

Original Article

Application of laparoendoscopic single-site surgery using conventional laparoscopic instruments in gynecological diseases

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Abstract: To investigate the feasibility and safety of laparoendoscopic single-site surgery (LESS) using conventional laparoscopic instruments in gynecologic disease by three-channel single port through a transumbilical access. A retrospective analysis of 11 patients who underwent LESS procedure from January 2011 to May 2011 was performed. Clinic data were collected from 11 patients, 5 patients underwent salpingectomy, 3 cases with ovarian cystectomy, 2 cases with adnexectomy and 1 case with laparoscopic assisted vaginal hysterectomy (LAVH). Surgical duration, amount of bleeding and postoperative complications were analyzed. Ten of 11 patients were treated with LESS surgery successfully. One patient who underwent laparoscopic assisted vaginal hysterectomy procedure required two additional 5 mm ports due to severe pelvic adhesion. The operation time was 25-85 minutes. The estimated bleeding amount was 5-80 ml. The scars of operation incision in 10 LESS patients were not obvious. One patient under LAVH showed 2 scars of 0.5 cm on the lower abdomen. There were no postoperative complications in all cases. Laparoendoscopic single-site surgery with conventional laparoscopic instrument on suitable gynecologic conditions is feasible, safe and cosmetic. It is easy to perform and low cost. Further studies are needed to confirm these advantages compared with traditional laparoscopic procedure.

Keywords: Laparoendoscopic single-site surgery, conventional laparoscopic instruments, gynecologic disease

Introduction

With the development of surgery technology, laparoendoscopic surgery is becoming the standard treatment for many gynecologic diseases. More and more clinicians choose laparoscopy instead of traditional abdominal approach with the goal of minimal invasive and cosmetic effect. Nowadays laparoendoscopic single-site surgery (LESS) is now showing increasing popularity [1, 2]. LESS has the advantage of better cosmetic effect compared to traditional laparoscopy, which attracts more patients especially those at young ages [3]. However, current LESS requires specialized multi-lumen ports. Many surgeons have used a com-

mercially available multichannel trocar, such as Triport and bendable surgical instrument. The Olympus TriPort is a novel multi-instrument access device containing three instrument ports (one of 10 mm and two of 5 mm) and two insufflation valves which can be used as the control of smoke evaluation. However, these port systems have also limitations because of the expensive price. Therefore, LESS is not widely available and hard to replace the place of traditional laparoscopy. Thus we used a new three channel single port incision to simulate TriPort working channel. In this study, we reported our techniques of LESS using conventional laparoscopic equipment in gynecologic procedures.

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Table 1. Clinical characteristics of the patients (*n* = 11)

| Patient NO. | Patient Age (years) | Body weight (kg) | Marriage status | Childbearing history | Pre-operative Diagnosis | Clinical manifestations | Examination results |
|-------------|---------------------|------------------|-----------------|----------------------|-------------------------|-----------------------------------|---|
| 1 | 21 | 48 | N | G2P0 | Ectopic pregnancy | Abdominal pain & vaginal bleeding | HCG↑, No GS, Adnexal mass |
| 2 | 22 | 46 | N | G1P0 | Ectopic pregnancy | Abdominal pain & vaginal bleeding | HCG↑, No GS, Pelvic fluid |
| 3 | 25 | 50 | N | G3P0 | Ectopic pregnancy | Abdominal pain | HCG↑, No GS, Pelvic fluid |
| 4 | 28 | 55 | N | G1P0 | Ectopic pregnancy | Abdominal pain | HCG↑, No GS, Adnexal mass |
| 5 | 29 | 47 | Y | G2P1 | Ectopic pregnancy | Abdominal pain & vaginal bleeding | HCG↑, No GS, Adnexal mass, Pelvic fluid |
| 6 | 30 | 55 | N | G2P0 | Ovarian tumor | Abdominal mass | Pelvic mass by ultrasound |
| 7 | 38 | 52 | Y | G1P1 | Ovarian cyst | Abdominal distending pain | Pelvic mass by ultrasound |
| 8 | 42 | 51 | Y | G2P1 | Ovarian cyst | Abdominal mass | Pelvic mass by ultrasound |
| 9 | 49 | 49 | Y | G4P1 | Ovarian cyst | Abdominal distending pain | Pelvic mass by ultrasound |
| 10 | 50 | 65 | Y | G3P2 | Ovarian tumor | Abdominal mass | Pelvic mass by ultrasound; CA-199↑ |
| 11 | 49 | 53 | Y | G2P1 | Adenomyosis | Dysmenorrhea menorrhagia | Anemia, Uterus size↑ & endometrial line shifting under ultrasound |

