Hysterectomy using the vNOTES technique. Experience from a highly specialized center

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Background:
Background: Natural orifice transluminal endoscopic vaginal surgery (vNOTES) is a successful alternative procedure to conventional hysterectomy techniques.
Objective: To analyze the results of hysterectomy with the vNOTES technique in a cohort of patients with uterine pathology.
Material and methods: Cross-sectional study in a retrospective cohort of 20 patients with uterine pathology undergoing hysterectomy with the vNOTES technique in the Department of Minimally Invasive Surgery in Gynecology of a Hospital in the city of Chihuahua, Mexico from April 1, 2022 to March 31, 2023. The records were consulted to know the general data, uterine pathology, technical characteristics of vNOTES (surgical time, estimated bleeding, complications, conversions to other techniques, complementary procedures), hospital stay, mortality, antibiotic therapy, outpatient analgesia and evaluation of postoperative pain with the Visual Analog Scale (VAS score).
Results: Age 43.5±5.56 years and obesity 15%. Previous surgeries: cesarean section 30%, bilateral tubal occlusion 25% and laparotomy/laparoscopy 25%. Uterine pathology: leiomyomatosis of large elements 75%, adenomyosis 10%, uterine prolapse grade-II 5%, endometrial hyperplasia without atypias 5% and cervical dysplasia CIN-II 5%. Scheduled vNOTES 100%, single procedure 95% and complemented with abdominal laparoscopy 5%. Surgical time 60 minutes, uterine weight 292.08 g, estimated bleeding 70 ml, complications 0%, reoperations 0%, hospital stay 1.09 days and mortality 0%. Medications: oral cephalexin 100%, oral ketorolac with paracetamol 100%. VAS score: day 1=2, day 3=1, day 7=0.
Conclusions: The results of vNOTES hysterectomy are successful. It is a safe surgical alternative with minimal adverse effects.

Keywords: Hysterectomy; vNOTES hysterectomy; Uterine pathology.

Chihuahua, México

Original Article

Gynecology & Obstetrics

OPEN ACCESS

Natural orifice transluminal endoscopic surgery (NOTES) is a technique that allows access to the peritoneal cavity through natural orifices (mouth, rectum, vagina, bladder) without traversing the anterior abdominal wall. Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) is a minimally invasive procedure that uses the vagina as the access route to the abdominal cavity to perform gynecological procedures, primarily adnexal and uterine surgeries. [1] **Figure 1**

vNOTES is a technique that provides excellent visualization of the surgical field to identify and manipulate anatomical structures with minimal bleeding, shorter operating time, lower complication rates, shorter hospital stays with reduced costs, less postoperative pain, faster recovery, and improved cosmetic results with lower rates of infection, hernias, and scarring. It is a relatively new procedure that offers an alternative to conventional hysterectomy techniques (abdominal, vaginal, laparoscopic, robotic) with the added advantages of being able to be performed on an outpatient basis and can be repeated as needed. [2,3]

The first report on the vNOTES technique was published by Ahn et al. [4] in 2012. The authors studied the results of the procedure in 10 patients with benign adnexal diseases and found favorable results, concluding that the vNOTES technique is an attractive, viable, and safe alternative to conventional gynecologic surgery. Subsequently, numerous investigations have been published regarding the results of surgical experience with the vNOTES technique in adnexal diseases and in an ever-expanding list of gynecologic conditions. [5]

From the Department of Minimally Invasive Gynecological Surgery. Christus Muguerza del Parque Hospital, Chihuahua City, Chihuahua Mexico. Received on May 10, 2025. Accepted on May 14, 2025. Published on May 15, 2025.

DOI 10.5281/zenodo.15429182

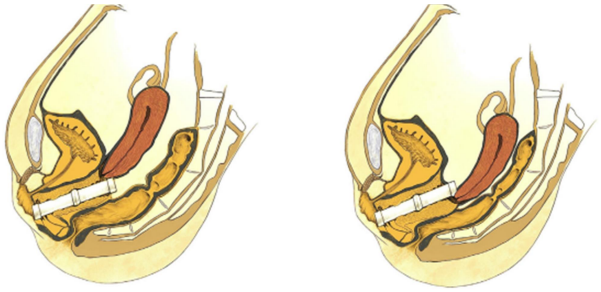

Figure 1. General schematic of the surgical landscape achieved with the vNOTES technique. Published by Li et al. [1]

Clinical conditions that present technical difficulties or that contraindicate vNOTES surgery have also been identified: history of pelvic inflammatory disease, active lower genital tract infection, obliteration of the pouch of Douglas on clinical examination, known or suspected malignancy, rectovaginal endometriosis, history of rectovaginal endometriosis surgery, history of rectal surgery, and history of pelvic radiotherapy.

