

Vaginal NOTES Retroperitoneal-Approach Hysterectomy (VNOTES RA-H): 12 Case Series-Surgical Techniques and Outcomes

Yantapant A, MD¹, Roekyindee R, MD¹

¹ Unit of Gynecologic Endoscopy, Department of Obstetrics and Gynecology, Rajavithi Hospital, College of Medicine, Rangsit University, Bangkok, Thailand

Background: Natural Orifice Transluminal Endoscopic Surgery-Assisted Vaginal Hysterectomy (tVNOTEH) is a scarless surgery from which patients can recover quickly and experience alleviated post-operative pain. The most popular form of this surgical technique is the intraperitoneal approach because it is easy and fast; however, it is difficult in single nulliparous patients with high undescended uterus and may, especially in cases of obliterated cul de sac, result in more injury to the vagina than is normal in the multiparous group. The retroperitoneal approach is introduced as an alternative in vaginal NOTES retroperitoneal approach-hysterectomy (VNOTES RA-H) in order to reduce vaginal injury and blood loss, decrease intra-abdominal gas volume, and lower the risk of internal organ injury.

Objective: To describe vaginal hysterectomy in 12 patients via the retroperitoneal approach.

Materials and Methods: VNOTES RA-H was performed in 12 patients who fulfilled the indications for hysterectomy. No patient had contraindications for laparoscopic surgery, and therefore all were included in the study. Patients' indications were as follows: 3 uterine myomas; 3 adenomyoses; 2 endometrial intraepithelial neoplasias (EIN); 2 submucous myomas; and 2 ovarian teratoma tumors. General information such as operative time (min), estimated blood loss (ml), pain, and the amount of gas used (liters) were recorded and analyzed.

Results: Mean operative time was 147.91±62.4 min (range 90 to 280 min); average blood loss was 291.67±214.89 ml (50 to 700 ml); median gas volume was 260.83 liters (60 to 687 liters); median abdominal pain was 2 (range 0 to 6); median shoulder pain was 0 (range 0 to 7); and median vaginal pain was 0 (range 0 to 3). One patient was readmitted due to stump infection and received intravascular antibiotics.

Conclusion: The results of VNOTES RA-H compared to the intraperitoneal approach showed no significant difference in terms of operative time, estimated blood loss or pain. Operative complications were resolved, and this technique is safe for appropriately selected patients.

Keywords: Retroperitoneal approach, Vaginal NOTES, RA-Hysterectomy, VNOTES RA-H

J Med Assoc Thai 2019;102(Suppl4):137-43

Website: <http://www.jmatonline.com>

Hysterectomy is performed to treat gynecological diseases in cases of uterine myomas, abnormal uterine bleeding, endometrial cancer, cervical cancer, adenomyosis, ovarian cyst and potentially cancerous tumors, as indicated in the uterine surgical guidelines⁽¹⁾. Hysterectomy has been used and developed for over 100 years, starting from conventional open techniques. The advantages of the conventional open technique are that it supplies good operative field and is easy to perform; however, it leaves a painful scar and cosmetic defects after surgery.

Recently, laparoscopic surgery has been used to replace the open technique. The first laparoscopic hysterectomy (LH) was performed in January 1988 by Harry Reich in Pennsylvania⁽²⁾. This surgery leaves a small wound size approximately of 5 to 10 mm and it can be used for both benign and malignant tumors with no difference in treatment results. The advantages of laparoscopic surgery are its smaller wound, reduced pain, and faster recovery period while the drawbacks are that it requires time to train the operators, demands good teamwork, and utilizes more expensive instruments⁽³⁾.

A recent development of hysterectomy is single-site surgery which has the benefit of leaving fewer wounds; moreover, it enables tumors to be removed easily through a large wound, and has the additional advantage of hiding the scar under the umbilical area. Unfortunately, this technique limits the maneuverability of instruments through a single channel, making surgery difficult; nevertheless, the outcomes

Correspondence to:

Yantapant A.

Department of Obstetrics and Gynecology, Rajavithi Hospital, 2 Phayathai Road, Ratchathawi, Bangkok 10400, Thailand.