No GS: No gestational sac in the uterine cavity; CA-199: carbohydrate antigen 199 (a tumor marker).

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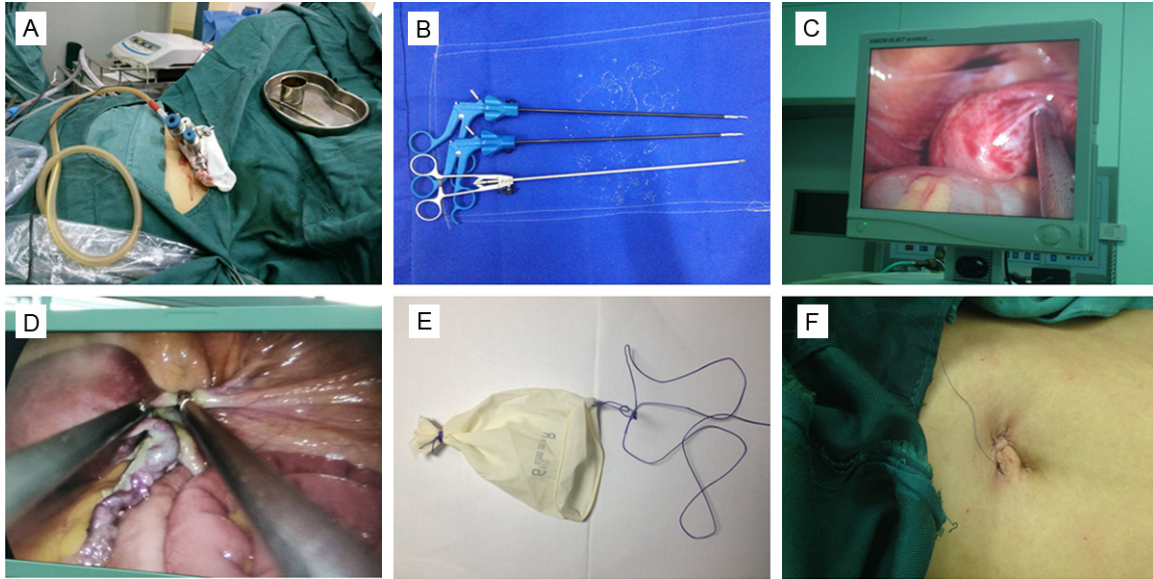


Figure 1. Operative technique for single-port laparoscopic surgery using conventional laparoscopic instruments. A. Three-channel single port puncture using traditional laparoscopic Trocar; B. Traditional laparoscopic instrument used in this study; C. The feasibility of procedure in the pelvic cavity assessed after the establishment of LESS channel; D. LESS assisted salpingectomy on the patients with right side of tubal pregnancy; E. Homemade sample bag from gloves with a line; F. Well stitched absorbable suture of umbilical incision.

Materials and methods

Clinic data

Eleven patients were treated with LESS in XXX hospital from January 2011 to May 2011. The average age was 30 years old (range 21-50 years). There were 5 of 11 patients with tubal ectopic pregnancy, 3 patients with simple ovarian cyst, 2 patients with simple ovarian cyst and 1 patient with adenomyosis. All clinic data were shown in **Table 1**. Before the procedures, all patients were fully informed of the characteristics of LESS and the possibility of requiring conversion to an open procedure or traditional laparoscopic surgery. The study was approved by the Third Affiliated Hospital of Suzhou University. The exclusion criteria for LESS were the same as for traditional laparoscopic surgery.