Since its introduction to the surgical field of gynecology, hysterectomy using the vNOTES technique has become widely used worldwide due to technological advancements, the training of more gynecologists in highly specialized centers, appropriate patient selection, the introduction of a staged procedure protocol, and, above all, its positive results. [6] Experts recommend that every highly specialized center where the vNOTES technique is performed should report its results to increase information about its benefits and risks and also to improve the knowledge of the operators. [7-9]

Specifically, the vNOTES technique was implemented in 2021 in the Department of Minimally Invasive Surgery in Gynecology and Obstetrics at Christus Muguerza del Parque Hospital, located in Chihuahua, a state in northern Mexico bordering the United States of America. At this location, abdominal laparoscopy preceded the vNOTES technique as the first-line hysterectomy option. The highly specialized medical team at the host hospital has addressed several interesting surgical topics related to laparoscopic surgery [10-13] and, in recent years, has gained experience performing hysterectomies with the vNOTES technique, making it the first-line surgical option. The purpose of this report is to share this data with the medical community and increase the national and international literature on the subject.

Objective

To analyze the results of hysterectomy with the vNOTES technique in a cohort of patients with uterine pathology treated at a highly specialized center in Chihuahua, Mexico.

Data	Results
Age years	43.5±5.56
Body mass index (Weight K / height (m)^2	27.04±3.01
Obesity grade I % (n)	15 (3)
Surgical history	
Caesarean section % (n)	
None	70 (14)
One	20 (4)
Two	5 (1)
Three	5 (1)
Bilateral tubal occlusion % (n)	
With laparatomy	20 (4)
With anterior abdominal laparoscopy	5 (1)
Laparoscopic resection of ovarian cyst % (n)	5 (1)
Laparotomy myomectomy % (n)	5 (1)
Laparoscopic cholecystectomy % (n)	15 (3)

Table 1. General data.

Methods

A cross-sectional study was conducted in a retrospective cohort of 20 patients with uterine pathology who underwent hysterectomy using the vNOTES technique in the Department of Minimally Invasive Gynecology Surgery at the Christus Muguerza del Parque Hospital in the city of Chihuahua, Chihuahua, Mexico, between April 1, 2022, and March 31, 2023. **All procedures were performed by the same interventional physicians (VARG, CLM, JRA) with the following equipment: laparoscopic tower Viztrol™ 4K, Ethicon endo-surgery generator Johnson-Johnson™, FT10 energy platform Valleylab™, NSLX137C X1 advanced bipolar tissue sealer with curved tip Enseal™, Pneumo Sure high flow insufflator Striker™, 400W Electrosurgery model SS501SX, WEM™ and UHD camera system AGM-UHD3 model, AOK ACE™**

The medical records were reviewed for general information (age, obstetric history, body mass index, morbidities), uterine pathology indicating surgery, duration of surgery, estimated bleeding, need to use a complementary vNOTES technique, complications, prescription of antibiotics and analgesic agents, perception of postoperative pain intensity from the first hours after surgery to day 7 after hospital discharge using the Visual Analogue Assessment (VAS) questionnaire, as well as length of stay and mortality.

Written informed consent was obtained from the patients or their legal guardians for this study, and authorization was obtained from the host hospital's authorities to obtain the necessary research information from their medical records. The patient database is under the protection of the authors and the host hospital's authorities.

