Original Article

Comparison of Surgical Outcomes between Natural Orifice Transluminal Endoscopic Surgery for Hysterectomy and Conventional Total Laparoscopic Hysterectomy

Sawaek Weerakiet MD[1], Watcharada Uckara MD[1], Kakanang Soimongkol MD[1], Ratchanee Daungroedeeswas MD[2], Jutarmart Pongphonkit MD[2], Suporn Chanasabaeng BSc[3], Piyathida Sutjaritphong BNS, MPH[3]

[1] Department of Obstetrics and Gynecology, Bangkok Hospital Udon, Udonthani, Thailand

[2] Department of Anesthesiology, Bangkok Hospital Udon, Udonthani, Thailand

[3] Department of Nursing, Bangkok Hospital Udon, Udonthani, Thailand

Objective: To compare surgical outcomes between transvaginal natural orifice transluminal endoscopic surgery for hysterectomy (vNOTESH) and total laparoscopic hysterectomy (TLH) for the benign uterine diseases.

Materials and Methods: A retrospective review of electronic medical records of women that underwent vNOTESH between January 2019 and June 2020 (n=33) and TLH between June 2017 and August 2019 (n=33) in Bangkok Hospital Udon, Udonthani Province, Thailand was carried out. Measurement outcomes included operative time, estimated blood loss, intra- and post- operative complications, and post-operative pain assessment.

Results: One woman of the TLH group was excluded from the study because of severe adhesion. The mean age and BMI were not significantly different between the groups. There was no intra-operative complication in both groups. A median operative time was significantly shorter in the vNOTESH at 73 minutes (30 to 260 minutes than in the TLH at 140 minutes (75 to 296minutes), p<0.0001]. Post-operative pain scores were significantly less in the vNOTESH than in the TLH. In addition, the number of women who needed the added analgesics were significantly less in the vNOTESH than the TLH groups at 6.1% versus 46.9% (p=0.001), respectively. However, the amount of blood loss and post-operative complication were not significantly different between the two groups.

Conclusion: The present retrospective study demonstrated that the vNOTES is a feasible and safe procedure for hysterectomy in experienced hands and well-selected cases. This new technique is superior not only in taking less operative time and in achieving less postoperative pain, but also from the cosmetic aspect. Hence, it may be an alternative method for hysterectomy of the benign uterine diseases in the future.

Keywords: Hysterectomy; Natural orifice transluminal endoscopic surgery (NOTES); Surgical outcomes; Total laparoscopic hysterectomy

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Hysterectomy is one of the most common procedures in gynecologic surgery. Both abdominal and vaginal approaches for hysterectomy have been performed for a long time[1,2]. After the first report of laparoscopic hysterectomy (LH) in 1989[3], various techniques of LH have been developed including laparoscopic-assisted vaginal hysterectomy (LAVH), total laparoscopic hysterectomy (TLH), single-port LAVH (SP-LAVH), and robotic-assisted LH[4]. Each modality has its advantages and disadvantages and has different outcomes when compared among the modalities[1,4]. Up until now, there has been a trend of increasing LH performing and decreased in the abdominal hysterectomy (AH) and the vaginal hysterectomy (VH) since 2005 in some institutes[2].

Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) for hysterectomy (vNOTESH) has been performed for benign gynecologic disease for almost a decade[5-9]. This procedure is a combined technique of VH and the single-port laparoscopic surgery. Although advantages of VH have been confirmed, particularly shorter operative and recovery durations, several disadvantages have persisted, including 1) surgical difficulty and limitations due to large uterine size[10] and lower uterine segment scar from previous operations[11], and 2) restriction in adnexal evaluation[2]. Hence, VNOTESH seem to be a solution

Correspondence to:

Weerakiet S.

Bangkok Hospital Udon, 111 Thongyai Road, Mueang District, Udonthani Province 41000, Thailand.

Phone: +66-81-7320358

Email: sawaek.we@bgh.co.th

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to these problems. Furthermore, this procedure has no abdominal incision scar and risk of trocar-related complications resulting in good satisfaction of the patients.

Up to date, there have been many reports with a small sample size[5,7,12-15]. Some studies comparing the vNOTESH with other types of LH have been published[8,9,16-18]. Of these, a few studies comparing between the vNOTESH and the TLH have been reported[16,18]. However, there were contradicting results in surgical outcomes including operative time, amount of blood loss, and hospital stay among these comparative studies[8,9,16-18]. Therefore, the current study was aimed to compare surgical outcomes between the vNOTESH and the TLH.