Surgical procedures

Before operation

After routine preoperative preparation, installing indwelling catheter, patients were placed in the supine or lithotomy position with legs extended based upon different conditions. Uterus-lifted equipment was placed in accordance to different surgical types.

Surgical instrument

Surgical Equipment Stryker HD Video Endoscopy/Laparoscopy System Complete (Stryker Endoscopy, San Jose, CA), conventional trocar (one of 10 mm trocar, two of 5 mm trocars), 30 degree laparoscope, laparoscopic scissors, dissecting forceps and bipolar forceps.

Surgical technique

The patient was placed under general anesthesia in supine or lithotomy position with the legs 30° higher than the head. After prepping and draping, the patients got a 20 mm curvilinear intraumbilical incision. After cutting into the subcutaneous tissue not peritoneum, we inserted an insufflation needle to induce the pneumoperitoneum by CO₂ gas to 12 mmHg. To simulate TriPort channel we docked 3 trocars. One 10 mm trocar was placed in the middle of incision, while other two 5 mm trocars were placed on both sides. All trocars were fixed with surgical gloves or gauzes. The conventional laparoscope was introduced through the 10 mm trocar channel. Conventional laparoscopic instruments were introduced through the other two trocar channels (**Figure 1A** and **1B**). After insertion of laparoscope, we inspected the pelvic cavity first to evaluate the feasibility and duration of LESS procedure as shown in **Figure 1C**

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Table 2. Intra-operative & post-operative outcomes of the patients (n = 11)

| Patient NO. | Operative procedures | Operative time (min) | Blood loss (ml) | Anal ex-haust (d) | Hospitalization time (d) | Complications | Post-operative pathology |
|-------------|----------------------|----------------------|-----------------|-------------------|--------------------------|-------------------|--------------------------|
| 1 | Salpingectomy | 25 | 10 | 0.5 | 2 | N | TP |
| 2 | Salpingectomy | 40 | 10 | 0.5 | 2 | N | TP |
| 3 | Salpingectomy | 30 | 5 | 1 | 3 | N | TP |
| 4 | Salpingectomy | 35 | 5 | 1 | 3 | N | TP |
| 5 | Salpingectomy | 35 | 20 | 1 | 3 | N | TP |
| 6 | Oophorocystectomy | 70 | 25 | 1 | 3 | N | OMCT |
| 7 | Oophorocystectomy | 65 | 35 | 1 | 3 | N | BOC |
| 8 | Oophorocystectomy | 60 | 25 | 1 | 4 | Febrile morbidity | BOC |
| 9 | Oophorocystectomy | 65 | 30 | 1 | 4 | N | BOC |
| 10 | Adnexal removal | 55 | 5 | 1 | 3 | N | OMCT |
| 11 | LAVH | 85 | 80 | 2 | 5 | Febrile morbidity | Adenomyosis & Myoma |

LAVH: Laparoscopy assisted vaginal hysterectomy; TP: Tubal pregnancy; OMCT: Ovarian mature cystic teratoma; BOC: Benign ovarian cyst.

and **1D**. For those with severe pelvic adhesion, bowel-uterus adhesions or peritoneal lining-uterus adhesions, we converted the surgical approach to 3 ports or 4 ports conventional laparoscopic procedure.

In our study, there were 5 cases received salpingectomy. We cleaned the pelvic blood and clots, coagulated the mesosalpinx, cut part of the fallopian tube and placed the samples in a homemade sample bag. Thus the specimen was removed through the 10 mm trocar channel by following methods. First we put the homemade sample bag into pelvic through the 10 mm trocar channel and left the longer line outside. When the procedures were completed, specimens were put in the sample bag under laparoscope's guide, then sample bag was clamped to the 10 mm trocar puncture. We took out the 10 mm trocar and laparoscope, then pulled the edge of sample bag out of the incision, divided the specimens to take all samples out. The homemade sample bag was shown in **Figure 1E**.

There were 3 cases who received ovarian cystectomy. Two dissecting forceps were introduced through 5 mm trocar channel at both sides. Clamp crushing technique was used to dissect all cysts from ovary. Sample bags were taken out described as before. The surface of the wound was coagulated by bipolar forceps.