DOI 10.5281/zenodo.15429182

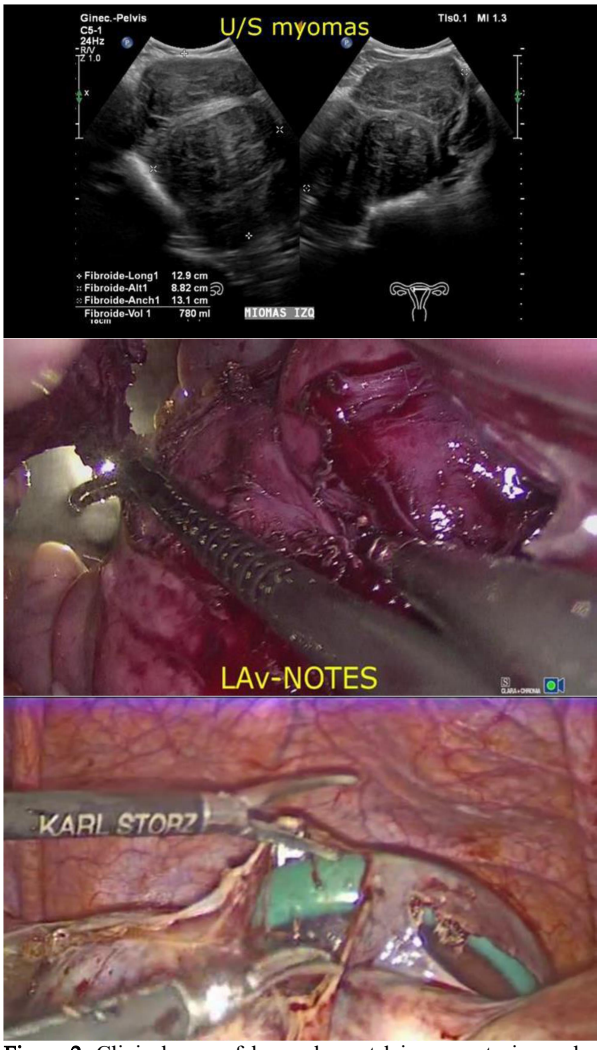

Figure 2. Clinical case of large-element leiomyomatosis resolved by Laparoscopy-Assisted Vaginal Natural Orifice Transluminal Endoscopic Surgery (LAv-NOTES). Upper. Preoperative ultrasound image. Middle. Laparoscopic view of the pedunculated abdominal myomas. Lower. Panoramic view using the vNOTES approach.

STATISTICAL ANALYSIS

Descriptive statistics were used, including measures of central tendency (mean, median) and measures of dispersion (standard deviation, range). Data are presented as rates or percentages using tables. Figures were used to display clinical images. The data were analyzed using the statistical program SPSS® version 22 was used.

Results

The general data for the 20-patient cohort are shown in **Table 1**. As can be seen, the mean age was in the fifth decade of life, and obesity was present in 15%. Previous surgeries were very common: prior cesarean section in 30%, bilateral tubal occlusion with various methods in 25%, pelvic surgery involving the ovary or uterus in 10%, and laparoscopic cholecystectomy in 15%.

Data	Results
Uterine pathology % (n)	100 (20)
Large element leiomyomatosis	75 (15)
Adenomyosis	10 (2)
Grade II uterine prolapse	5 (1)
Endometrial hyperplasia without atypia	5 (1)
Intracervical neoplasia grade II	5 (1)
Hysterectomy with the vNOTES technique % (n)	100 (20)
Unique procedure	95 (19)
Complemented with abdominal laparoscopy	5 (1)
Scheduled surgery	100 (20)
Urgent surgery	0
Surgical time minutes (limits)	60 (35 to 170)
Uterine weight g (limits)	292.08 (42.8 to 2285)
Estimated bleeding ml (limits)	70 (20 to 200)
Postoperative complications % (n)	0
Reinterventions % (n)	0
Hospital stay days (limits)	1.09 (0.77 to 1.43)
Mortality % (n)	0
Antibiotics % (n)	100 (20)
Cephalexin tablet 500 mg every 8 hours for 5 days	
Oral analgesic agents % (n)	100 (20)
Ketorolac tablet 10 mg every 6 hours for 5 days with	
Paracetamol tablet 500 mg every 6 hours for 5 days	0
Intravenous rescue analgesic: % (n)	
Postoperative pain (VAS score) median (limits)	
Day 1	2 (0 to 3)
Day 3	1 (0 to 2)
Day 7	0 (0 to 1)

VAS = Visual Analogue Scale for the assessment of pain

Table 2. Surgical data, evolution and postoperative management

Uterine leiomyomatosis predominated as the main uterine pathology for performing hysterectomy with the vNOTES technique, which was performed as a single procedure in the majority of cases (95% (19 cases). In 5% (1 case), abdominal laparoscopy was required as a complementary technique to vNOTES because the uterine dimensions due to leiomyomatosis with large elements did not allow the removal of the organ due to technical difficulties. **Figure 2** This hybrid technique is called Laparoscopy-Assisted Vaginal Natural Orifice Transluminal Endoscopic Surgery (LAv-NOTES).

