Tzu Chi Medical Journal 2017; 29(4): 208-212

Original Article

Hysterectomy and ovarian cystectomy using natural orifice transluminal endoscopic surgery: An initial experience at Tzu Chi General Hospital

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Abstract

Objectives: The objective of this study is to report our initial experience with patients undergoing transvaginal natural orifice transluminal endoscopic surgery (NOTES). **Materials and Methods:** From September 2016 to December 2016, patients who were not virgins and did not have pelvic inflammation or obliteration of the cul-de-sac who underwent NOTES hysterectomy or ovarian cystectomy (OC) were included in the study. **Results:** Transvaginal NOTES was performed smoothly in six patients, two patients (mean age 35 years, mean body mass index [BMI] 25) received an OC and four patients (mean age 49 years, mean BMI 27) underwent a hysterectomy. One patient with a hysterectomy received concurrent adhesiolysis. The mean surgical times were 74 and 75 min and blood loss was 50 and 87.5 ml in the OC and hysterectomy groups, respectively. One patient with a hysterectomy had a postoperative fever with 38°C last for 2 days. Pain scores were 0 at 48 h postoperatively in both groups. **Conclusion:** Transvaginal NOTES is a feasible and safe technique for hysterectomy and OC in our patients and those in previous reports. This procedure was minimally invasive with no scars on the abdomen as well as little pain.

Keywords: *Hysterectomy, Laparoscopy, Natural orifice transluminal endoscopic surgery, Ovarian cystectomy, Single port*

Received : 14-Feb-2017
Revised : 24-Apr-2017
Accepted : 09-May-2017

Introduction

Natural orifice transluminal endoscopic surgery (NOTES) has been used for a decade [1]. NOTES is performed through natural orifices as the surgical channels for endoscopy. It avoids abdominal entry and could be the next trend in minimally invasive surgery. However, there is still limited experience in gynecologic surgery [2-5]. To perform NOTES, doctors could be hampered by experience with a single-port lack of suitable instruments and energy source for electrocauterization. Familiarity with pelvic anatomy from upside down through the vagina is essential.

Vaginal hysterectomy has been used for hundreds of years [6], but poor visualization and limited space for manipulation are limiting factors. Although vaginal hysterectomy is the route of choice [7], its use has decreased with the increasing use of abdominal laparoscopic hysterectomy since the 1990s [8,9].

Our surgical team has a lot of experience in performing laparoendoscopic single-site surgery (LESS), so we are very familiar with single-port surgery [10-14].

The aim of this study is to report our initial experience with NOTES using the single-port technique in benign gynecological disease.

Materials and Methods

The study was conducted in accordance with the Declaration of Helsinki and was approved by the local ethics committee of the institute. Informed written consent was waived because the study was a retrospective data analysis. Four patients with uterine myoma, adenomyosis, or carcinoma *in situ* (CIS) of the cervix and two patients with ovarian teratoma applicable for laparoscopic surgery were recruited to undergo NOTES in our hospital (Buddhist Tzu Chi General Hospital). The patients were not virgins and did not have pelvic inflammation or obliteration of the cul-de-sac. All patients receiving surgical management gave their written informed consents. The first author performed all the

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How to cite this article: Ding DC, Chu TY, Hong MK. Hysterectomy and ovarian cystectomy using natural orifice transluminal endoscopic surgery: An initial experience at Tzu Chi General Hospital. Tzu Chi Med J 2017;29:208-12.

Access this article online

Quick Response Code:

Website: www.tcmjmed.com

DOI: 10.4103/tcmj.tcmj_127_17

surgeries. Prophylactic parenteral cefazolin was administered 1 h preoperatively.

Surgical techniques

The patients received general anesthesia with endotracheal intubation. They were placed in the Trendelenburg position with their legs supported in stirrups. Urine was drained by an indwelling 12Fr Foley catheter. The surgical procedures were carried out as follows:

Hysterectomy

Indications for hysterectomy included myoma, adenomyosis, and CIS of the cervix.