Materials and Methods

The current study was a single-center, retrospective comparative one. Electronic medical records of women that underwent vNOTESH and TLH at Bangkok Hospital Udon, Udonthani Province Thailand, were reviewed. Thirty-three women that underwent vNOTESH between January 2019 and June 2020 were consecutively enrolled in the present study. In the controlled group, 33 women that underwent TLH were consecutively enrolled between June 2017 and August 2019. The operations of all women of both groups were performed by the same gynecologist (Weerakie S). Before surgery, all women were counseled regarding risks of bleeding during the operation resulting in receiving blood transfusion, the intra-and post-operative complications, and the conversion from vNOTESH to TLH in the vNOTESH group, and TLH to AH in the TLH group. In addition, the patients were informed that bilateral salpingectomy (BS) would be performed in addition to hysterectomy. An option for oophorectomy was also offered in women with ovarian pathology or age approaching menopause. The written informed consent forms were obtained from all women before surgery. The indications of hysterectomy were benign uterine diseases and precancerous disease of the cervix and of the endometrium. All women who underwent NOTESH had to have experience in sexual intercourse. Other inclusion criterion for both groups was having no pelvic adhesion assessed by pelvic examination such as no nodularity at the posterior cul-de-sac or a fixed uterus. Excluded after the enrollment were women who had uterine prolapse as stage III and IV uterine prolapse according to the Pelvic Organ Prolapse Quantification (POP-Q) measurement[19], severe adhesion found during the operation, and pathological diagnosis of malignancy. Clinical characteristics including age, body mass index (BMI), parity, type and number of deliveries, and history of previous surgery were recorded. Measurement outcomes in the present study were the number of conversions to other operation, operative time, estimated blood loss (EBL), the number of women that received blood transfusion, intra- and post-operative complications, post-operative pain assessment with visual analogue scales (VAS), the number of women who needed the added analgesics, weight of specimens, and the final pathological diagnosis. The present study was approved by the Bangkok Hospital Headquarters Institutional Review Board (BHQ-IRB) (COA. 2020-39).

vNOTESH technique

The vNOTESH was performed under general anesthesia with endotracheal intubation. Each woman was placed in the lithotomy position then Trendelenburg position with both legs supported by elastic bandages. Foley catheter was indwelled. The steps of vNOTESH were as follow: following traction of the uterine cervix with a tenaculum, 20 mL of 1% Xylocaine with 1:200,000 epinephrine was injected into the submucosal space around the cervix. Then, a circumferential incision was done, followed by submucosal dissection anteriorly and posteriorly. Anteriorly, dissection was continued up to the anterior fornix, followed by a colpotomy when the vesicouterine peritoneum could be clearly identified. If it was not clear, the anterior colpotomy was performed endoscopically later. Posteriorly, dissection was continued until reaching the cul-de-sac peritoneum, followed by a colpotomy. Bilateral cardinal and utero-sacral ligaments were sealed and cut using a Curved Large Jaw Open Sealer LigaSure™ system (Covidien, Mansfield, MA, USA). To create a vaginal channel for endoscopy, the inner rim of an 8 cm in diameter of a wound retractor (Lagis, Lagis Enterprise Co., Ltd., Taichung, Taiwan) was inserted into and placed in the pelvic cavity. If the wound retractor could not be applied or was pushed out after application, a smaller one (6 cm in diameters) was used instead. The outer rim was covered with a silicone cap, of which one 10 mm and three 5mm holes were punctured for ports of a telescope and instruments. After completed pneumoperitoneum with the intra-abdominal pressure of 12 mmHg CO_2 insufflation was established, the telescope and the 3-D laparoscope (Endoeye Flex HD 3D, Olympus Corporation, Japan), were inserted and pelvic organs

were identified. If the anterior colpotomy had not been done, the vesicouterine peritoneum could be identified at this stage, the colpotomy was done. The broad ligaments were dissected, followed by sealing and cutting the uterine vessels using an energy sealing device LigaSureTM (Covidien, Mansfield, MA, USA) and occasionally using the conventional bipolar coagulation. Then, the remaining broad ligaments and tubo-ovarian pedicles were sealed and cut, followed by the BS. If the ovary was needed to be removed, the infundibulopelvic ligament would be sealed and cut instead. The control of bleeding was carried out during surveillance of both stumps of the ovarian ligaments or of the infundibulopelvic ligaments. Surveillance and hemostasis of the stumps of uterine vessel, and the cardinal and uterosacral ligaments were achieved after removal of the specimens. Then, the vaginal stump was closed using no.2-0 coated polyglactin suture (Vicryl, Ethicon Inc., Cincinnati, OH, USA).