In all cases, vNOTES hysterectomy was an elective procedure, not an emergency procedure. The mean surgical time was 60 minutes, with minimal estimated bleeding and no surgical complications such as infection. No reinterventions were required, and the postoperative hospital stay was very short (mean 1.09 days). There were no cases of postoperative mortality. Antibiotic monotherapy with oral cephalexin was used in 100% of patients. Management with anti-inflammatory analgesic agents (ketorolac with paracetamol) was sufficient, and there was no need for other rescue medications. The VAS score for postoperative pain assessment reported by patients was very low. **Table 2**

DOI 10.5281/zenodo.15429182

Parameters	Su et al. [18] Taiwan China	Nulens et al. [19] Belgium	Rubio et al. current research Mexico
Year of publication	2012	2021	2025
Year of data	2010	2015 to 2020	2022 to 2023
Number of cases	16	114	20
Age years	47.8±1.2	50±3.5	43.5±5.56
Obesity % (n)	No reported	19.3 (22)	15 (3)
Previous abdominal surgery % (n)	37.5 (6)	40 (46)	80 (16)
Uterine pathology (n)	Leiomyomatosis (11) Adenomyosis (4) ICN Grade III (1)	Benign gynecological conditions *	Leiomyomatosis (15) Adenomyosis (2) Uterine prolapse Grade II (1) Endometrial hyperplasia without atypia (1) ICN Grade II (1)
Surgical time minutes (limits)	122.7±17.6 (55 to 380)	63±34	60 (35 to 170)
Estimated bleeding ml	379.4±95.4	Not reported	70 (20 to 200)
Surgical complications % (n)	0	3 (4)	0
Uterine weight g (limits)	538.8±102.9 (115 to 1630)	560±426 (281 to 3361)	292.08 (42.8 to 2285)
Conversion to other techniques % (n)	0	0.9 (1)	5 (1)
Hospital stay days	2.8±0.2	19.3%,n (22)=12 hours	1.09 (0.77 to 1.43)
Mortality % (n)	0	0	0

ICN = Intracervical neoplasia

* Hormone-resistant dysfunctional uterine bleeding, postmenopausal bleeding, atypical endometrial hyperplasia, myomatosis, chronic pelvic pain, and prophylactic surgery in BRCA mutation carriers.

Table 3. Comparison of patient characteristics and outcomes of hysterectomy with the vNOTES technique

Discussion

Gynecological surgery has been evolving rapidly over the last decade. The vNOTES technique has significantly expanded and is replacing the four traditional hysterectomy procedures (abdominal, vaginal, laparoscopic, and robotic-assisted) due to its successful results. [14,15] In Mexico, Sosa-Bravo et al. [16] reported in 2023 the case of a patient undergoing hysterectomy using the vNOTES technique. The authors reported that the procedure lasted 100 minutes, with a postoperative hospital stay of 24 hours, with no complications. In conclusion, the results were successful.

In this study, we analyzed the results of hysterectomy using the vNOTES technique in a retrospective cohort of 20 patients with uterine pathology treated at a highly specialized center in Chihuahua, Mexico. The mean patient age was found to be in the fifth decade of life, with 15% of cases presenting obesity and a high percentage of patients with a history of cesarean section and pelvic and abdominal surgeries. **Table 1**

Benign uterine pathology predominated in frequency over malignant diseases (95% vs. 5%). Hysterectomy with the vNOTES technique as a single procedure resolved 95% of cases in a reasonable average time (60 minutes) with minimal estimated bleeding (70 ml), no operative complications, no reoperations, and no mortality. Hospital stay was very short (1.09 days) and postoperative pain was very low. **Table 2**

In 5% (1 case), laparoscopy was used as a complementary procedure to the vNOTES technique because the size of the uterus with giant leiomyomas prevented complete vaginal resection. This hybrid technique is called LAv-NOTES and was introduced and reported by Leal et al. in 2022. [17] The case involved a 42-year-old woman with no significant medical history and a uterus invaded by very large pedunculated and intramural leiomyomas whose dimensions resembled a 34-week pregnancy. Two surgical teams were formed to perform the surgery simultaneously. The first surgical team approached the anterior abdomen using the laparoscopic technique to perform bilateral salpingectomy and resection of the pedunculated leiomyiomas while preserving the ovaries. The vaginal approach using the vNOTES