The cervix was circumcised using a cold knife. Both anterior and posterior colpotomy were then performed, as in conventional vaginal surgery. After exposing the extraperitoneal space along with broad, cervical, and uterosacral ligaments, a bipolar vessel sealer (Ligasure, Covidien, Boulder, CO, USA) was used to clamp and divide. Then, we established the vaginal channel for endoscopy by applying an Alexis wound retractor (Applied Medical Resources Corp., Rancho Santa Margarita, CA, USA) in the vaginal cavity [Figure 1a]. One 10 mm and two or three 5 mm cannulas were inserted through the fingers of a surgical glove [Figure 1b]. A 5 mm, 30° endoscope (Karl Storz, Tuttlingen, Germany) and a 5 mm bipolar Ligasure system (Covidien) were used for the surgery. After adequate pneumoperitoneum, the endoscope was inserted and then the bilateral broad ligament and uterine vessels were identified, followed by coagulation and cutting. Then, using one grasper, we grabbed the cervix [Figure 1c], cut the left side uterine vessels [Figure 1d], broad ligament [Figure 1d], ovarian ligaments [Figure 1e], and fallopian tube sequentially [Figure 1f]. Then, the procedures were repeated on the right side. After cutting all the pedicles, the uterus was removed through the vagina.

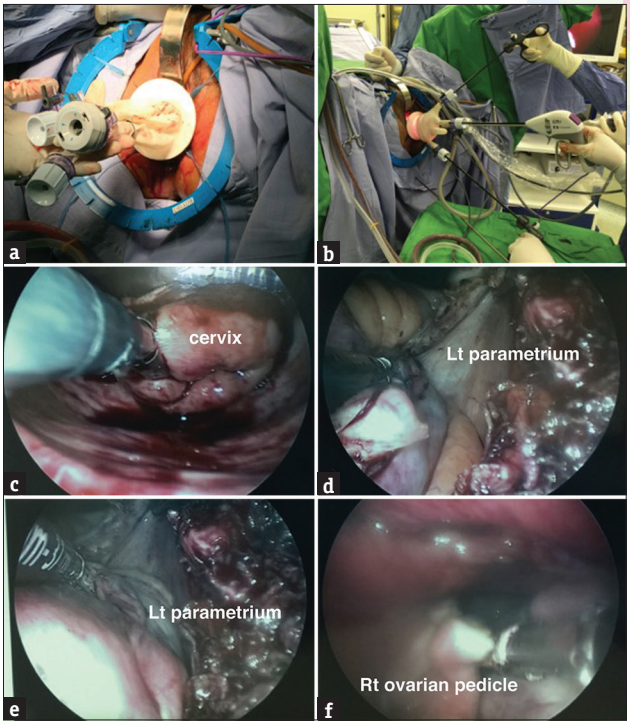

Figure 1: Natural orifice transluminal endoscopic surgery operative images in a hysterectomy. (a) Transvaginal natural orifice transluminal endoscopic surgery portal. The anterior and posterior colpotomy was protected by an Alexis wound retractor. (b) A surgical glove with four cannulas attached was draped into the retractor. (c) Exploring the uterine cervical region. (d and e). Exploring the left parametrial space and cutting the uterine artery. (f) Exploring the right parametrial space and cutting the right ovarian pedicle

Ovarian cystectomy

The indication for ovarian cystectomy (OC) was ovarian teratoma. The mass diameter of the teratomas was 4.8 and 5.0 cm.

The procedures at the beginning of the operation were a little different from those for the hysterectomy. Only a posterior colpotomy was performed. Then, an Alexis wound retractor with a glove insertion of one 10 mm and two or three 5 mm trocars was inserted into the cul-de-sac. After establishing an adequate pneumoperitoneum, a 30° endoscope and two conventional 5 mm laparoscopic instruments were inserted into the pelvic cavity. The uterus and bilateral adnexa were then inspected. During enucleation of the ovarian cyst, we first used scissors to cut the ovarian surface [Figure 2a]. Then, we used one grasper to grab the surface epithelium and cut the inner surface of ovarian epithelium with scissors to enucleate the ovarian tumor [Figure 2b]. The specimens were removed by detaching the surgical glove through the colpotomy wound. The surgical glove was reattached to the wound retractor to check for bleeding. The colpotomy wound was then closed using 1-0 vicryl (Ethicon, Somerville, NJ, USA).

Visual analog scale (VAS) pain scores were measured at 2, 24, and 48 h postoperatively. Nonsteroidal anti-inflammatory drugs were prescribed for 24 h routinely. Vaginal intercourse was prohibited for 1 month. Patients returned to the clinic at 1 week, 1 month, and 6 months after surgery for follow-up.

