5 mm mini-incision laparoendoscopic single-site surgery of total hysterectomy: a report of five cases and literature review

J.L. Liu¹, J.M. Chen¹*, Y.F. Zheng¹, X.W. Zhang¹, R.X. Shi¹

¹Department of Obstetrics and Gynecology, The Affiliated Changzhou No. 2 People’s Hospital of Nanjing Medical University, Changzhou, Jiangsu 213000 (P.R. China)

Introduction

Total hysterectomy is a most common procedure in obstetrics and gynaecology. The main surgical methods include abdominal total hysterectomy, transvaginal hysterectomy and laparoscopic total hysterectomy. Conventional abdominal total hysterectomy has large trauma and obvious postoperative scar, so more and more patients prefer minimally invasive and aesthetic Laparoscopic surgery or vaginal surgery.

With the development of gynecological laparoscopic surgery, laparoscopic single-site surgery (LESS) has gradually become a new hotspot in minimally invasive surgery. LESS also brings more humane care to patients, due to it can reduce or conceal surgical scars and meet women’s beauty needs [1-6].

Materials and Methods

Study design

1) Basic information: 5 patients were 40 to 52 years old in this group, with a median age of 48 years old. They were already married and have children and have no birth requirements. Three patients diagnosed with cervical intraepithelial neoplasia grade III (CINIII); one case diagnosed with endometrial atypical hyperplasia; the other one diagnosed with cervical cancer (Ia1 phase). 3 patients with CINIII and 1 patient with cervical cancer (stage Ia1) underwent 5 mm mini-incision laparoendoscopic single-site surgery of total hysterectomy + bilateral salpingectomy, and another patient with endometrial atypical hyperplasia underwent 5 mm mini-incision laparoendoscopic single-site surgery of total hysterectomy + bilateral attachment resection. Five patients gave informed consent and agreed to participate in the study.

2) Case selection criteria: Patients aged < 60 years old; uniform body and weight within standard range; patient had stable vital signs and normal cardiopulmonary function; the uterus was smaller than 10 weeks of gestation; they have no previous history of pelvic surgery.

3) Case exclusion: Patients with abnormal spine and pelvis, who were unable to adopt bladder lithotomy position; obesity patients with abdominal wall hypertrophy and puncture difficulty. Patients with severe pelvic adhesions...
which were caused by endometriosis and previous history of pelvic and abdominal surgery; patients with a history of umbilical hernia; The uterus was larger than 10 weeks of gestation.

*Surgical technique*

1) Preoperative preparation: Preoperative preparation include indwelling catheter, monitoring vital signs, excluding laparoscopic contraindications, cleansing umbilicus before surgery, disinfecting and scrubbing the vagina 3 days before surgery, starting fluid diet and bowel preparation 2 to 3 days before surgery, preparing standard laparoscopic instruments. The patients were placed in bladder lithotomy position and placed cup-type uterine manipulator.

2) Surgical approach platform: A 40/50 small abdominal retractor was used to connect 6.5 disposable surgical gloves as an access platform during the surgical operation. Cutting the thumb, middle finger and little finger of the glove and inserting 5 mm disposable plastic puncture trocar and pediatric surgical micro-puncture trocar respectively to construct instrument working channels.

3) Main surgical instruments and consumables: Two pediatric surgery micro-puncture trocars, one 5 mm disposable plastic puncture trocar (easy to use ultrasonic scalpel), 30° pediatric surgical laparoscopic lens, pediatric surgical micro-endoscopic surgical instruments, conventional light source and pneumoperitoneum system. Conventional laparoscopic surgery instruments such as scissors, separation forceps, ultrasonic scalpelabsorber, needle holder, bipolar electrocoagulation forceps and 5 mm ligature. A 18th T-shaped drainage tube, one 1-0 absorbable inverted tooth suture (used to suture vaginal stump under laparoscope).

4) Establishment of surgical anesthesia, position and pathway: patients underwent general anesthesia with endotracheal intubation and bladder lithotomy position (head low 30 degrees). After routine disinfection and toweling, lifting the umbilicus and taking a longitudinal incision about 5 mm in the middle of the umbilicus to ensure that the surgical incision does not exceed the umbilical. Placing the disposable incision retractor into the incision to open the incision (Figure 1) to form a diameter about 10-15 mm of operating hole. Placing the disposable 6.5th glove on the incision retractor and fixing it with silk suture. Cutting the small holes at the end of the finger of the glove and putting the trocar in them (5 mm disposable plastic puncture trocar was placed in the middle finger, pediatric surgical micro-puncture trocar was placed in the thumb and the little finger separately). Filling with CO2 gas to form a satisfactory pneumoperitoneum, so that the intra-abdominal pressure was maintained at 10-12 mmHg. The pediatric surgical micro-puncture trocar with glove thumb was used to place the laparoscopic lens and connect the pneumoperitoneum machine; the other two trocars on the side are used to place the operation pliers for the operation.