Phone: +66-2-3548108 ext.3226

E-mail: yaranya@hotmail.com

How to cite this article: Yantapant A, Roekyindee R. Vaginal NOTES Retroperitoneal-Approach Hysterectomy (VNOTES RA-H): 12 Case Series-Surgical Techniques and Outcomes. J Med Assoc Thai 2019;102(Suppl4):137-43.

of single-site surgery are comparable to those of conventional laparoscopic surgery⁽⁴⁾. In 2005, a white paper described the use of a camera to assist in natural orifice transluminal endoscopic surgery (NOTES). This is a non-invasive procedure performed outside the body. The Natural Orifice Surgery Consortium for Assessment and Research (NOSCAR) was established by the American Society for Gastrointestinal Endoscopy (ASGE) and the Society of American Gastrointestinal & Endoscopic Surgeons (SAGES) to carry out research on NOTES in terms of its procedures, advantages, disadvantages, and complications that may occur, as well as safety issues⁽⁵⁾.

In 2012, Su H et al⁽⁶⁾ reported sixteen cases of the use of vaginal hysterectomy by transvaginal NOTES hysterectomy (tvNOTEH) and demonstrated its safety in non-cancer gynecological diseases, concluding that vaginal hysterectomy was safe.

In 2014, Baekelandt J⁽⁷⁾ further developed vaginal hysterectomy using a camera at the beginning of surgery (Total vaginal NOTES Hysterectomy: TVNHs) in 10 patients. There were no complications, the procedure involved little or no pain, and it reduced the risk of trocar injury to abdominal wounds. All the above-mentioned advantages and disadvantages of transvaginal vaginal NOTES hysterectomy, (tvNOTEH) have been noted in several reports. At the same time, Lee CY⁽⁸⁾ reported that robot-assisted NOTES hysterectomy can be performed in uterine surgery without any complications. The advantage of this technique is that it facilitates stopping bleeding in deep positions, but the equipment is not difficult to use.

As a result of these studies, there have been various developments in NOTES, but it is difficult to perform in cases of obliterated cul de sac, nulliparous patients, and high undescended uterus. In order to reduce the number of steps in vaginal hysterectomy and lower the amount of gas in the abdomen, the present study used a camera during the first stage of the surgery and reached the abdomen in a short time. This is known as the Transvaginal NOTES Retroperitoneal Approach Hysterectomy (VNOTES RA-H). It will make vaginal NOTES hysterectomy easier to perform, reduce blood loss and also lower the amount of gas used during surgery. In the present study, the compared its feasibility, safety, and levels of postoperative pain with those of the traditional approach.

Materials and Methods

The patients indicated for hysterectomy were enrolled at the gynecologic out-patient department at Rajavithi Hospital, from March 1st 2018 to June 30th 2018. Patients included were women who were between >20 to 65 years old, had uterine size ≤20 weeks and had given consent. Patients were excluded if they had thrombocytopenia, had been diagnosed as having endometriotic cyst, had chronic pelvic inflammatory disease, history of deep vein thrombosis, history of colon resection, suspected cancer in the reproductive system, or suspected gastrointestinal cancer.

The study was approved by the Ethics Committee

of Rajavithi Hospital (196/25561). All patients received an explanation about the surgery and signed consent forms. They underwent surgery from expert physicians.

Surgical techniques

1) Opening vaginal wall and developing pelvic retroperitoneal space.

First, patients had a catheter inserted into the urinary bladder, after which anterior and posterior retractors of the appropriate size were applied to stretch the vagina. Two tenaculums were then used to catch the cervix at 11 & 7 o'clock and 1 & 5 o'clock in order to pull down the vagina, and 20 ml of normal saline were injected into the mucosa and submucosa of the uterine cervix. A monopolar hook was used to cut the vaginal mucosa around the cervix into a 360-degree angle, and the vaginal flap was opened. Fingers were used to separate the avascular spaces of the pelvis and retroperitoneal structures.

2) Expanding wound equipment (a wound retractor) was applied and the pelvis was extended using Allis forceps on the anterior and posterior sides of the vaginal flaps. A wound retractor was then placed and trocars were used to make holes sized 10 mm. in the first channel and 5 mm. for the second and third channels (Figure 1). Carbon dioxide was released under the peritoneum in the pelvic area with gas pressure of less than 15 mmHg, and a flow rate of less than 20 liters per minute which did not pass through the abdomen. The retroperitoneal space and structures were then identified (Figure 2, 3).

