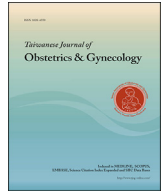




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## Original Article

## Natural orifice transluminal endoscopic surgery (NOTES) subtotal hysterectomy: A feasibility study

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## ABSTRACT

**Objective:** Hysterectomy via transvaginal natural orifice transluminal endoscopic surgery (NOTES) has been carried out for benign uterine diseases and nonprolapsed uteri in recent years. Subtotal hysterectomy was performed to remove the uterus with preservation of the cervix by abdominal, laparoscopic, or vaginal routes. The aim of this retrospective study is to gain insight into the feasibility and safety of subtotal hysterectomy through transvaginal NOTES.

**Materials and methods:** This is the first case series study to describe the technique and to evaluate the feasibility of this innovative surgical procedure. 10 patients were recruited and underwent NOTES subtotal hysterectomy within one-year duration.

**Results:** The mean operative time was  $106.7 \pm 40.0$  min with a mean blood loss of  $250.0 \pm 120.2$  mL. The mean weight of specimen retrieved was  $452.2 \pm 227.8$  g (range 195 g–905 g). None of these patients sustained injury to surrounding structures or major blood vessels during the surgery. Five patients required analgesia during the first 24 h post-surgery. Post-operative hospital stay ranged from 2 to 3 days. No patients complained of surgical complications at 1, 3, and 6 months follow-up. All patients recovered uneventfully and carried on daily activities without difficulty.

**Conclusion:** This study confirms the feasibility and safety of NOTES subtotal hysterectomy.

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## Introduction

We recently established an innovative approach to perform total hysterectomy using the transvaginal natural orifice transluminal endoscopic surgery (NOTES) for the treatment of benign gynecological diseases [1–3]. Instead of laparoscopic assisted vaginal hysterectomy (LAVH), our previous work first demonstrated that transvaginal NOTES can be feasible and safe for hysterectomy, which not only overcomes the limitation of vaginal surgery but also results in a scarless abdomen.

Subtotal hysterectomy, also known as supra-cervical hysterectomy, is a surgical procedure that excises the uterine corpus with preservation of the cervix. Several surgical techniques for subtotal hysterectomy were developed in the past decades, including

abdominal, laparoscopic and vaginal approaches. Until now, many studies did not conclude that neither subtotal nor total abdominal hysterectomy adversely affects pelvic organ function while preservation of the cervix may enhance the prevention of pelvic organ prolapse and improve sexual satisfaction [4–7]. Further research should evaluate laparoscopic approaches to subtotal and total abdominal hysterectomy, as well as methods for vaginal suspension on long-term complications. Subtotal abdominal hysterectomy (SAH) was first described in literature, while advancement in surgical techniques allowed laparoscopic subtotal hysterectomy (LSH) to be feasible. Subtotal hysterectomy was preferred in certain subjects due to the advantages of a shorter intra-operative time, speedier recovery, diminished organ injury, particularly the urinary tract, and the reduced risk of pelvic organ prolapse [8]. Vaginal subtotal hysterectomy (VSH) is an alternative surgical option when an abdominal incision is not desired through SAH or LSH [9,10]. Uterine mobility, vaginal access and experienced assistants are important parameters to consider in this procedure. Certain limitations cannot be ignored, which include a large uterine size and

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post operative light menstruation [9]. With the expectation to combine the technical advantages of laparoscopic and vaginal approaches to enhance visibility during operation as well as to eliminate a visible surgical scar, our team aimed to assess the feasibility and safety of transvaginal NOTES as a minimally invasive approach for subtotal hysterectomy.

## Materials and methods

At present retrospective study, 10 women received subtotal hysterectomy for benign uterine conditions via NOTES, which was performed by one of the authors (H.S) at Chang Gung Memorial Hospital at Linkou between September 2013 and December 2014. Women who had undergone more than two caesarean sections or abdomino-pelvic surgeries in the past were excluded from the study. Before the surgery, all patients underwent preoperative assessment, including a detailed medical history, pelvic examination and ultrasonography. All patients were screened for the absence of cervical and endometrial malignancy by Pap smear and office hysteroscopy [11,12]. The risks of surgery were explained to the patients, including the potential need to switch to traditional laparoscopy during the operation and the risks of intraoperative bleeding, transfusion and adhesion. All women had bowel preparation in the morning of surgery. The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital NO 104-0740B.