5) Surgical procedures: One-handed operation of the ultrasonic scalpel separates the adhesion and restores the anatomical position. Cutting bilateral fallopian tubes or bilateral adnexa with an ultrasonic scalpel. The round ligament and proper ligament of ovary were separated by one-handed operation with Ligasure. Opening the anterior and posterior lobes of the broad ligament and the uterine bladder to fold the peritoneum, and then pushing the bladder down with the ultrasonic scalpel. After the para-uterine tissue was treated and the blood vessels were condensed by one hand with Ligasure. The contralateral side was treated with the same method. Coagulating and cutting the bilateral cardinal ligament and partial uterosacral ligaments with the ultrasonic scalpel gradually. Then assistant makes vaginal fistula exposed with the Cup-type uterine manipulator. One-handed operation of the monopolar electrocoagulation hook cuts the vaginal vault and disconnects the uterus gradually. Then removing the whole uterus and bilateral fallopian tubes from the vagina. Washing and disinfect of vaginal stump with diluted iodophor repeatedly. Using the 1-0 absorbable line to suture the vaginal stump under laparoscope. The bilateral ureters were normal and the peristalsis was normal. After checking the gauze and surgical instruments, take out
5 mm mini-incision laparoendoscopic single-site surgery of total... 897

Figure 2. — (A) Ultrasound knife pushes the vesical peritoneal reflection. (B) One-handed 5 mm Ligasure for blood vessels near uterus. (C) Treatment of uterine sacral ligaments with bipolar electrocoagulation with one hand. (D) Cutting the vaginal wall with monopolar electrocoagulation hook with one hand. (E, F) Suture the stump of the vagina and Place T-shaped drainage tube through the vagina. (G, H) Take out the 40/50 surgical incision protector. (I) After the umbilical hole is formed, the shape of the umbilical wheel is not broken, and the wound is slightly hidden.

the incision protective sleeve under the guidance of the lens. Suturing the subcutaneous tissue of the umbilicus with 1-0 absorbable thread. Reshaping the umbilicus with the 4-0 absorbable line and pressing with gauze. End of procedure (The operation was shown in Figure 2).

6) Postoperative observation and clinical treatment: patients returned to the ward safely. Monitoring the patient’s vital signs closely. Paying attention to abdominal incision and the fluid volume by drainage. The patient was given oxygen at a low rate and immobilized for 4 to 6 hours. Patients were given anti-infection rehydration and symptomatic support treatment, and analgesics were given according to the patient’s situation.

Results

5 patients in this group were operated successfully. No other channels were added and none were converted to open procedures during the operation. The adjacent organs such as ureter, bladder colon and rectum, as well as large blood vessels and nerves were not damaged during the operation. The operation time was (153 ± 34.02) min, mean estimated blood loss was (60 ± 30.82) milliliters, the median temperature was 37.2 (36.5-37.5) °C on the first day after surgery, and the anus exhaust time was 1.0-1.5 days. the urinary function of the patient was restored after removing the catheter at 2-3 days after surgery and no case of urinary retention occurred. No need to use analgesics after surgery. All the surgical incisions were II/A healing and the scars were hidden. The patients were hospitalized for 6-7 days. No postoperative complications such as wound infection, incisional hernia, bladder dysfunction, subcutaneous emphysema, and venous thrombosis occurred in the patients. The patients recovered well and were satisfied with the treatment.

Discussion

In recent years, with the continuous improvement of laparoscopic techniques and the rapid development of surgical
instruments, laparoscopic surgery has been widely used in gynecological surgery. Laparoscopic hysterectomy is very common in obstetrics and gynecology [7-10], which have most grassroots hospitals been able to carry out skillfully. Endoscopic surgery has many advantages such as small incision, light postoperative pain, rapid recovery of the patient and good wound healing. Therefore, it is favored by patients in clinical practice. However, traditional laparoscopic hysterectomy often requires 3-4 puncture scars on the abdominal wall. For female patients, especially young patients, there is still a problem of aesthetic deterioration. In view of this, LESS surgery with better cosmetic results came into being. It was popular all over the country. However, it is necessary to clearly understand that compared with traditional laparoscopic surgery, LESS surgery is more minimally beautiful, but common LESS surgery often requires a 1.5-3.0 cm incision in the umbilicus, which may damage the umbilicus and leave traces of scars in the umbilicus more or less. At the same time, the complete incision and suture of the normal structure of the umbilicus may increase the incidence of umbilical incisional hernia. Based on the traditional LESS surgery, which is relatively destructive to the umbilical structure, if the incision is further reduced to keep the umbilical pore morphological structure be not destroyed, on the one hand, the cosmetic effect can be increased, on the other hand, the umbilical incisional hernia can be further reduced. Based on this concept, 5mm mini-incision laparoendoscopic single-site surgery of total hysterectomy was performed and completed successfully by the author, which achieved better cosmetic results and patient satisfaction. Our findings indicate that compared with the traditional LESS surgery, 5 mm mini-incision laparoendoscopic single-site surgery of total hysterectomy has the less operation bleeding during operation, the lighter postoperative pain, the faster intestinal function recovered and the higher patient’s self-morphological satisfaction. These clinical indicators have preliminary indicated that 5 mm mini incision single-port laparoscopic hysterectomy may be safe and feasible for some patients with suitable conditions.