3) NOTES retroperitoneal surgery of the caudal

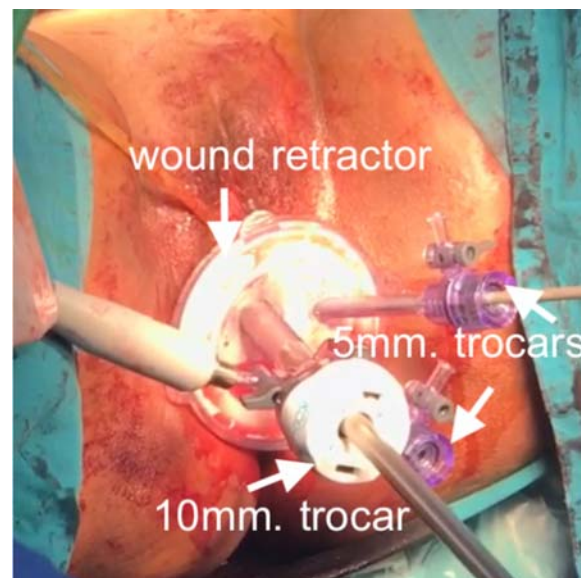


Figure. 1 Wound retractor was placed, and three trocars were inserted at the cap of the wound retractor.

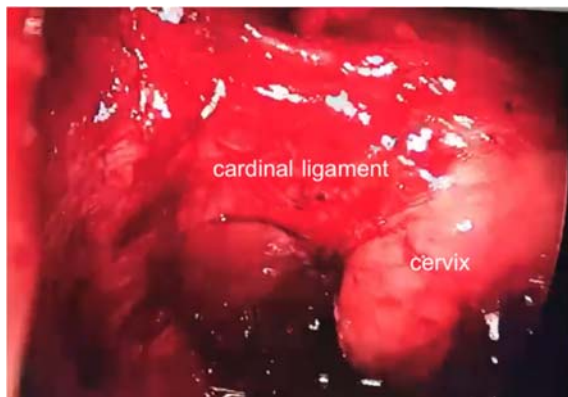


Figure. 2 After the wound retractor had been fixed, retroperitoneal space was inspected under an endoscope. This picture shows the right cardinal ligament and the cervix.

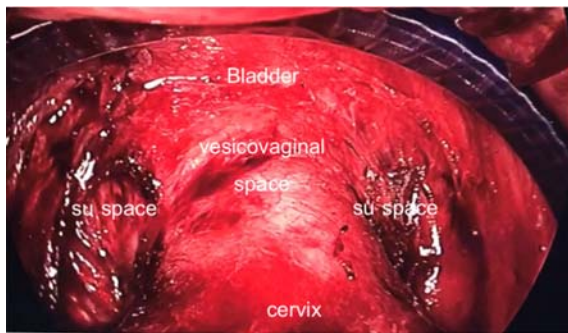


Figure. 3 Retroperitoneal spaces and structures were identified.

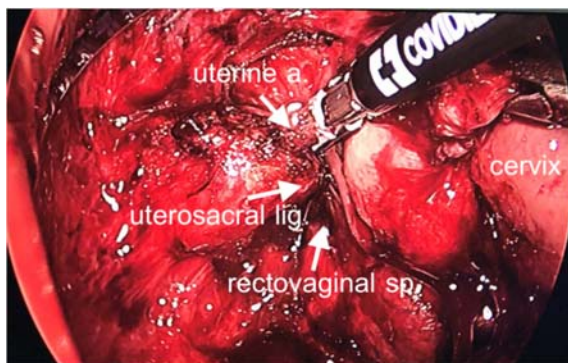


Figure. 4 After the right cardinal ligament had been cut, the right uterine artery was identified above the right uterosacral ligament. Rectovaginal space was identified between the vagina and rectum.

part of uterus was performed as follows:

A. Cardinal ligaments were identified and cut.

B. Uterosacral ligaments were cut (Figure 4).

C. Uterine blood vessels were cut using vascular sealing (Figure 4).

D. Vesicovaginal space was identified in order to find anterior cul de sac.

E. Rectovaginal space was identified in order to find the posterior cul de sac.

4) Posterior colpotomy was performed under endoscope.