DOI 10.5281/zenodo.15429182

technique was used to perform bladder, peritoneum, and ligament dissection, ligation of uterine vessels, and hysterectomy. The abdominal laparoscopy lasted 124 minutes, and the vaginal procedure lasted 34 minutes, considering the two surgeries were performed simultaneously. No complications or abnormal bleeding were reported, no reoperation was required, and the hospital stay was 32 hours. [17]

In Mexico, there are no reports of series of patients who underwent hysterectomy using the vNOTES technique to compare the results of the present study, but international series are available. **Table 3** compares the results with those of the studies by Su et al. [18] and Nulens et al. [19] As can be seen, the percentage of patients with obesity and a history of previous abdominal surgery was higher in the retrospective cohort studied. Uterine pathology was similar, with leiomyomatosis predominating, and patients with ICN were the minority. Comparatively, the surgical time was shorter, with no excessive bleeding and no operative complications. The uterine weight was lower, but included a large uterus, the resection of which was successful with simultaneous abdominal laparotomy without incident.

Obesity, previous surgeries and a large uterus were not considered barriers to vNOTES hysterectomy as reported by Temtanakitpaisan et al. [20] Their findings indicate that it is a safe and feasible procedure, even in large uteruses. Leal et al. [17] have highlighted the importance of abdominal laparoscopy as a complication-free adjunctive technique. When comparing vNOTES hysterectomy versus total laparoscopic hysterectomy, Baekelandt et al. [21,22] have found vNOTES to have similar or superior outcomes, with the advantage of a shorter hospital stay and improved quality of life.

Housmans et al. [6] published a practical, step-by-step guide for successfully performing the vNOTES technique and Baekelandt [23] designed a low-cost device for performing the surgery in hospitals with limited financial resources. These two contributions and successful outcomes have contributed to the dissemination of the vNOTES technique as the first choice for performing hysterectomy in virtually all types of patients. Our findings are favorable and do not encourage us to continue performing hysterectomy with the vNOTES technique as the first option.

Conclusion

The results of hysterectomy with the vNOTES technique were successful. It is a safe surgical alternative with minimal adverse effects. In selected cases, LAvNOTES may be an option as a simultaneous complementary procedure without increased surgical time or complications.

Conflicts of interests

None declared by the authors.

References

1. Li CB, Hua KQ. Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) in gynecologic surgeries: A systematic review. Asian J Surg. 2020;43(1):44-51. DOI: 10.1016/j.asjsur.2019.07.014.
2. Coomber RS, Sodergren MH, Clark J, Teare J, Yang GZ, Darzi A. Natural orifice translumenal endoscopic surgery applications in clinical practice. World Gastrointest Endosc. 2012;4(3):65-74. DOI: 10.4253/wjge.v4.i3.65
3. Nulens K, Van Genechten I, Baekelandt J. Repeat vaginal natural orifice transluminal endoscopic surgery: A first feasibility study. Gynecol Obstet Invest. 2021;86(1-2):117-122. DOI: 10.1159/000513403.
4. Ahn KH, Song JY, Kim SH, Lee KW, Kim T. Transvaginal single-port natural orifice transluminal endoscopic surgery for benign uterine adnexal pathologies. J Minim Invasive Gynecol. 2012;19:631-635.
DOI: 10.1016/j.jmig.2012.04.001
5. Kim JC, Yim GW, Kim YT. Clinical relevance of vaginal natural orifice transluminal endoscopic surgery (vNOTES) in gynecology. Obstet Gynecol Sci. 2024;67(2):199-211. DOI: 10.5468/ogs.23205.
6. Housmans S, Stuart A, Bosteels J, Deprest J, Baekelandt J. Standardized 10-step approach for successfully performing a hysterectomy via vaginal natural orifice transluminal endoscopic surgery. Acta Obstet Gynecol Scand. 2022;101(6):649-656. DOI: 10.1111/aogs.14367.
7. Reddy H, Kim SW, Plewniak K. Applications of vaginal natural orifice transluminal endoscopic surgery (vNOTES) in gynecologic surgery. Curr Opin Obstet Gynecol. 2022;34(4):220-226. DOI: 10.1097/GCO.0000000000000799.
8. Lerner VT, May G, Iglesia CB. Vaginal natural orifice transluminal endoscopic surgery revolution: The next frontier in gynecologic minimally invasive surgery. JSLS. 2023;27(1):e2022.00082. DOI: 10.4293/JSLS.2022.00082.
9. Lerner V, Stuart AE, Baekalandt J. Vaginal natural orifice transluminal endoscopic surgery hysterectomy deconstructed: expanding minimally invasive gynecologic surgeons' toolbox. J Gynecol Surg. 2024;40:78-99. DOI: 10.1089/gyn.2023.0098
10. Leal C, Villegas J, Guigón M, Rubio VA, Valenzuela A. Complications of gynecologic surgery: CO_2 massive pneumothorax after a total laparoscopic hysterectomy. J Minim Invasive Gynecol. 2022;29(4):455-456. DOI: 10.1016/j.jmig.2021.12.001.
11. Leal C, Rubio VA, Villegas J, Guigón M, García Y, Rodríguez M, Covián N, Leal De La Rosa JA, Leyva Valencia ME. Pelvic anatomy: Unusual anatomical ureteric variation. Do we need to be aware of? Video Case report. The Trocar. 2022;3(4):80-83. DOI: 10.36205/trocarvid4.2022002
12. Leal C, Villegas J, Guigón M, Rubio V, Valenzuela A. Double adnexal twist. Ann Minim Invasive Surg. 2022;4(1):44-45. DOI: 10.36959/351/591
13. Leal C, Villegas J, Guigón M, Rubio V, Valenzuela A. Richter's hernia: Incarcerated bowel hernia at 5 mm