Because LESS is operated by a single site, there is a “chopstick effect”, which is more difficult than traditional laparoscopic surgery [2]. When the hysterectomy is performed with a 5 mm mini incision, the operation space is more limited and the “chopstick effect” is bound to be more obvious. Therefore, the 5 mm mini incision single-port laparoscopic hysterectomy operation time must be further extended, the difficulty of surgery is further increased and the dependence on surgical equipment and surgical skills is greater [11-13]. Therefore, the implementation of mini incision LESS has higher requirements. It is better to prepared fully and well-trained to reduce the risk of surgery effectively and ensure the success of the operation.

In view of the greater difficulty and limitations of the mini-incision LESS, so when the mini-incision LESS is applied to the hysterectomy, the author believes that the following points should be taken seriously: 1) In order to ensure the success of the operation and the safety of the patient, the surgeon should have rich experience in routine gynecologic LESS before performing a mini-incision single-hole laparoscopic hysterectomy. 2) Choosing the right case is the key to successful surgical completion, which is especially important for operators of early mini-incision LESS procedures. For the patients with hypertrophic abdominal and puncture difficulty or severe pelvic adhesions which were caused by the history of pelvic and abdominal surgery and endometriosis, etc, should be selected mini-incision LESS carefully [14, 15]. 3) Perfect preoperative preparation is very important for the final success of the operation. Perfecting relevant examination and eliminating surgical contraindications before surgery is the most basic requirement. 4) According to the specific circumstances of the operation, evaluate the feasibility of the mini-incision LESS operation. When the operation encounters difficulties, it is necessary to expand the incision in time for operation; if necessary, increasing the operation hole to the traditional porous Laparoscopic surgery or switching to open surgery to ensure patient safety. 5) Effective use of intelligent energy instruments and electrocoagulation and electric cutting combined instruments, which is more convenient and safer. Reducing equipment replacement effectively and improving surgical efficiency. 6) In order to reduce the effect of chopsticks effectively, we replace the traditional 10 mm laparoscopic lens with a smaller diameter laparoscopic, hysteroscopic or cystoscope lens to make room for operation. 7) In view of the limited operating space of the mini incision, the two-handed operation will inevitably interfere with each other, so we try to avoid the chopsticks effect effectively by one-handed operation. 8) Because 5 mm mini incision operating space is very limited, one-handed operation can only complete part of gynecological surgery. In order to further expand the indications for surgery, it is perhaps a development direction to develop a lengthened instrument with smaller diameter and appropriate hardness. 9) 5 mm mini-incision laparoendoscopic single-site surgery of total hysterectomy is obvious difficulty in operation, so the surgeon should have enough patience and be familiar with the pelvic anatomy. Especially when you are dealing with the uterine vessels, it should be handled in place to avoid bleeding. 10) Difficulty to take out the specimen: it is difficult to take out the uterine specimen in 5 mm mini-incision laparoendoscopic single-site surgery, especially the huge uterus. In order to solve this problem, we use transvaginal extraction. A number of studies have shown that transvaginal specimen extraction has the advantages of increasing the incision, less complications, safe operation, less bleeding, less postoperative pain, beautiful incision, and high patient satisfaction and so on, thus this promote the wider application of micro incision single hole laparoscopic technology, which is consistent with our research [16-18]. However, transvaginal sampling may have some disadvantages, such as postoperative pelvic infection, coital pain, decreased sexual sensitivity of patients and influence on fertility, but Stefano et al. [18].
did not find the occurrence of these complications through the retrospective analysis. It has been reported that the su-
ture of vaginal stump after minimally invasive laparoscopic
surgery may be split. To avoid this situation, we used the re-
verse needled suture to suture the vaginal stump. No split of
vaginal stump has occurred since the follow-up of patients.

Conclusions
In conclusion, this study initially confirmed that 5 mm
mini-incision laparoendoscopic single-site surgery of to-
thal hysterectomy is safe and feasible. However, the mini-
incision LESS may require longer operative time and be
more difficult to perform than the usual LESS surgery, thus
it depends more on the surgeon’s excellent surgical tech-
nique. The safety and efficacy of 5 mm mini-incision la-
paroendoscopic single-site surgery of total hysterectomy are
further confirmed by prospective, randomized large-sample
studies.