Lower hysterectomy was started by opening the posterior cul de sac using the posterior colpotomy technique through the rectovaginal septum (Figure 5) and opening the anterior cul de sac with the anterior colpotomy technique through the anterior cul de sac and vesicovaginal space in

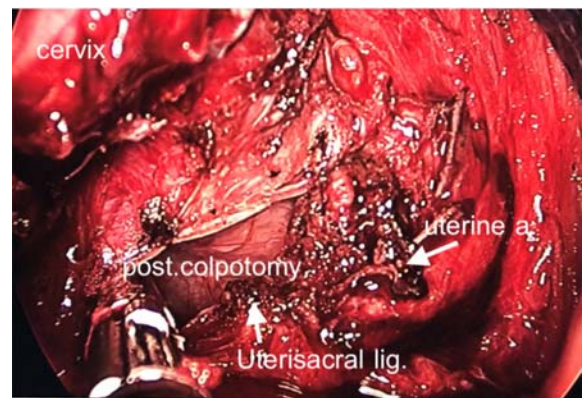


Figure. 5 Posterior colpotomy was performed between both uterosacral ligaments after uterine arteries were coagulated and cut under the scope.



Figure. 6 Anterior colpotomy was performed under the scope after vesicovaginal space had been identified.

order to enter the abdomen (Figure 6). After that, upper hysterectomy was performed.

5) NOTES intraperitoneal surgery of the cephalic part of the uterus was performed (Figure 7). Ovarian ligaments, both round and infundibulopelvic, were identified and cut. After the uterus had been removed from the vagina, bleeding was stopped and the vaginal wall was repaired with Vicryl 1-0 under endoscopy.

Treatment protocols

In the present study, patients who satisfied the eligibility criteria were selected from the outpatient clinic of Rajavithi Hospital between March 1st and June 30th 2018. All patients, regardless of whether they met the inclusion criteria or not, were counseled on the new technique of vaginal hysterectomy with RA-Hysterectomy. Twelve agreed to undergo this technique and signed consent forms.

On the day of surgery, the patients fasted (NPO) for 6 to 8 hours before the operation, and they were given intravenous (IV) fluid at least three hours before surgery. All patients received Cefazolin 1 g and IV metronidazole 500 mg to prevent infection in the operating room. In cases of penicillin allergy, gentamicin 240 mg in 100 ml of 5% dextrose in water was administered 1 hour before and 1 hour after surgery. The operation was performed under general anesthesia, and it was recorded. Significant data were collected during the operation such as anesthesia, amount of gas used, blood loss, surgical time, blood supply and complications. Postoperative pain data using Visual Analog Scale (VAS) were collected on the first day of the surgery, and then seven days and two months after surgery⁽⁹⁾.

Data analysis

Patient demographic data were recorded and analyzed (including BMI, number of births, sex, abdominal

surgical history, and congenital disorders) together with surgical details regarding postoperative information (including diagnosis, type of surgery, blood loss, amount of gas used, operative time, pain score, sexual onset, pain when having sex, and peri/postoperative complications). The IBM SPSS statistics version 22.0 was for calculations. The data were presented as numbers with percentage, mean with standard deviation (SD), median with minimum (min) and maximum (max).

Results

Twelve patients underwent hysterectomy with the NOTES RA-Hysterectomy technique. Their average age was 44.58 ± 6.09 years, three were nulliparous, and the others were multiparous. Average BMI was 24.56 ± 5.04 kg/m². Cesarean delivery had been performed on four of the women, one of whom had given birth by this method once before, and five women had had vaginal deliveries. Four had a history of abdominal surgery: two were cases of ovarian cystectomy, one of myoma uteri, and another of sterilization (Table 1).

No patient undergoing RA-Hysterectomy had any major complications during their operation. One patient had blood loss of 700 ml and received a blood transfusion of 450 ml during surgery. This case was difficult to perform because she had pelvic adhesion and had a history of sterilization after birth. The uterus and tumor weighed 500 g, and gas used was 255 ml. Postoperative pain occurred on the first day. Pain score in shoulder, abdomen and pelvis were zero score at follow-up on the seventh day and two months after surgery. Twenty-four hours after surgery, four patients had pain in the shoulder (Figure 8). One case with BMI 36 kg/m² had VAS level 7 and received CO₂ 751 ml. Of the remaining three cases, one had level 3 pain and required CO₂ 687 ml, and two cases had level 2. Amounts of CO₂ used were 85, 310, and 681 ml, respectively. With regard to abdominal pain 24 hours after surgery (Figure 9), seven cases had pain score levels of 1, 2, 3, and 6 (this was the same patient that had a shoulder pain score of 7). One case with uterus and submucous myoma weight of 406 g had vaginal pain score of 3 and two cases had vaginal pain score of 1 (Figure 10). Two patients had vaginal pain score 1: one had blood loss 500 ml during operation, and operative time 120 minutes while the other patient lost 450 ml of blood, and 751 ml of CO₂ was used with an operative time of 280 minutes.