Statistical analysis

Continuous variables are presented as the means ± standard deviation. Descriptive statistics were calculated by SPSS software (version 20, IBM-SPSS, Inc., Chicago, IL, USA).

Results

From September to December 2016, six patients undergoing transvaginal NOTES were enrolled in this study. Tables 1 and 2 list the patient data, surgical outcomes, and pain scores of the patients who underwent OC and hysterectomy, respectively. Their mean ages were 35 and 49 years and body mass indexes

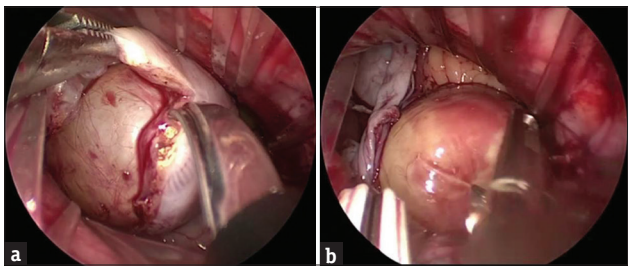

Figure 2: Natural orifice transluminal endoscopic surgery operative images in an ovarian cystectomy. (a) Dissecting the ovarian surface epithelium out of the ovarian teratoma. (b) Complete dissection of the ovarian cyst

Table 1: Data of patients who had natural orifice transluminal endoscopic surgery for ovarian cystectomy

Patient	1	2
Age (year)	46	24
BMI	20.3	29.9
Mass diameter (cm)	4.6	5
Parity	1	0
Surgery	OC	OC
Pathology	Teratoma	Teratoma
Blood loss (mL)	50	50
Fever	No	No
Operative time* (min)	58	90
Hospital stay* (days)	4	3
VAS pain score (2 h)	4	6
VAS pain score (24 h)	2	2
VAS pain score (48 h)	0	0

BMI: Body mass index, VAS: Visual analog scale, OC: Ovarian cystectomy

Table 2: Data of patients who had natural orifice transluminal endoscopic surgery for hysterectomy

Patient	1	2	3	4	Mean±SD
Age (years)	59	61	46	30	49±14.3
BMI	27.3	28.9	23.3	32.1	27.9±3.7
Mass diameter (cm)	6	6	10	8	7.5±1.9
Parity	3	3	2	2	2.5±0.6
Surgery	VH	VH	VH	VH	
Pathology	CIS of cervix	Myoma	Myoma	Adenomyosis	
Additional surgery				Adhesiolysis	
Blood loss (mL)	50	50	150	100	87.5±47.9
Fever	No	No	No	Yes	
Operative time (min)	100	60	70	70	75±17.3
Hospital stay (days)	4	4	4	4	4±0.0
VAS pain score (2 h)	4	2	2	2	2.5±1.0
VAS pain score (24 h)	3	0	2	2	1.75±1.3
VAS pain score (48 h)	0	0	0	0	0±0.0

SD: Standard deviation, BMI: Body mass index, VAS: Visual analog scale, VH: Vaginal hysterectomy

were 25 and 27 in the OC and hysterectomy groups, respectively. One patient who had an OC was nulliparous, and one who had a hysterectomy was multiparous without a history of vaginal delivery. One patient in the hysterectomy group had a history of abdominal surgeries including cesarean section and several laparotomies.

Transvaginal NOTES was completed in every patient without conversion to conventional laparoscopy or laparotomy. The mean surgical times were 74 and 75 min and blood loss was 50 and 87.5 ml in the OC and hysterectomy groups, respectively. One patient with a hysterectomy had a postoperative fever with 38°C last for 2 days. There were no blood transfusions in either group. The mean hospital stays were 3.5 days in the OC group and 4 days in the hysterectomy group.

- Pain scores were 0 at 48 h postoperatively in both groups
- All patients had good healing of the vaginal cuff on follow-up examinations at 1 week and 1 month postoperatively.

Discussion

NOTES hysterectomy or OC is feasible for women with benign uterine or ovarian tumors needing surgery. It has advantages that conventional vaginal hysterectomy does not offer, such as an endoscopic view and laparoscopic instruments.

