



Full length article

vNOTES as a salvage method for adnexectomy and high uterosacral ligament suspension after vaginal hysterectomy under epidural anesthesia: A feasibility and safety study

Adeviye Elçi Atılğan^{a,1,*}, Ismail Bıyık^{b,2}, Asiye Uzun^{a,3}, Şükriye Leyla Altuntas^{a,4}, Fatma Kılıç^{c,5}

^a Department of Obstetrics and Gynecology Istanbul Medipol University Faculty of Medicine İstanbul Turkey

^b Department of Obstetrics and Gynecology Kütahya Health Sciences University Faculty of Medicine Kütahya Turkey

^c Department of Obstetrics and Gynecology Necmettin Erbakan University Faculty of Medicine Konya Turkey

ARTICLE INFO

Keywords:

High uterosacral ligament suspension

Vaginal hysterectomy

vNOTES

Scarless surgery

Salpingo-oophorectomy

ABSTRACT

Objective: To evaluate the feasibility and safety of transvaginal natural orifice transluminal endoscopic surgery (vNOTES) for performing adnexectomy and high uterosacral ligament suspension (HUSLS) after vaginal hysterectomy (VH) under epidural anesthesia.

Method: This was a retrospective case series of 42 women who underwent VH for stage II or greater apical prolapse according to pelvic organ prolapse quantification (POP-Q); however, adnexectomy could not be performed and replace the vNOTES technique. The procedure continued with vNOTES adnexectomy and bilateral HUSLS under epidural anesthesia. Patient demographics, operation outcomes, and short-term and long-term complications were analyzed. Patients' quality of life was assessed with the Pelvic Floor Distress Inventory-20 (PFDI-20) at the 24-month visit.

Results: vNOTES procedures were performed successfully under epidural anesthesia in all patients. One patient was converted to general anesthesia due to ureter injury. The mean age of the patients was 54 years. The mean operating time for all procedures was 55 min (range 42–122). The mean blood loss was 90 ml. All patients ambulated 6 h later. The mean pain score 24 h later according to the visual analog scale (VAS) was 2 (range 0–5). The median length of hospital stay was 1 night (range 1–3). There were no complications or morbidities during the postoperative period. Each POP-Q score significantly improved at the 6-month visit ($p < 0.05$). While the preoperative mean total PFDI-20 score was 20.4 ± 6.6 , it significantly decreased to 8 ± 1.2 24 months later ($p < 0.05$).

Conclusion: The vNOTES technique is a good option when adnexectomy can not be performed after VH. The procedure can be completed safely under epidural anesthesia by performing HUSLS for apical support along with adnexectomy. In this way, patients combine the advantages of scarless minimally invasive surgery with the advantages of epidural anesthesia.

Introduction.

Introduction

Vaginal hysterectomy (VH) is generally the preferred method for the

treatment of women with symptomatic apical prolapse at menopause. However, salpingo-oophorectomy may not be easy even in patients with prolapse because ovarian descent does not always accompany

* Corresponding author at: Department of Obstetrics and Gynecology, Istanbul Medipol University Faculty of Medicine, İstanbul, Turkey.

E-mail address: dradeviye@gmail.com (A. Elçi Atılğan).

¹ ORCID ID:0000-0003-4833-8978.

² ORCID ID:0000-0001-6111-9302.

³ ORCID ID:0000-0001-8322-6643.

⁴ ORCID:0000 0003 1985 552X.

⁵ ORCID:0000 0002 9735 3552.

uterine prolapse. Other factors that make it challenging to remove ovaries vaginally include the ovaries being located higher and lateral to the pelvic rim, pelvic adhesions, intestines filling the pelvic cavity and the vagina being a narrow space.

Maintaining apical vault support during VH is very important. There is no gold standard method for suspension vault during vaginal hysterectomy. Since the Food and Drug Administration (FDA) warning about the use of transvaginal mesh [1], high uterosacral ligament suspension (HUSLS) has attracted increasing attention as a native tissue method for the restoration of apical prolapse.

Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) is a relatively new modality in gynecology that works vaginally with endoscopic instruments under general anesthesia. It enables quality visualization and better access to deep pelvic structures [2]. However, vNOTES procedures have never been performed under epidural anesthesia to date.

The study aimed to evaluate the safety and feasibility of the vNOTES technique under epidural anesthesia as a salvage method for performing adnexectomy and HUSLS after VH in challenging cases.