### NOTES subtotal hysterectomy techniques

Surgery was performed under general anesthesia with endotracheal intubation. Throughout the procedure the patient was positioned in lithotomy and Trendelenburg position. A 12-French Foley catheter was indwelled. Then, the hysterectomy was carried out in the stepwise manner as follows:

- 1) *Anterior colpotomy.* With traction on the uterine cervix using two tenaculums, one on each cervical lip, incision was made at the anterior cervico-vaginal junction. The vaginal mucosa along with the uterine-cervical fascia was pushed up at the anterior fornix. The peritoneum between the bladder and the uterus could be identified and opened.
- 2) *Cervical transection and establishing the vaginal channels for endoscopic surgery.* We used electro-surgical pencil to transect the cervix at the level of peritoneal reflection of anterior pouch of Douglas (Fig. 1) and extended it to create a posterior opening at the level of uterine isthmus. We used two Heaney-Simon retractors: first one anteriorly to retract bladder through anterior colpotomy and the other was inserted into the posterior opening at the level of isthmus which retracted the cervical stump (Fig. 2). Next the uterine arteries were divided, one by one on both sides, using a bipolar vessel sealer (LigaSure Impact system; Covidien, Mansfield, MA, USA). Following this, we used the established method to create the vaginal ports for endoscopy, as previously reported by us [13] with a LAGIPORT™ Kit (LAGIS endo-surgical devices, Taiwan) (Fig. 3).
- 3) *Endoscopic performance of subtotal hysterectomy.* After creation of adequate pneumoperitoneum, the endoscope was inserted to explore the pelvis. The endoscope we used was a 10-mm, 0-degree endoscope (KARL STORZ GmbH & Co. KG, Tuttlingen Germany). The energy source used throughout the endoscopic procedure was a 5-mm bipolar LigaSure system (Covidien) designed for laparoscopy. To start, the ascending uterine vessels were identified by grasping the uterine body and pushed toward the contralateral site with an endoscopic single-tooth tenaculum. Then the vessels were secured and ligated using a bipolar

vessel sealer. The remaining broad and round ligaments were secured and divided step-by-step using the LigaSure bipolar forceps (Fig. 4). If the adnexa had to be preserved, the tubo-ovarian pedicles were divided. If the adnexa was for removal (depending on patients age and associated adnexal pathology), bilateral infundibulopelvic ligaments were clamped, secured, and divided. After securing all of the pedicles, the uterus was removed through the vagina.

At the end of surgery, the anterior lip of the cervical stump was sutured near the isthmus with vagina using 2-0 polyglycolic acid sutures. The operation was concluded after a routine diagnostic cystoscopy. Prophylactic antibiotic (cefazolin plus gentamicin) one dose was administered right before the start of the procedure and continued post-operatively for 24 h. No further oral antibiotics were prescribed in the absence of proven infection. Nonsteroidal anti-inflammatory drugs were routinely prescribed after the operation. Numeric rating score for pain was assessed and recorded every 6 h, and 10 mg of Nalbuphine was administered intramuscularly if required. Foley catheter was kept *in situ* overnight following the operation. Patients were discharged according to our national regulations with an afebrile status for at least 24 h, without symptoms of surgical complications and full recovery of gastrointestinal function with satisfactory oral intake [1].

### Statistical analysis

Demographic details of all the women were collected prospectively. An independent observer recorded details of surgery, including total duration and blood loss. Removed specimen was weighed immediately. Postoperative details and complications were recorded. Histopathological report was collected at a later time. All calculations were made using SPSS Version 18 software (Chicago, IL, USA). Descriptive statistics was used to analyze data.

## Results

A total of 10 women with myoma or adenomyosis were recruited within one-year period and all of them underwent NOTES subtotal hysterectomy. The characteristics of patients are described in Table 1. Mean age of women in this study was  $44.5 \pm 3.6$  years and mean parity was 2. One patient was nulliparous, and one had undergone a cesarean delivery earlier. Mean body mass index (BMI) was  $28.9 \pm 7.1$  kg/m<sup>2</sup>. Indication for hysterectomy included eight cases of leiomyoma and two cases of adenomyosis of uterus. All ten women chose subtotal hysterectomy.

Altogether the mean operation time was  $106.7 \pm 40.0$  min with a mean blood loss of  $250.0 \pm 120.2$  mL. The mean weight of specimen retrieved was  $452.2 \pm 227.8$  g (range from 195 g to 905 g). None of these patients sustained injury to surrounding structures or major blood vessels during the surgery.

One patient (Serial Number 6 in Table 1) received preoperative blood transfusion. None of the patients required intra-operative or post-operative blood transfusion. Five patients required additional analgesia with Nalbuphine during the first 24 h. Post-operative hospital stay ranged from 2 to 3 days. All patients completed 1, 3, and 6 months follow-up in an outpatient setting. No patients had significant complaints related to surgery.

## Discussion

This study presents an innovative approach to execute subtotal hysterectomy utilizing NOTES. Performing hysterectomy by NOTES diminishes pain, speeds recovery, and results in an excellent cosmetic effect with a scarless abdomen. We performed the same

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