The feasibility and safety of NOTES in gynecological hysterectomy and OC have been reported [2-5,15,16]. Tables 3 and 4 list previous studies of NOTES OC and hysterectomy and compare them with the present study.

Lee *et al*. reported that one patient with an OC among five patients who had NOTES adnexal surgery had an operative time of 64 min and blood loss of 20 mL [15] [Table 3]. Later, they reported that four patients with OC among ten patients receiving NOTES adnexal surgery had operative times of 64–162 min and blood loss of <50 mL [5]. Wang *et al*. compared 34 patients receiving NOTES OC with 243 women receiving laparoscopic ovarian cystectomy (LOC) [3]. They found operative times and hospital stays were shorter in NOTES ovarian cystectomy than LOC. Blood loss was <50 mL in both groups, similar to that in our patients. The operative times in our two patients were 58 and 90 min and the hospital stays were 3 and 4 days.

Lee *et al*. reported their initial experience with NOTES hysterectomy in 16 patients [16]; the mean operative time was 122.7 min and mean blood loss was 379 mL [Table 4]. They further reported their experience with NOTES hysterectomy in 137 patients; the operative time was shortened to 88.2 min and blood loss decreased to 257 mL [4]. In our study, the mean operative time was 74.7 min and mean blood loss was 75 mL. The blood loss was less than in other reports. The size and weight of the uterus may affect the degree of blood loss and length of surgery. The mean uterine size (the longer diameter) in our study was 7.5 cm. However, we did not measure the uterine weight. Therefore, comparison of these two parameters with other studies would not be possible.

NOTES is not contraindicated in patients without a history of vaginal delivery. In this study, we performed NOTES in one nulliparous woman and one woman without a history of vaginal delivery. The surgical times were 70 and 90 min in these cases. The absence of vaginal delivery does not seem to increase surgical time. NOTES, nevertheless, may carry a risk of infection, visceral organ injury, dyspareunia, and spread of tumor contents [5,17]. None of our six patients had infections or dyspareunia, similar to a previous report [18]. These risks can be compensated for by the good cosmetic outcomes with NOTES [5,17].

Severe adhesions in the cul-de-sac could be a contraindication to NOTES because of the potential for rectal injury when entering the cul-de-sac [15]. A pelvic examination should be performed before surgery to prevent rectal injury. Moreover, abdominal computed tomography (CT) also can also be used for preoperative evaluation. CT can demonstrate if intestines adhere to the uterus and there is obliteration of the cul-de-sac.

Single-port laparoscopy has become popular recently as shown in several reports by Kim *et al*. [10-14,19,20]. Their results showed superior cosmetic outcomes compared with conventional laparoscopy. Yang *et al*. noted shorter operative

Table 3: Studies of natural orifice transluminal endoscopic surgery ovarian cystectomy

Report	Year	Patient number	Mean operative time (min)	Blood loss (mL)	Hospital stay (days)	VAS pain score	Remarks
Wang *et al*. [3]	2016	34	93.2	31.6	4	N/A	
Lee *et al*. [5]	2012	10	100	50	4	N/A	
Lee *et al*. [15]	2012	5	64	50	4	N/A	
Van Peer and Baekelandt *et al*. [27]	2015	5	33	36	N/A	2 (12 h)	Salpingectomy only
Present study	2017	2	74	50	4	2 (24 h)	

VAS: Visual analog scale, N/A: Not available

Table 4: Previous studies regarding natural orifice transluminal endoscopic surgery hysterectomy

Report	Year	Patient number	Mean operative time (min)	Blood loss (mL)	Hospital stay (days)	VAS pain score
Yang *et al*. [21]	2014	16	93.2	201	4	N/A
Wang *et al*. [2]	2015	147	78.5	191	2.1	N/A
Su *et al*. [16]	2010	16	122.7	379	2.8	N/A
Lee *et al*. [15]	2012	10	93.4	245	2.7	N/A
Lee *et al*. [4]	2014	137	88.2	257.7	3	N/A
Baekelandt [28]	2015	10	97	Hb drop 1.5 g/dL	3	1.7 (24 h)
Present study	2017	4	75	87.5	4	1.7 (24 h)

VAS: Visual analog scale, Hb: Hemoglobin, N/A: Not available

times and hospital stays with NOTES compared with single-port laparoscopy [21]. NOTES also resulted in much better cosmetic outcomes than single-port surgery. The scarless abdominal wall is an advantage of NOTES.