Patients and study design

Between March 2019 and January 2022, patients for whom adnexectomy could not be performed after VH and who switched on the vNOTES technique were included in this study. vNOTES adnexectomy and HUSLS were performed under epidural anesthesia. The inclusion criterion was symptomatic stage II–IV apical prolapse according to the pelvic organ prolapse quantification (POPQ) system [3]. The indications for adnexectomy were; postmenopausal women with atypical endometrial hyperplasia, adnexial cysts with no suspicion of malignancy, confirmed deleterious BRCA1 and BRCA2 germline mutations or a strong family history of either ovarian or breast cancer. Patients agreed with hysterectomy and adnexectomy with no contraindication for epidural anesthesia were included in this study. Women under 45 years old age, in whom the ovary should be preserved; hysterectomy needed for endometrial or cervical cancer; history of bilateral salpingo-oophorectomy; high risk of malignancy for ovarian or tubal cysts; diagnosis of endometriosis or endometrioma; diagnosis of intra-abdominal malignancy; history of colorectal surgery; and history of pelvic radiotherapy were excluded.

Patient demographics and perioperative outcomes were documented from hospital files: age, body mass index (BMI), ASA score, parity, number of vaginal deliveries, previous operation history, preoperative transvaginal ultrasound reports, and size of the adnexal mass, if present. All women underwent a routine preoperative evaluation, including bimanual pelvic examination and rectovaginal examination. Papanicolaou smears, transvaginal ultrasound imaging, and urinary ultrasound were performed. Women with postmenopausal uterine bleeding were subjected to diagnostic hysteroscopy and endometrial biopsy.

Preoperative POP-Q scores were recorded to assess physical prolapse. The Pelvic Floor Distress Inventory-20 (PFDI-20) was used to assess patients' quality of life [4]. The PFDI-20 and POPQ scores were collected before surgery and 24 months after surgery. Prolapse recurrence was defined as any POP-Q score $\geq$ stage II or any retreatment (pessary or surgery) for prolapse [5].

The operation time was recorded separately as the total operation time and from the completion of vaginal hysterectomy to the completion of vNOTES USO/BSO and vNOTES HUSLS to assess the exact vNOTES procedure time. Intraoperative and postoperative complications were measured via the Clavien–Dindo classification [6]. The length of hospital stay was documented. Postoperative pain was routinely assessed 24 h later via the visual analog scale (VAS): from 0 = no pain to 10 = worst pain.

This study was approved by the Institutional Review Board and Ethics Committee (02.2024–216) of the Obstetrics and Gynecology Hospital of Istanbul Medipol University. All patients provided written

and signed informed consent included the risks for both surgery and anesthesia, as well as the possibility of conversion from regional to general anesthesia.

Surgical technique

Premedication: Antibiotic prophylaxis was administered 30 min before surgery with intravenous 1.5 g cefalosporine. Midazolam (1 mg) was administered for the patient's anxiety.

Anesthesia technique

Patients prepared at the sitting position. The lumbar area was disinfected with chlorhexidine 2 %. Local anesthesia with 1 % lidocaine (5 mL) was injected and then a 27 G pncan needle was inserted into the L2–L3 intervertebral space for epidural anesthesia. A total of 12 mg of hyperbaric bupivacaine 0.5 % was injected. Later, an epidural catheter was inserted by the anesthesiologist. A bolus of 15 mL of ropivacaine 0.75 % was injected into the epidural catheter.

Surgical step

Patients were placed in the high dorsal lithotomy, Trendelenburg position (10 degrees) under epidural anesthesia. Abdominal wall and vagina were disinfected with the same chlorhexidine 2 % solution. After sterile draping, a 14F Foley catheter was inserted into the bladder. The procedure starts with VH in a conventional manner. After the uterus was removed, when the surgeon could not perform adnexectomy, a 7 cm diameter Alexis was inserted through the vagina. Then, a gelport (Gel-point vPath, Applied Medical, Rancho Santa Margarita, CA, USA) was placed on the alexis. A 10 mm rigid 30° endoscope (Karl Storz GmbH & Co KG, Tuttlingen, Germany) was inserted at the 6 o'clock position on the gelport, and two 5 mm ports were inserted at the 2 and 10 o'clock positions (Fig. 1). CO₂ was insufflated up to 10 mmHg intraabdominal pressure. The pelvic cavity, fallopian tube-ovaries, uterosacral ligaments and ureters were observed under vaginotendoscopic vision. The proximal end of the fallopian tube was grasped with a laparoscopic grasper, and the mesoovarium was dissected with a 5 mm Ligasure (Covidien, Mansfield, MA) vessel sealing device up to the infundibulopelvic ligament. The infundibulopelvic ligament was coagulated and cut with Ligasure to perform a unilateral salpingo-oophorectomy (Fig. 2). The same steps were repeated on the other side for bilateral salpingo-oophorectomy (BSO). The specimen was usually removed directly through the vagina. On the other hand, if there was an ovarian or paraovarian cyst, it was removed in an endobag introduced through a gelport without intraperitoneal spilling.

