur following 5-mm punctures. In the present study, no incisional hernias were observed in the MLS or LESS groups, which likely reflected the limited sample size. In theory, MLS surgery has an extremely low risk of trocar hernias.

Strengths and limitations

The present study also had some limitations. The sample size was relatively small, and this was a retrospective study rather than a prospective, randomized controlled study. Therefore, the current study was unable to conclusively demonstrate that MLS has a clear advantage over LESS or may replace LESS or conventional laparoscopic surgery in the future. Despite these limitations, there are few studies that have compared MLS and LESS for the treatment of benign gynecologic diseases. Therefore, a corollary study is warranted.

The resected uterus during a mini-laparoscopic hysterectomy can be removed through the vagina without an additional incision to remove the specimen. MLS is as safe and effective as trans-umbilical single-port laparoscopy and has more advantages in reducing post-operative pain and yielding better cosmetic results. For laparoscopic surgeons, a mini-laparoscope is easier to master with no requirement for a learning curve; however, MLS also has some drawbacks. Specifically, the imaging quality of 5-mm telescopes is not as good as 10-mm telescopes and 3-mm devices are too thin, have an inadequate grasping force, have poor device durability, the 3-mm suction tubes are easily occluded by blood clots and tissue debris.

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Authors Contributions

Wang GW: Methodology, study design, data analysis, and writing; Wang DD & Sun MG: Data collection; Liu XF: Data analysis; Yang Q: Methodology and study design.

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