The advantages of single-port laparoscopy include less postoperative pain, and thus less pain control is needed than with conventional multiport laparoscopy [14,22]. Hong *et al*. reported VAS pain scores of 5.6, 3.7, and 2.2 at 1, 24, and 48 h, respectively, in LESS hysterectomy [14]. In our present study, the pain scores with NOTES were much lower, at 3.3, 1.8, and 0 at 2, 24, and 48 h, respectively. Lack of an abdominal wound with NOTES may explain the lower pain scores compared with LESS.

In addition to hysterectomy and OC, NOTES may also be applied to myomectomy and staging surgery [23,24]. However, only three cases of each surgery have been reported. Large trials are needed to prove the value of NOTES in these types of surgery.

One limitation of this study was the small case number. However, this case series was the initial experience in our hospital. We hope to collect more cases in the future.

Conclusion

NOTES surgery can be feasibly and safely performed in gynecologic patients with benign pathology of the ovary and uterus. As the approach from the vagina cavity is difficult in ovarian surgery, NOTES surgery could have advantages compared with pure vaginal surgery. Less pain and better cosmetic outcomes were noted in NOTES surgery. Nulliparous patients and those with no history of a vaginal delivery can receive NOTES. Obliteration of the cul-de-sac can hamper the procedure. A prospective controlled and randomized clinical trial is needed to elucidate the feasibility and safety of NOTES [25,26].

Acknowledgment

We thank Dr. Jon-Son Kuo for English editing of the manuscript.

Financial support and sponsorship

This work was financially supported by grants from the Intramural Research Project of Buddhist Tzu Chi General Hospital (TCRD 105-14).

Conflicts of interest

There are no conflicts of interest.

References

1. Kalloo AN, Singh VK, Jagannath SB, Niiyama H, Hill SL, Vaughn CA, et al. Flexible transgastric peritoneoscopy: A novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. Gastrointest Endosc 2004;60:114-7.
2. Wang CJ, Huang HY, Huang CY, Su H. Hysterectomy via transvaginal natural orifice transluminal endoscopic surgery for nonprolapsed uteri. Surg Endosc 2015;29:100-7.
3. Wang CJ, Wu PY, Kuo HH, Yu HT, Huang CY, Tseng HT, et al. Natural orifice transluminal endoscopic surgery-assisted versus laparoscopic ovarian cystectomy (NAOC vs. LOC): A case-matched study. Surg Endosc 2016;30:1227-34.
4. Lee CL, Wu KY, Su H, Wu PJ, Han CM, Yen CF, et al. Hysterectomy by transvaginal natural orifice transluminal endoscopic surgery (NOTES): A series of 137 patients. J Minim Invasive Gynecol 2014;21:818-24.
5. Lee CL, Wu KY, Su H, Ueng SH, Yen CF. Transvaginal natural-orifice transluminal endoscopic surgery (NOTES) in adnexal procedures. J Minim Invasive Gynecol 2012;19:509-13.
6. Moen MD, Noone MB, Elser DM, Urogynecology N. Natural orifice hysterectomy. Int Urogynecol J Pelvic Floor Dysfunct 2008;19:1189-92.
7. ACOG committee opinion no 444: Choosing the route of hysterectomy for benign disease. Obstet Gynecol 2009;114:1156-8.
8. Wu JM, Wechter ME, Geller EJ, Nguyen TV, Visco AG. Hysterectomy rates in the united states, 2003. Obstet Gynecol 2007;110:1091-5.
9. Wu MP, Huang KH, Long CY, Tsai EM, Tang CH. Trends in various types of surgery for hysterectomy and distribution by patient age, surgeon age, and hospital accreditation: 10-year population-based study in taiwan. J Minim Invasive Gynecol 2010;17:612-9.
10. Ding DC, Chang YH. Laparoendoscopic single-site surgical cystectomy of a twisted ovarian dermoid cyst during early pregnancy: A case report and literature review. Gynecol Minim Invasive Ther 2016;5:173-7.