TLH technique

The woman position, anesthetic method, and all other preparations were the same as those in the vNOTESH. A uterine manipulator was inserted to control the uterus. TLH was performed using a 4-port technique in the present hospital, and a 3-D laparoscope (Endoeye Flex HD 3D, Olympus Corporation, Japan) was used in all cases. A 10 mm trocar was inserted at the umbilicus for the laparoscope, followed by two 5 mm trocars at the left and right lower quadrant sites for ancillary ports, and another 5 mm trocar at the left midclavicular line, 5 to 10 cm far from the umbilicus. The process was carried out as follows: both round ligaments were sealed and cut, followed by an opening the vesicouterine peritoneal fold and the bladder was mobilized downward with blunt dissection. The ovarian ligaments and the proximal part of both tubes were cauterized and cut. The uterine vessels were dissected, sealed, and cut after identification of both ureters, followed by cauterization, and cutting the cardinal and utero-sacral ligaments. The vaginal fornix was incised using a monopolar laparoscopic L-hook cautery. Then, both tubes were removed. If the bilateral salpingo-oophorectomy needed to be performed, both infundibulopelvic ligaments were sealed and cut instead. For sealing and cutting of all ligaments and vessels, an energy sealing device LigaSure™ (Covidien, Mansfield, MA, USA) was used and the conventional bipolar coagulation was occasionally applied to stop the bleeding. The specimens were removed through the vagina or by morcellation for the large one. Then, the vaginal stump was closed laparoscopically using no.0 absorbable barbed suture (V-LOC™, Covidien, New Haven, CT, USA). Skin incisions were approximated using no.4-0 coated polyglactin suture (Vicryl, Ethicon Inc., Cincinnati, OH, USA).

Pre- and post-operative protocols were the same in all women of both groups as follow: A prophylactic antibiotic, 2 g of cefazolin was given before starting the operation in all cases, unless the patients had the drug allergy, then 600 mg of clindamycin was used instead. Another dose of these medicines was administered post-operatively, six to eight hours later. No oral antibiotics were administered. Two doses of 40 mg parecoxib were routinely prescribed during the operation and 12 hours later if there was no contraindication. An intravenous 25 mg of pethidine or 50 mg of tramadol every six hours was added, if necessary, within 24 hours after the operation. Then 25 mg diclofenac was orally administered three times daily. The intravenous fluid and Foley catheter were maintained overnight. The women were discharged after 48 hours of admission, or two nights after the operation, according to our protocol, unless there was any postoperative complication. All women returned to the hospital one week for wound examination, and one month for the vaginal examination. If the women had any symptoms, such as bleeding, abnormal vaginal discharge, or fever, they could come as required before their appointments.

Statistical analysis

The sample size at first was calculated based on the operative times of the study compared between vNOTESH and TLH groups[16]. The sample size was around 10 for each group, which was not appropriate. Therefore, the authors used the operative time in the study, which compared between the NOTES assisted vaginal hysterectomy (NAVH) and the SP-LAVH groups[9] with the power of 90%, the α of 0.05, the δ of 10% and an estimated 10% dropped out. Thirty-three women for each group were required.

Data were presented as mean ± standard deviation, median (range), and number (%). Unpaired t-test, Mann-Whitney U test, chi-square test and Fisher's exact test were used where appropriate. A p-value of less than 0.05 was considered as statistically significant. The Stata, version 10.1 (StataCorp LP, College Station, TX, USA) was used for data analyses.

Results

One woman of the TLH group was excluded

Table 1. Comparison of clinical characteristics between vNOTESH and TLH groups

	vNOTESH (n=33); n (%)	TLH (n=32); n (%)	p-value
Age (year); mean±SD	43.24±4.57	44.66±4.78	0.2275
BMI (kg/m^2); mean±SD	24.21±4.40	24.66±3.75	0.6988
Parity			0.13
0	6 (18.18)	9 (28.13)	
1	2 (6.06)	6 (18.75)	
≥2	25(75.76)	17 (53.12)	
Delivery			0.361
No	6 (18.18)	10 (31.25)	
Vaginal	15 (45.45)	10 (31.25)	
Cesarean section	12 (36.36)	12 (37.50)	
Previous surgery	2 (6.06)	3 (9.38)	0.616
Major diagnosis			0.296
Adenomyosis	18 (54.55)	14 (43.75)	
Leiomyoma	10 30.30)	14 (43.75)	
Others	5 (15.15)	4 (12.50)	
Specimen weight (g); median (range)	198 (57.5 to 1755.5)	196 (87 to 615)	0.7578