With regard to postoperative pain 7 days and 2 months after surgery (Figure 8), none of the women experienced shoulder pain, but one patient who had 406 gm. uterus had abdominal pain score of 1. The other cases had abdominal pain score of 0 (Figure 9). At two-month postoperative follow-up, no patients were experiencing pain (Figure 8 to 10). The follow-up found that one patient had sex 8 weeks after surgery, but with pain. Another had sex 5 weeks after surgery and had no dyspareunia. The only complication encountered was bleeding during surgery (1 case), and this patient was given one blood unit. Another case had operative time of 4 hours and 40 minutes. There were two cases of surgical wound infection, one of which had

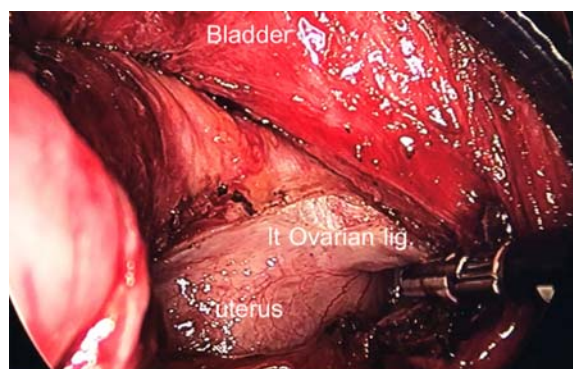


Figure. 7 After the caudal part of the uterus had been cut, anterior and posterior colpotomy were performed, and intra-abdominal organs were identified. This picture shows the left ovarian ligament.

Table. 1 Patient demographics for NOTES RA-Hysterectomy

Case No.	Age (years)	BMI (kg/m ²)	Nulliparous	Route of delivery (number)		Previous abdominal surgery	
				C/S	Vagina	Yes	No
1	41	25.64	/				/
2	46	20.94	/				/
3	40	19.81		1		/	
4	43	22.63			2		/
5	44	19.67		1			/
6	59	20.03	/				/
7	48	26.59			2	/	
8	34	36.00		2			/
9	50	26.25			4	/	
10	42	29.02			3	/	
11	43	28.37			3		/
12	45	19.77		2			/
Sum			3	4	5	4	8
Mean \pm SD	44.58 \pm 6.09	24.56 \pm 5.04					

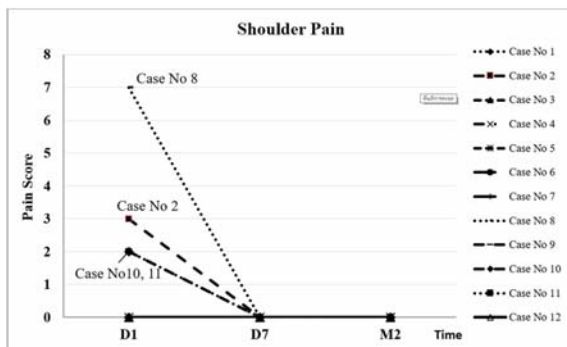


Figure. 8 Shoulder pain score (VAS) post-operative by NOTES RA-Hysterectomy.

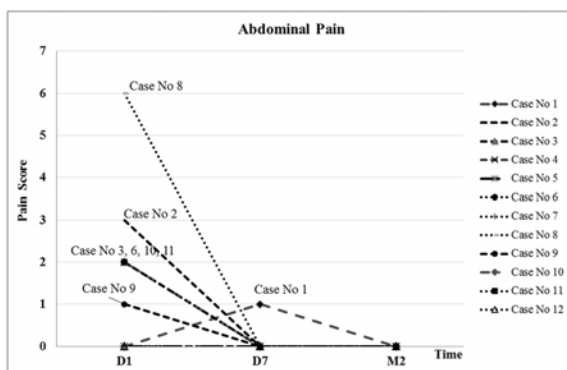


Figure. 9 Abdominal pain score (VAS) post-operatively after NOTES RA-Hysterectomy

to be admitted for disinfection.