port site. J Minim Invasive Gynecol. 2022;29(3):338-339. DOI: 10.1016/j.jmig.2021.11.014.
14. Aarts JW, Nieboer TE, Johnson N, Tavender E, Garry R, Mol BW, et al. Surgical approach to hysterectomy for benign gynaecological disease. Cochrane Database Syst Rev. 2015;12(8):CD003677. DOI: 10.1002/14651858.CD003677.pub5.
15. Cohen SL, Ajao MO, Clark NV, Vitonis AF, Einarsson JI. Outpatient hysterectomy volume in the United States. Obstet Gynecol. 2017;1:130(1):130–137. DOI: 10.1097/AOG.0000000000002103
16. Sosa Bravo FJ, Leal-Meléndez JA, Palau-Torre J, Lara-Esqueda J, Castro-Torres I. Histerectomía mediante acceso vNOTES. Reporte de caso. Ginecol Obstet Mex. 2023;91(6):454-461. Available in: https://doi.org/10.24245/gom.v91i6.8022
17. Leal C, Rubio VA, Villegas J, Guigón M, García Y, Rodríguez M. Hybrid v-NOTES: Laparoscopic-Assisted vaginal Natural Orifice Transluminal Endoscopic Surgery (LAv-NOTES): Case report and new hybrid technique in complex gynecological surgery. The Trocar. 2022;3(2):33-43. DOI: 10.36205/ trocar3.2022003
18. 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(2):217-221. DOI: 10.1016/j.tjog.2012.04.009
19. Nulens K, Bosteels J, De Rop C, Baekelandt J. vNOTES hysterectomy for large uteri: A retrospective cohort study of 114 patients. J Minim Invasive Gynecol. 2021;28(7):1351-1356. DOI: 10.1016/j.jmig.2020.10.003.
20. Temtanakitpaisan T, Wu KY, Huang CY, Jaiswal A, Yen CF, Lee CL. The outcomes of transvaginal NOTES hysterectomy in various uterine sizes. Taiwan J Obstet Gynecol. 2018;57(6):842-845. DOI: 10.1016/j.tjog.2018.10.013.
21. Baekelandt JF, De Mulder PA, Le Roy I, Mathieu C, Laenen A, Enzlin P, et al. Hysterectomy by transvaginal natural orifice transluminal endoscopic surgery versus laparoscopy as a day-care procedure: A randomised controlled trial. BJOG. 2019;126(1):105-113. DOI: 10.1111/1471-0528.15504.
22. 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. DOI: 10.1016/j.ejogrb.2016.10.044.
23. Baekelandt J. Total vaginal NOTES hysterectomy: A new approach to hysterectomy. J Minim Invasive Gynecol. 2015;22(6):1088–1094. DOI: 10.1016/j.jmig.2015.05.015.

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 DOI 10.5281/zenodo.15429182