SD=standard deviation; vNOTESH=transvaginal natural orifice transluminal endoscopic surgery for hysterectomy; TLH=total laparoscopic hysterectomy; BMI=body mass index

Table 2. Comparison of surgical outcomes between vNOTESH and TLH groups

	vNOTESH (n=33); n (%)	TLH (n=32); n (%)	p-value
Surgical procedures			0.24
Hysterectomy + BS	6 (18.18)	10 (31.25)	
Hysterectomy + BSO	2 (6.06)	5 (15.63)	
Hysterectomy + USO	25 (75.76)	17 (53.12)	
Conversion to other method	0 (0.00)	0 (0.00)	
Surgical time (minute); median (range)	73 (30 to 260)	140 (75 to 296)	<0.0001
Blood loss (mL); median (range)	100 (20 to 800)	100 (20 to 400)	0.3137
Pain scores (VAS); median (range)			
Post-operative 6 to 8 hours	3 (2 to 5)	3 (2 to 5)	0.0057
Post-operative 24 hours	2 (1 to 3)	3 (2 to 3)	0.0003
Post-operative 48 hours	0 (0 to 3)	2 (0 to 3)	0.0003
Added analgesics			0.001
No	31 (93.94)	17 (53.12)	
1 dose	0 (0.00)	9 (28.13)	
2 doses	1 (3.03)	6 (18.75)	
3 doses	1 (3.03)	0 (0.00)	
Intraoperative complication	0 (0.00)	0 (0.00)	
Postoperative complication			
Vault complication			0.509
• Bleeding	2 (6.06)	3 (9.38)	
• Stump infection	0 (0.00)	1 (3.13)	
Vaginal stump healing			0.564
• Good	30/31(96.77)	24/24 (100)	
• Granulation tissue	1/31 (3.23)	0 (0.00)	

vNOTESH=transvaginal natural orifice transluminal endoscopic surgery for hysterectomy; TLH=total laparoscopic hysterectomy; BS=bilateral salpingectomy; BSO=bilateral salpingo-oophorectomy; USO=unilateral salpingo-oophorectomy; VAS=visual analogue scores

from the present study because there was severe adhesion between the posterior wall of the uterus and the rectum. There was no conversion to other operation in both groups. The clinical characteristics of women are shown in the Table 1. The mean age and BMI were not significantly different when compared between groups at 43.24±4.57 versus 44.66±4.78 years (p=0.2275), and 24.21±4.40 versus 24.66±3.75 kg/m² (p=0.6988), respectively. The number and type of previous delivery of both groups did not significantly differ. Nulliparous women were found in six (18.18%) and nine (28.13%) of the vNOTESH and TLH groups, respectively. The most common pathological diagnosis was adenomyosis, followed by leiomyoma in both groups (Table 1). There were no significant differences in the pathological diagnoses and weight of specimens compared between groups (Table 1).

No intraoperative complication occurred in either group. A median of operative time was 73 (30 to 260) minutes in the vNOTESH group, which was significantly shorter than that of the TLH group 140 (75 to 296), p<0.0001 (Table 2). The amount of blood loss was not significantly different when compared between groups. No one needed blood transfusion. Post-operative pain scores were significantly less in the vNOTESH than the TLH groups at every assessment. The number of women who needed the added analgesics were much less in the vNOTESH than in the TLH groups with two out of 33 (6.06%) versus 15 out of 32 (46.88%) (p=0.001) (Table 2). Of the 15 women in the TLH group, pethidine was used in 12, and tramadol in three. In the vNOTESH group, both women used tramadol.

Secondary bleeding at two to three weeks after surgery were found in two (6.06%) and three (9.38%) women of the vNOTESH and TLH groups, respectively (Table 2). All women had minimal bleeding and recovered after oral antibiotics treatment. One woman in the TLH group experienced vaginal stump infection at one week after the operation but

healed completely after taking antibiotics (Table 2). Thirty-one women and 24 women of the vNOTESH and the TLH groups, respectively, returned for post-operative visit after one month. All but one of these women showed a good healing of the vaginal stump including those with the secondary bleeding and the vaginal stump infection. One woman in the vNOTESH group had a small granulation tissue at the left angle of the vaginal stump, which disappeared after one-month expectant therapy.

