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Original Article

Hysterectomy via transvaginal natural orifice transluminal endoscopic surgery (NOTES): Feasibility of an innovative approach

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Abstract

Objective: To evaluate the feasibility and safety of performing a hysterectomy using the transvaginal natural orifice transluminal endoscopic surgery (NOTES).

Materials and Methods: From May through December 2010, 16 patients with benign uterine diseases who were eligible for laparoscopic hysterectomy were recruited to undergo transvaginal NOTES at a tertiary referral medical center. Intraoperative and postoperative surgical outcomes were measured.

Results: All of the included hysterectomies were completed via transvaginal NOTES without conversion to conventional laparoscopy. The mean (± standard error of mean (SEM)) uterine weight was 538.8 ± 102.9 g, the mean operative time was 122.7 ± 17.6 minutes, and the mean blood loss was 379.4 ± 95.4 mL. The mean postoperative hospital stay was 2.8 ± 0.2 days. No intraoperative or postoperative complications were noted in this series.

Conclusion: Hysterectomy for the treatment of benign diseases can be feasibly carried out via transvaginal NOTES. However, prospective studies are needed to determine its full clinical applications.

Keywords: hysterectomy; innovation surgery; natural orifice transluminal endoscopic surgery; NOTES

Introduction

The concept of natural orifice transluminal endoscopic surgery (NOTES), which uses the natural orifices of the body as the surgical channels for endoscopy, is a new development in the field of minimally invasive surgery and it can be used to avoid injuring the abdominal wall. Recently, we performed the transvaginal NOTES by applying the techniques of laparoendoscopic single-site surgery (LESS) surgery via the vaginal route, and we found that it can be used to carry out adnexal procedures in select patients [1].

Vaginal hysterectomy has been a convention in gynecology for hundreds of years and our daily practice [2]; however, its application is restricted by the poor visualization and limited space for manipulation, and that are especially notable uteri that present without descensus or with adhesions. Though it is still recommended as the route of choice [3], the use of vaginal hysterectomy declined after the rise of abdominal laparoscopic hysterectomy in the 1990s [4,5].

According to the findings in our previous report [1], we believe that our innovative approach of transvaginal NOTES can be feasibly applied to hysterectomy. The objective of this study was to evaluate its feasibility and safety and to determine if there are any additional advantages of NOTES over the conventional approach.

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Materials and methods

Patients

From May through December 2010, hysterectomies were performed using transvaginal NOTES in Chang Gung Memorial Hospital. Patients with benign uterine diseases who were eligible for laparoscopic hysterectomy were included. Exclusion criteria included virginity, international continence society (ICS) classification Stage III or IV uterine prolapse, uterus $>$ 20 weeks of gestation, $\geq$ 2 previous cesarean deliveries, suspected severe endometriosis, and complete obliteration of the cul-de-sac noted at pelvic examination. On the contrary, obesity (body mass index $\geq$ 30 kg/m^2) and no previous with vaginal deliveries were not considered as contraindications.

This study was reviewed and approved by the human investigational review board of Chang Gung Memorial Hospital. All patients who underwent surgery gave their informed written consent. All surgeries were performed by experienced gynecologic endoscopists.

Surgical techniques

Under general anesthesia with endotracheal intubation, each patient was placed in the Trendelenburg position with their legs bandaged and supported in the stirrups. A 12-French Foley catheter was indwelled. Then, the hysterectomy was carried using the following steps.

1) *Circumcision of the uterine cervix and posterior colpotomy.* With tractions placed on the uterine cervix using two teneculums, each operation began with the circumcision of the vaginal mucosa around the cervix followed by a 3-cm posterior colpotomy, as is the case for conventional vaginal surgery. The anterior portion was carried out by pushing up the vaginal mucosa along with the uterine-cervical fascia at the anterior fornix. Unless the peritoneum between the bladder and the uterus could be identified and cut confidently, anterior colpotomy was not completed at this stage and was performed during the later laparoscopic phase. By exposing the extraperitoneal space along with the bilateral board ligaments, the transverse cervical and the uterosacral ligament complexes were well exposed and then clamped and divided using a bipolar vessel sealer (Liga Sure Impact system; Covidien, Boulder, CO, USA).
2) *Establishing the vaginal channels for endoscopic surgery.* We used our established method as previously reported to create the vaginal ports for endoscopy [1]. In brief, a small-size Alexis wound retractor (Applied Medical Resources Corp., Rancho Santa Margarita, CA, USA) was inserted into vagina, and the outer rim was draped with a surgical glove into which one 10-mm and two 5-mm cannulas were inserted through the fingers of the glove. The endoscope we used was a 5-mm, 30-degree endoscope (KARL STORZ GmbH & Co. KG, Tuttlingen Germany), and the energy source was a 5-mm bipolar Liga Sure system (Covidien) designed for laparoscopy.
3) *Endoscopic management of the uterine arteries and completion of the anterior colpotomy.* After adequate creation of pneumoperitoneum, the endoscope was inserted to explore the pelvis. The bilateral broad ligaments of the uterine vessels were identified by grasping the cervix and pushing toward the contralateral site with n endoscopic single-tooth tenaculum. Then, the uterine vessels were secured and divided using a bipolar vessel sealer (Fig. 1). Following the stump of the uterine arteries and the anterior margin of uterus, we were able to trace and identify the uterovesical junction from both the caudal and cephalic point of view. After dissecting the junction with laparoscopic scissors, the anterior colpotomy was completed under laparoscopic guidance (Fig. 2).
4) *Endoscopic management of the upper portion of the hysterectomy.* The remaining board and round ligaments were secured and divided step-by-step using the Liga Sure bipolar forceps. If the adnexa were preserved, the tubo-ovarian pedicles were divided (Fig. 3). If the adnexa were removed, the bilateral infundibulopelvic ligaments are clamped, secured, and divided. After clearing all of the pedicles, the uterus was removed through the vagina (Fig. 4).

Finally, the vaginal cuff was closed using 2-0 Vicryl sutures and the operation was concluded after a routine diagnostic cystoscopy.

Treatment protocol

Prophylactic antibiotics were administered along with preoperative cefazolin, and postoperative cefazolin and gentamicin were administered for 1 day. No additional oral antibiotics were prescribed without evidence of infection. Nonsteroidal anti-inflammatory drugs were routinely prescribed after the operation, and 30 mg nalbuphine was

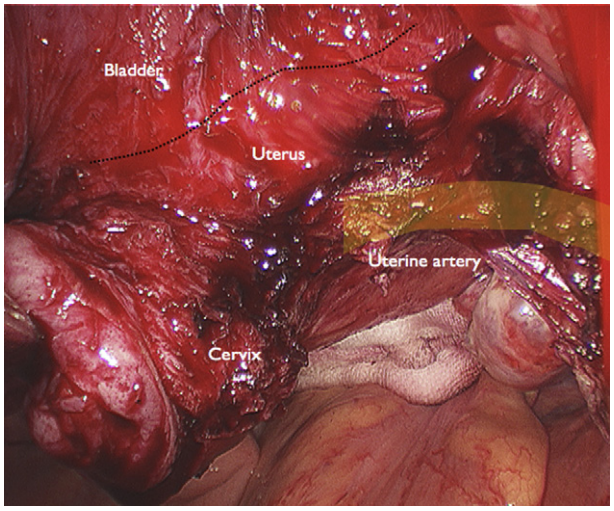

Fig. 1. Exploring the left parametrial space and dividing the uterine artery.