The next step involved apical support of the vaginal vault via vNOTES HUSLS. First, the right and left ureters and uterosacral ligaments (USLs) were identified under endoscopic guidance. If the ureter was found to be very close to the ipsilateral uterosacral ligament, a peritoneal release incision was made to avoid ureteral kinking [7]. A double needle 0 polyglactin polymer (Vicryl, Ethicon, Edinburgh, UK)

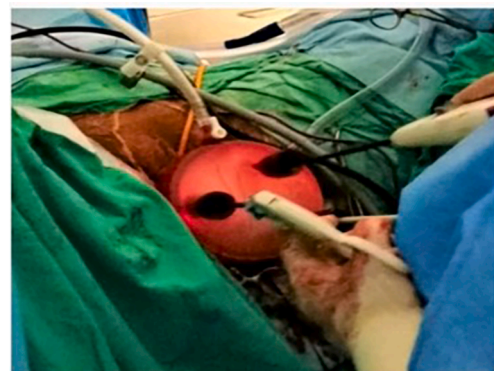


Fig. 1. Vaginal port system for vNOTES.



Fig. 2. Performing vNOTES right salphingo-oophorectomy.

suture was placed at the upper two-thirds of the left uterosacral ligament (Fig. 3), and it was passed from the posterior vaginal cuff edge. Another needle was passed from the anterior vaginal cuff edge. The same steps were repeated on the right side. The gelport and alexis were removed. If needed, other urogynecologic procedures were performed. The vaginal cuff was closed vaginally in a classic manner with an absorbable 0 polyglactin polymer (Vicryl, Ethicon, Edinburgh, UK) interrupted suture. Finally, the sutures that had passed from the USLs and the corner of the vaginal cuff were tied one by one. No sponge was inserted into the vagina. The Foley catheter was removed 6 h after surgery.

Statistical analysis

The statistical analyses were performed with SPSS version 12.0 (SPSS, Chicago, IL, USA). Numerical values are presented as the means $\pm$ standard deviations, numbers (percentages) or medians (minimum values-maximum values). A paired *t* test was used to compare the pre- and postoperative values. *p* < 0.05 indicated statistical significance.

Results

During this period, we operated on 96 women with conventional VH and BSO for POP-Q stage II–IV apical prolapse. There was no need for any endoscopic system for vaginal BSO. In total, 42 women needed to switch on the vNOTES technique and performed the vNOTES USO/BSO + HUSLS after VH under epidural anesthesia. The reasons for the inability to perform planned unilateral/bilateral salphingo-oophorectomy were high ovarian location in 13 patients (30 %), due to obesity in 11 patients (26 %) and pelvic adhesions in 18 patients (42 %). Twenty five patients diagnosed with ovarian cysts or paraovarian cysts with benign ultrasonic features. The final pathologic diagnosis was benign. The mean cyst size was 22.1x34.3x41.2 mm. Other urogynecologic procedures included 8 colporectomy anterior and posterior for the cystocele, 4 tension-free vaginal tape (TVT) procedures for the treatment of stress and urinary incontinence and 6 perineorrhaphy procedures.

The detailed patient characteristics are shown in Table 1; the median

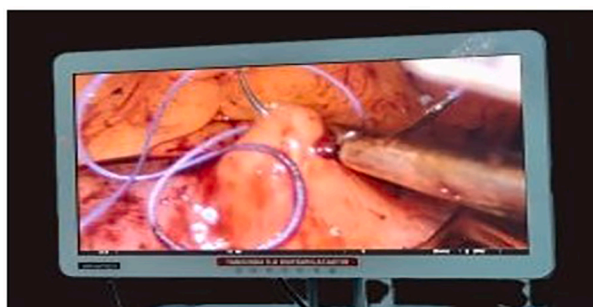


Fig. 3. Performing vNOTES left Uterosacral ligament suspension.

Table 1

Demographic and perioperative features of patients (n = 42).

Parameters	Median (range)*
Age (year)	58 (49–71)
BMI (kg/m ²)	25.2(22.4–29.6).
Vaginal birth (n)	3 (1–5)
Cesarean (n)	2 (1–4)
Operation duration (min)**	29 (25–56)
Total operation time (min)	45(40–122)
Hospital stay(day)	1 (1–3)
Blood loss (ml)***	190(80–550)
Blood loss for vNOTES(ml)	55(30–95)
Uterine weight (gram)	261.8(110–370)

BMI: body mass index CS: Cesarean section min: minutes, ml: millilitres.

*Range; minimum and maximum value.