11. Ding DC, Hong MK, Chu TY, Chang YH, Liu HW. Robotic single-site supracervical hysterectomy with manual morcellation: Preliminary experience. World J Clin Cases 2017;5:172-7.
12. Hong MK, Chu TY, Ding DC. Two-phase laparoendoscopic single-site cervical ligament-sparing hysterectomy: A novel approach in difficult laparoscopic hysterectomy. Taiwan J Obstet Gynecol 2016;55:423-6.
13. Hong MK, Ding DC. Seprafilm® application method in laparoscopic surgery. JSLS 2017;21. pii: e2016.00097.
14. Hong MK, Wang JH, Chu TY, Ding DC. Laparoendoscopic single-site hysterectomy with Ligasure is better than conventional laparoscopic assisted vaginal hysterectomy. Gynecol Minim Invasive Ther 2014;3:78-81.
15. Lee CL, Wu KY, Su H, Wu PJ, Han CM, Wang CJ, et al. Natural orifice transluminal endoscopic surgery in gynecology. Gynecol Minim Invasive Ther 2012;1:23-6.
16. Su H, Yen CF, Wu KY, Han CM, Lee CL. Hysterectomy via transvaginal natural orifice transluminal endoscopic surgery (NOTES): Feasibility of an innovative approach. Taiwan J Obstet Gynecol 2012;51:217-21.
17. Thele F, Zygmunt M, Glitsch A, Heidecke CD, Schreiber A. How do gynecologists feel about transvaginal NOTES surgery? Endoscopy 2008;40:576-80.
18. Zornig C, Mofid H, Siemssen L, Emmermann A, Alm M, von Waldenfels HA, et al. Transvaginal NOTES hybrid cholecystectomy: Feasibility results in 68 cases with mid-term follow-up. Endoscopy 2009;41:391-4.
19. Kim TJ, Lee YY, Kim MJ, Kim CJ, Kang H, Choi CH, et al. Single port access laparoscopic adnexal surgery. J Minim Invasive Gynecol 2009;16:612-5.
20. Wu MY, Ding DC, Chu TY, Hong MK. Contain before transection, contain before manual morcellation with a tissue pouch in laparoendoscopic single-site subtotal hysterectomy. Gynecol Minim Invasive Ther 2016;5:178-81.
21. Yang YS, Kim SY, Hur MH, Oh KY. Natural orifice transluminal endoscopic surgery-assisted versus single-port laparoscopic-assisted vaginal hysterectomy: A case-matched study. J Minim Invasive Gynecol 2014;21:624-31.
22. Kim SM, Park EK, Jeung IC, Kim CJ, Lee YS. Abdominal, multi-port and single-port total laparoscopic hysterectomy: Eleven-year trends comparison of surgical outcomes complications of 936 cases. Arch Gynecol Obstet 2015;291:1313-9.
23. Lee CL, Huang CY, Wu KY, Hu YF, Yen CF, Han CM. Natural orifice transvaginal endoscopic surgery myomectomy: An innovative approach to myomectomy. Gynecol Minim Invasive Ther 2014;3:127-30.
24. Lee CL, Wu KY, Tsao FY, Huang CY, Han CM, Yeh CF, et al. Natural orifice transvaginal endoscopic surgery for endometrial cancer. Gynecol Minim Invasive Ther 2014;3:89-92.
25. Baekelandt J, Mulder PAD, Roy IL, Mathieu C, Laenen A, Enzlin P, et al. HALON—hysterectomy by transabdominal laparoscopy or natural orifice transluminal endoscopic surgery: A randomised controlled trial (study protocol). BMJ Open 2017;6:e011546.
26. Baekelandt J, De Mulder PA, Le Roy I, Mathieu C, Laenen A, Enzlin P, et al. Postoperative outcomes and quality of life following hysterectomy by natural orifice transluminal endoscopic surgery (NOTES) compared to laparoscopy in women with a non-prolapsed uterus and benign gynaecological disease: A systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol 2017;208:6-15.
27. Van Peer S, Baekelandt J. Natural orifice transluminal endoscopic surgery (NOTES) salpingectomy for ectopic pregnancy: A first series demonstrating how a new surgical technique can be applied in a low-resource setting. Gynecol Surg 2015;12:299-302.
28. Baekelandt J. Total vaginal NOTES hysterectomy: A New approach to hysterectomy. J Minim Invasive Gynecol 2015;22:1088-94.