There were 2 cases who received adnexectomy. We first lifted the uterine cornual part to explode the adnexa of affected side. After coagulating the infundibulopelvic ligament, we dissected mesosalpinx to the corneal part of uter-

us and separated the interstitial tubal and the ovarian ligament. The dissected adnexa was placed in homemade sample bag and easily removed via the transumbilical incision.

For the case of adenomyosis, LAVH was performed. Two additional 5 mm ports were required due to severe pelvic adhesion. After dissecting of adhesion, the fallopian tubes and ovaries were to be removed from their ligaments. Then the organs and tissues were removed through an incision made in the vagina. After the procedure, the subcuticular absorbable suture was conducted in the umbilical wound as shown in **Figure 1F**.

Results

LESS procedure was performed successfully for 10 patients, except for one LAVH patient needed two additional ports due to the severe pelvic adhesion. Of all the procedures, there were no intraoperative injuries to the ureter, bladder, colorectal and other adjacent blood vessels. As shown in **Table 2**, the duration of the operation was 25~85 min. The estimated bleeding amount was 5-80 ml. The first flatus time was 0.5-2 days post operation. Peritoneal drainage was not necessary because of the low bleeding amount. Urinary function recovered immediately after catheter removal in 3 days post operation in all cases. Among them, 10 patients had slight cicatricial contracture hidden in the umbilicus fold and did not show obvious scar of abdominal wound. The additional 1 cases of LAVH patient showed two 0.5 cm scars on the lower abdominal. All patients were discharged from hospital without complications

such as incision infection, incisional hernia, bladder dysfunction, subcutaneous emphysema and venous thrombosis. All patients were satisfied with the surgery and were in the following-up observation at present.

Discussion

In 1997 NAVARRA G et al [3] reported one case of single port laparoscopic cholecystectomy. Since then LESS has been reported in the following procedures, such as nephrectomy, prostatectomy, splenectomy, appendectomy [4-6]. But due to greater surgical technique requirement and higher surgical costs, LESS was not widely used in gynecologic surgery compared with general surgery. However, with the rapid development of surgical equipment, LESS technique has emerged as a minimally invasive surgery in many gynecologic conditions. Especially in western countries, it was reported that LESS was performed in gynecologic carcinoma [7, 8].

To solve the problem of instrument interruption in LESS, some surgeon used bendable surgical instrument to perform LESS procedure [9, 10]. However it is relatively expensive. Therefore, to avoid high cost by such new surgical instrument, we used three-channel single port incision by three traditional laparoscopic trocar incisions in the same part of the body to simulate the channel of TriPort. Our method has a similar concept and effects as JEON HG reported [11]. In our report, 10 of 11 patients who underwent LESS procedure were successfully, except 1 case with LAVH. It has advantages of minimal invasiveness interoperation, lower amount of bleeding, less postoperative complications, faster recovery, shorter hospitalization time and smaller scar [12-15]. However it has also disadvantages of longer operation time and more difficult procedure for clinicians [16, 17]. Our experience is that the patients with thick abdominal wall or severe pelvic adhesion are not recommended to LESS, which is accordance with other studies [18, 19]. Moreover, we invent a sample bag out of gloves with a line to solve the problems of sample taking.

The present study has several limitations. Only a small number of study participants was included, although it was based on the sample size calculation. Our study participants were Chinese women living in China, thus these results may not be applicable to other popula-

tions. Finally, this study did not set control group.

In conclusion, our study has preliminarily confirmed the feasibility, safety and cosmetic effects of three channel single port LESS procedure using conventional laparoscopic devices. So far the outcomes of our methods have improved patients' outcomes by minimizing invasion and discomfort. However, the specific indications and contraindications of this new technique need to be clarified in further research and more large prospective randomized clinical studies are needed for the comparison of the difference between this new technology with traditional laparoscopic gynecologic operation in the outcomes like postoperative pain, recovery time, complications, patient satisfaction and cosmetic effect.

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Disclosure of conflict of interest

None.

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