Patients' pathologic results after surgery revealed

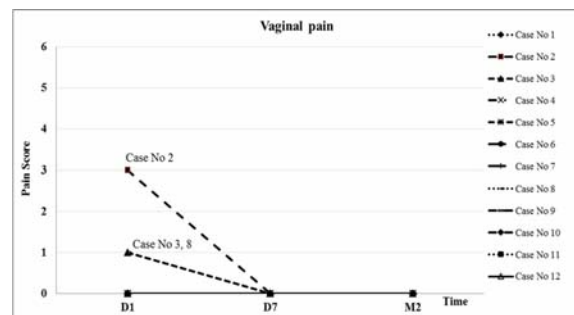


Figure. 10 Vaginal pain score (VAS) post-operatively after NOTES RA-Hysterectomy.

that there were 2 submucous myomas, 2 intramural myomas, 3 adenomyosises, 1 myoma with pelvic endometriosis, 1 dermoid cyst with endometrial intraepithelial neoplasia (EIN), 1 dermoid cyst with endometrial polyp, and 2 endometrial intraepithelial neoplasia (EIN) as shown in Table 2.

Comparison of patients' baseline and surgical data showed that 50 patients had conventional hysterectomy while 12 patients underwent the NOTES RA technique. The two groups' data were similar in terms of BMI, blood loss, operative time, uterine weight and abdominal pain score, as shown in Table 3.

Discussion

VNOTES RA-H, which was developed from NOTES vaginally-assisted hysterectomy, entails surgery below the pelvis first and then separating the organs under the peritoneum in the pelvis. It helps to solve problems which result from conventional surgery by applying laparoscopic techniques to assist from the very first stage of vaginal hysterectomy. Use of this technique renders a clearer

Table. 2 The vaginal NOTES RA-Hysterectomy

Case No.	Final diagnosis	Operative time (min)	Blood loss (ml)	Uterine weight (gm)	Residual urine (ml)	Hospital stay (days)	Gas volume (liters)
1	Submucous myoma	115	300	212	105	2	105
2	Submucous myoma	150	100	406	50	3	85
3	Myoma pelvic endometriosis	120	500	182	80	2	92
4	Adenomyosis hypermenorrhea	150	500	278	450	2	250
5	Left dermoid cyst	90	50	118	NA	2	60
6	Left dermoid cyst and endometrial polyp	100	50	56	100	2	235
7	intramural myoma	230	700	550	NA	2	255
8	Endometrial intraepithelial neoplasia	280	450	154	17	2	751
9	Endometrial intraepithelial neoplasia	100	200	142	Na	2	150
10	Adenomyosis	130	250	124	15	2	687
11	Adenomyosis	220	350	540	15	2	310
12	Intramural myoma	90	50	104	NA	2	150
	Mean \pm SD/median (min-max)	147.91 \pm 62.4/125 (90 to 280)	291.67 \pm 214.89/275 (50 to 700)	238.83 \pm 169.74	65 (15 to 450)	2 (2 to 3)	192.50 (60 to 751)

Table. 3 Comparison of patients who underwent vaginal hysterectomy via the conventional technique (NOTES IA-Hysterectomy) and those who had NOTES RA-Hysterectomy

	NOTES IA-hysterectomy (n = 50)	NOTES RA-Hysterectomy (n = 12)
Age (years)	47.26 \pm 6.70	44.58 \pm 6.09
Parity		
Nulliparous	17 (34)	3 (25)
Multiparous	33 (66)	9 (75)
Previous surgery		
Minor surgery	11 (22)	2 (16.7)
Major surgery	7 (14)	6 (50)
Diagnosis		
Adenomyosis	19 (38)	3 (25)
Myomas	24 (48)	4 (33.3)
Other (EIN, Ovarian cysts, etc)	6 (12)	4 (33.3)
Presence of Endometriosis	1 (2)	1 (8.3)
BMI (kg/m ²)	24.73 \pm 4.41	24.56 \pm 5.04
Blood loss (ml)	300 (30 to 1,500)	275 (50 to 700)
Operative time (min)	130 (80 to 325)	125 (90 to 280)
Uterine weight (gm)	197.62 \pm 118.92	238.83 \pm 169.74
Gas volume (liters)	NA	192.50 (60 to 751)
Should pain Day1	NA	0 (0 to 3)
Abdominal pain Day1	2 (0 to 6)	2 (0 to 3)
Vaginal pain day 1	NA	0 (0 to 3)
Stump infection (readmit)	0	1 (8.3)
Massive bleeding (\geq 1,000 ml)	2 (4)	0

Readmit = admission in first month after surgery

Values are represented as n (%), mean \pm SD, median (min-max)

view of the anatomy of the pelvis, making the procedure safer with less blood loss, and reducing injury to the bladder and intestine. During lower uterine surgery, it also separates the rectovaginal space, and this is useful in the case of adhesion between the vaginal wall and sigmoid colon, reducing the risk of injury to the latter. Another important aspect is that there is less CO₂ in the lower abdomen because the VNOTES RA-H technique uses a camera for lower abdominal surgery before allowing gas into the abdomen and performing upper abdominal surgery with the result that patients encounter less shoulder pain.