Discussion

After the first report of vNOTESH had been published in 2012[7]. Many following publications of this type of surgery have been reported[6,8,9,13,14,16,20]. Of these, there were some differences in the technique of the vaginal approach among institutes, whereas it was quite similar in the section of the endoscopic surgery. In Korea, the procedure was named as NAVH[9]. Technically, the vaginal approach in the NAVH was performed step by step after circumcision of the cervix up to the disconnection of the uterine vessels and the completion of trachelectomy after anterior and posterior colpotomies. Then the pneumoperitoneum was created after application of a wound retractor. A report from Thailand showed a different technique[21]. The procedure was named as the vaginal NOTES retroperitoneal-approach hysterectomy. The vaginal approach technique in this procedure aimed to create and widen the retroperitoneal space after the circumcision around the cervix. Then a wound retractor was applied, and pneumoperitoneum in the pelvis area was created. The cardinal and the uterosacral ligaments, and the uterine vessels were identified, sealed, and cut, followed by the anterior and posterior colpotomies.

More interestingly, as the vNOTESH is quite a new technique that has not been widely practiced, it is worth considering whether it is better and has more advantages than other LH. During the following decade, studies comparing the surgical outcomes between the vNOTESH or NAVH and the LAVH[8,17], between the NAVH and the SP-LAVH[9], and between the vNOTESH and the TLH have been published[16,18].

The present study results demonstrated the median operative time was shorter in the vNOTESH than the TLH groups, which supported the other studies. Baekelandt et al[16] ran a randomized controlled trial (RCT) that compared the vNOTESH with the TLH and found that the mean operative time in the vNOTESH group was almost a half of that in the TLH group at 41±22 versus 75 ± 27 minutes ($p<0.001$). Similarly, in the work of Kaya et al[18], the mean operative time was less in the vNOTESH than in the TLH at 79.56±32.54 versus 120.67±38.35 minutes ($p<0.001$). However, there was no difference in operative time compared between the vNOTESH and the TLH in a study from Thailand[22]. A report from Taiwan also showed the vNOTESH took significantly lesser time when compared to the conventional LAVH[8]. Furthermore, comparing in the subgroups, classified by uterine weights, the duration of the operation was significantly shorter in all subgroups of the vNOTESH[8]. However, studies from Korea that compared the NAVH with the SP-LAVH[9] and the conventional LAVH[17] demonstrated contradicting results. One study showed that the mean operative time was shorter in the NAVH than the SP-LAVH[9]. By contrast, the operative time was significantly shorter in the conventional LAVH than the NAVH in another study[17].

The amount of blood loss did not significantly differ compared between the two groups in the current study. A previous study has demonstrated the volume of blood loss was less in the vNOTESH than the conventional LAVH[8]. By contrast, the EBL was higher in the vNOTESH than the TLH in the work of Puisungnoen et al[22]. As for the NAVH, there were contradicting data of EBL as well. The volume of blood loss in NAVH was not different from that in the SP-LAVH[9]. By contrast, there was more blood loss in the NAVH than that in the conventional LAVH assessed by a change in hemoglobin after the operation[17]. Interestingly, some authors showed that the amount of blood loss increased as the increased size of the uterus[8]. Although, there were differences in blood loss between groups, the amount of blood loss in all groups of all studies could be acceptable clinically.

The discrepancy in operative time and amount of blood loss between studies might be the results from the comparison of difference in surgical types. In fact, these studies compared the vNOTESH or the NAVH with various types of LH including TLH, LAVH, and SP-LAVH. In addition, using different techniques of vNOTESH, for instance, the vaginal NOTES retroperitoneal-approach technique used by some authors[21,22] was different from the technique used in the current study. This might be another factor of these controversial outcomes in comparison of the vNOTESH with the TLH.

It seemed that women who underwent the vNOTESH had lesser post-operative pain than the TLH. Recent reports of initial experienced

gynecologists showed the mean pain scores of 2.5 and 4.1 assessed two- and six-hours post-operatively. The pain scores gradually declined in the following day[12,13]. The present study results have shown that the post-operative VAS assessed at 6, 24, and 48 h after surgery were significantly lower in women who underwent the vNOTESH than the TLH. Rather significantly, the number of women needing the added analgesics were almost eight times more in the TLH than in the vNOTESH groups. The findings supported the previous RCT that compared between vNOTESH and TLH[16]. In that RCT post-operative pain had been evaluated twice a day for one week. As a result, the VAS pain scores were significantly lower in the vNOTESH than the TLH groups with mean difference of –0.89 (95% CI –0.31 to –1.5), p=0.003[16]. The explanation of the difference in VAS pain scores was that there was no surgical cut on abdominal wall in the vNOTESH, but there were 4-port sites in the TLH. Nevertheless, there was no difference in VAS pain scores between the NAVH without abdominal scar and the SP-LAVH with one umbilical scar[9].