Ethics Approval and Consent to Participate
All subjects gave their informed consent for inclusion be-
fore they participated in the study. This study has been ap-
proved by the Medical Ethics Committee of the Affiliated
Changzhou No.2 People’s Hospital of Nanjing Medical Uni-
versity.

Acknowledgments
This study was supported by grants from the Scien-
tific Research Support Program for Postdoctoral of Jiangsu
Province (2019K064), the Major Science and Technol-
ogy Program of Changzhou Health and Family Planning
Commission (ZD201812), the 2018 Annual Educational
Research Project of Kangda college of Nanjing Medi-
cal University (KD2018JYJYB055), the Scientific Re-
search Support Program for “333 Project” of Jiangsu
Province (BRA2019161), Six Talent Peaks Project in
Jiangsu Province (LGY201701), Applied Science Founda-
tion of Changzhou (CJ201808028) and the Changzhou Sci-
ence and Technology Bureau (CE20175004).

Conflict of Interest
The authors declare no conflict of interest.

Submitted: December 23, 2019
Accepted: May 25, 2020
Published: December 15, 2020

References
ener C.M.: “Single-port laparoscopy in gynecologic oncology: seven
years of experience at a single institution”. J. Am. Obset. Gynecol.,
2017, 217, 610.e1-610.e8.
laparoscopic salpingectomy”. J. Minim. Invasive Gynecol., 2018, 25,
326-327.
S., et al.: “Laparoendoscopic single-site surgery (less) for prophylla-
tic salpingo-oophorectomy improves cosmetic satisfaction compared
for large benign adnexal tumors: one surgeon’s experience over one-
hysterectomy of laparoendoscopic single site surgery”. Zhonghua Fu
Chuan Ke Za Zhi, 2014, 49, 287-289. [In Chinese]
coscopic single-site surgery for extremely large ovarian cysts: a fea-
sibility, safety, and patient satisfaction study”. Gynecol. Obset. In-
vest., 2014, 78, 81-87.
oncological outcome of total laparoscopic radical hysterectomy
versus radical abdominal hysterectomy in early cervical cancer in
[8] Margulies S.L., Vargas M.V., Denny K., Sparks A.D., Marfiori C.Q.,
outcomes in early cervical cancer patients treated with nerve plane-
sparing laparoscopic radical hysterectomy”. J. Minim. Invasive Gy-
colec., 2020, 27, 687-696.
[10] Cianci S., Guelli Anelli S., Runolo V., Rosati A., Rossitto C.,
Costenino F., et al.: “Total laparoscopic hysterectomy for enlarged
uteri: factors associated with the rate of conversion to open surgery”.
coscopic single-site surgery using a 2.5 mm mini-laparoscopic instru-
ment versus conventional three-port laparoscopy for gynecologic ad-
nexal diseases: a prospective randomized trial”. Gynecol. Obset. In-
vest., 2019, 84, 495-502.
“A randomized, prospective study of laparoendoscopic single-
site plus one-port versus mini laparoscopic technique for live donor
laparoendoscopic single-site pyeloplasty: the best compromise be-
tween surgeon’s ergonomy and patient’s cosmesis (IDEAL Phase
2a)”. European Urology Focus, 2016, 2, 319-326.
[14] Buckley F.P., Vassaur H., Monsivais S., Sharp N.E., Jupiter D., Wat-
son R., et al.: “Comparison of outcomes for single-incision laparo-
coscopic inguinal herniorrhaphy and traditional three-port laparoscopic
herniorrhaphy at a single institution”. Surg. Endosc., 2014, 28, 30-
35.
tional laparoscopic versus single-incision laparoscopic right hemi-
colectomy: a case cohort comparison of short-term outcomes in 144
Kashir C.L., et al.: “Laparoendoscopic single-site radical hysterec-
tomy with pelvic lymphadenectomy: initial multi-institutional expe-
rience for treatment of invasive cervical cancer”. J. Minim. Invasive
[17] Lagana A.S., Vitale S.G., Palmaro V., Ban Franegel H. and Triolo
R.O.: “Transvaginal specimen removal in minimally invasive surgery:
feasibility and possible complications during the incision of the pos-
nal specimen extraction at laparoscopy without concomi-
tant hysterectomy: our experience and systematic review of the lit-

Corresponding Author:
JIMING CHEN, M.D., Ph.D.
Department of Obstetrics and Gynecology,
Yanguhu District, the Affiliated Changzhou No.2 Peo-
ples’ Hospital of Nanjing Medical University, No. 68
Gehu Milddle Road, Wujin District, Changzhou City,
Jiangsu Province, 213000 (P. R. China)
e-mail: cjming@126.com