The 12 patients in this study who underwent VNOTES RA-H had mean age and BMI of 44.58 years and 24.56 kg/m² respectively, and childbirth occurred through both cesarean and vaginal delivery. Some cases had a history of previous abdominal surgery. The surgical data showed that mean operative time was 147±62.40 minutes (range 90 to 280 minutes) while SU et al reported an operative time for tVNOTEH of 122.7±17.6 minutes⁽⁶⁾, and Baekelandt J reported that the mean operative time using TVNHs was 97 minutes (range 60 to 120 minutes)⁽⁷⁾. The finding of VNOTES RA-H in the present study and tVNOTEH from SU were similar, but they were longer than that reported by Baekelandt J.

The VNOTES RA-H study found an average uterine weight of 238.83±169.74 gm (range 56 to 550 gm), which was less than in the tVNOTEH procedure where the average uterine weight was 538.8±102.9 gm⁽⁶⁾. Median blood loss during surgery was 275 ml (range 50 to 700 ml), comparable to tVNOTEH, and average blood loss was 379.4±95.4 ml⁽⁶⁾. Patients treated with VNOTES RA-H had median hospital stay of 2 days (range 2 to 3 days), while tVNOTEH had an average hospital stay of 2.8±0.2 days⁽⁶⁾.

The results in terms of postoperative pain score and morbidity in VNOTES RA-H showed that this technique was safe and resulted in less pain. The postoperative pain score was low and there were no adverse symptoms two months after surgery. With careful selection of patients and a longer learning curve, transvaginal retroperitoneal lymphadenectomy should be developed in the future.

What is already known on this topic?

Usually, the technique used in total vaginal NOTES hysterectomy (tVNOTEH) is the intra-peritoneal approach (IA). Su H. et al reported that the IA technique is a safe and feasible method for vaginal NOTES hysterectomy in selected patients⁽⁶⁾; however, no report had been made of the use of the retroperitoneal approach in vaginal NOTES hysterectomy.

What this study adds?

This study presents a method of vaginal endoscopic surgery using a pelvic retroperitoneal space approach leading to vaginal NOTES radical hysterectomy or vaginal NOTES radical trachelectomy. It can also serve as a guideline for vaginal NOTES lymphadenectomy and for the development of scarless surgery in other gynecologic oncologic procedures. This technique helps to solve problems in cases of severe pelvic adhesion between the lower uterine segment and the rectovaginal septum. The technique of rectovaginal space identification is the most common method used to deal with severe pelvic adhesion in both laparotomy and laparoscopic surgery. Researchers believe that this technique is beneficial for appropriately selected patients when carried out by well-trained operators to ensure that patients undergo surgery safely.

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Thompson JD, Birch HW. Indications of hysterectomy. *Clin Obstet Gynecol* 1981;24:1245-58.
2. Reich H, DeCaprio J, McGlynn F. Laparoscopic hysterectomy. *J Gynecol Surg* 1989;5:213-6.
3. Walsh CA, Walsh SR, Tang TY, Slack M. Total abdominal hysterectomy versus total laparoscopic hysterectomy for benign disease: a meta-analysis. *Eur J Obstet Gynecol Reprod Biol* 2009;144:3-7.
4. 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.
5. Rattner D, Kalloo A. ASGE/SAGES Working Group on Natural orifice transluminal endoscopic surgery. October 2005. *Surg Endosc* 2006;20:329-33.
6. 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.
7. Baekelandt J. Total vaginal NOTES hysterectomy: A new approach to hysterectomy. *J Minim Invasive Gynecol* 2015;22:1088-94.
8. Lee CL, Wu KY, Su H, Han CM, Huang CY, Yen CF. Robot-assisted natural orifice transluminal endoscopic surgery for hysterectomy. *Taiwan J Obstet Gynecol* 2015;54:761-5.
9. Haefeli M, Elfering A. Pain assessment. *Eur Spine J* 2006;15 Suppl 1:S17-S24.