Risk of both intra-operative and post-operative complications in the vNOTESH was very low. In fact, the present study showed no intra-operative complication in both vNOTESH and TLH groups. The intra-operative complication in the vNOTESH mostly was an injury to the bladder with prevalence of 0.7% to 3% in some studies[8,16]. These rates did not seem to be different from the conventional LAVH[8,17]. When compared between the NAVH and the SP-LAVH or the conventional LAVH, there was no such complication in the NAVH group[9,17], whereas the bladder injury was found in 1.7% in the conventional LAVH[17]. To prevent the injury of the bladder in the vNOTESH, some authors have suggested to use the Sheth's technique[23] to approach the anterior colpotomy[8] in the difficult case.

As for the post-operative complication, it could be found in only a few reports[8,16]. In a large sample size study, the minor post-operative complication, post-operative fever, was found in two (1.4%) out of 147 women who underwent the vNOTESH, which was significantly lower than 6.8% of the conventional LAVH[8]. Baekkelandt et al[16] showed the post-operative complication was significantly less in the vNOTESH group with three out of 35women (9%) than in the TLH group with 13 out of 35 women (37%). Of these women, all three women had minor complication, type I and II, in the vNOTESH group whereas 11 had minor complication and two had major complication, type III and IV in the TLH group according to classification proposed by Dindo et al[22]. The report from Korea showed that there was 2.5% post-operative minor complication in the NAVH compared to 3.4% in the conventional LAVH without statistical significance[17]. Another report demonstrated that there was no post-operative complication both in the NAVH and the SP-LAVH groups[9]. According to the present study, two women (6.06%) in the vNOTESH and three women (9.38%) in the TLH groups demonstrated post-operative minimal bleeding from vaginal stumps. This complication might be the effect of thermal energy for hemostasis on the vaginal cuff leading to tissue damage[24]. As a result, small hematoma, vaginal stump infection, and bleeding could occur. Nevertheless, these complications are minor and can successfully be treated with oral antibiotics at an outpatient department.

Since the present study hospital protocol indicated that patients should be kept in the hospital for at least 48 hours after surgery, it was difficult to evaluate the definite duration of hospitalization required for each group. Because the vNOTESH is quite a new technique and not widely practiced, a thorough assessment of all aspects of the surgical outcomes could not be completed in limited time. A study reported the post-operative hospital stay was significantly shorter in the vNOTESH group[18]. Until now, only one RCT has reported no difference in quality of life assessed three and six months after the operation between the vNOTESH and the TLH groups[16].

The strength of the current study is that the subjects included in both groups had almost similar characteristics, and the study demonstrated more advantages of the NOTESH. However, there are some limitations. The first one is that small sample size included in each group had too low power to evaluate differences in some parameters between groups, including rates of conversion and perioperative complications. The second limitation is that the current study did not assess long- term outcomes including quality of life, and sexual function as well as cost-effectiveness.

In conclusion, the present retrospective study demonstrated that the vNOTESH is a feasible and safe procedure for hysterectomy in experienced hands and well-selected cases. This new technique is superior to TLH, not only in reducing risk of trocar injury, in taking shorter operative time and in achieving lesser postoperative pain, but also from the cosmetic aspect due to no abdominal scar. It may be

an alternative method for hysterectomy of the benign uterine diseases in the future. However, vNOTESH needs to be assessed regarding the outcomes with a greater number of subjects and a longer duration of evaluation.

What is already known on this topic?

Reports of the vNOTESH have been published for a decade. Most reports are ones of the initial experiences with small sample size. Some are comparative studies with contradictory results. However, there are a few studies comparing between the vNOTESH and the TLH.

What this study adds?

The vNOTESH is quite new and not a practiced technique worldwide. The current study is one of a few publications that has compared between the surgical outcomes of the vNOTESH and the TLH. It gives valuable information of the vNOTESH and confirms that in carefully selected patients, the vNOTESH is superior to the TLH in term of the duration of surgery and post-operative pain. Hence, it may be an alternative method of hysterectomy in the future.

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Conflicts of interest

All authors declare no conflicts of interest

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