**Time for only vNOTES BSO + HUSLS.

***For total procedures.

age was 58 years (range 49–71 years), and the median BMI was 25.2 kg/m² (range 22.4–29.6 kg/m²). Sixteen women had at least one vaginal delivery (range 1–5), and 12 women had a history of one cesarean session (range 1–4). Nine women had a history of one abdominal surgery; 4 had laparoscopic cholecystectomy, 3 had open appendectomy, 1 had open myomectomy, and 1 had a history of right open salphingo-oophorectomy for ruptured ovarian ectopic pregnancy. The median operating time for total procedures was 45 min (range 40–122), whereas it was 29 min (range 25–56) for the vNOTES BSO and HUSLS procedures. Whereas 11 cases (26 %) of vNOTES HUSLS had been performed for stage II apical POP for prophylaxis of future development of advanced apical prolapse, 31 cases (73 %) of vNOTES HUSLS had been performed to correct stage III–IV apical prolapse. The mean estimated blood loss was 190 ml for total procedures, whereas it was 55 ml for vNOTES procedures. The median uterine weight was 261.8 g (ranging from 110 to 1220 g). Postoperative analgesia maintained with ropivacaine 0.2 % at a rate of 6–10 mL/h, which utilized on the epidural catheter. Additionally one gram intravenous paracetamol was administered per 12 h. No patient needed extra intravenous analgesic. The mean pain assessment at 24 h later according to the VAS score was 2 (range 0–5). The median length of hospital stay was 1 night (range 1–3 nights). All patients returned to a normal diet 8 h later.

There was only one Grade IIIb–Clavien–Dindo intraoperative complication. However, this did not occur at the vNOTES step; rather, it occurred at the VH step and released at the vNOTES step that the right ureter had been cut at the level of crossing the arteria uterina. Therefore, the procedure was converted to conventional laparoscopy under general anesthesia. The Urology Team performed laparoscopic ureteral reanastomosis. Furthermore, no patient was converted to laparoscopy or laparotomy. Four patients complained of hypotension, and 6 patients complained of vomiting as a Grade I–Clavien–Dindo complication. These patients were managed with volume replasment, antipyretics and antiemetics.

The patients' postoperative examinations at one week, 6 weeks after surgery and annually were uneventful. The patients' mean pre- and

Table 2

Change in Pelvic Organ Prolapse Quantification System (POP-Q) score before and after surgery (n = 42).

POP-Q point	Preoperative (mean $\pm$ SD)	Postoperative* (mean $\pm$ SD)	P
Aa	+2.1 $\pm$ 1.3	–2.8 $\pm$ 0.2	0.011
Ap	–0.7 $\pm$ 1.6	–3.0 $\pm$ 0.2	0.012
C	+3.8 $\pm$ 2.7	–7.4 $\pm$ 0.4	0.001
TVL	7.1 $\pm$ 0.4	8.5 $\pm$ 0.6	0.04
Ba	+3.1 $\pm$ 0.7	–3.2 $\pm$ 0.5	0.012
Bp	+3.0 $\pm$ 0.8	–3.2 $\pm$ 0.7	0.012

P < 0.05 was considered statistically significant, TVL: total vaginal length.

SD: Standard deviation,

*POP-Q scores was evaluated 24 months after surgery.

postoperative POP-Q scores are shown in Table 2, all the variables significantly improved after surgery. Table 3 shows the changes in each PFDI-20 score and total PFDI-20 score before and 24 months after surgery. The total PFDI-20 score significantly decreased from 20.4 ± 6.6 to 2.8 ± 1.2 ($p < 0.05$), indicating great improvement in patients' quality of life. Decreasing at each score, indicating significant improvement in patients' pelvic, urinary and colorectal symptoms ($p < 0.05$) (Table 3).

Discussion

The application of vNOTES in gynecology is rapidly increasing. First, the vNOTES term was used in 1949 as a technique that allows access to the abdominal cavity, merging traditional vaginal surgery techniques with modern laparoscopic techniques [8]. In the 1970 s, they used the natural orifice for operative culdoscopy [9] and then contended with many culdoscopic tubal ligations under general anesthesia [10-12]. General anesthesia is standard for laparoscopic procedures as well as vNOTES procedures. This is the first study to provide data concerning the performance of vNOTES under epidural anesthesia. VH is usually performed under spinal or epidural anesthesia. Continuing the remaining part of the surgery with this form of anesthesia has great advantages. Unless high sympathetic denervation occurs, the risk of respiratory depression or cardiovascular instability is minimal [13]. Patients are awake and can be fast oriented at the end of surgery. In addition, they have less nausea and vomiting. Providing continuous analgesia with an epidural catheter is another significant advantage [14]. The risk of mouth or tooth injury is not present under regional anesthesia, and stomach inflation as a result of mask ventilation can be avoided under regional anesthesia [15]. There are many laparoscopic procedures have been reported in the literature without any problems with epidural anesthesia: laparoscopic pelvic lymphadenectomy [16], gasless laparoscopic hysterectomy [17], laparoscopic cholecystectomy during pregnancy [18] and laparoscopic tubal ligation [19]. The common feature of these procedures is relatively short operation times. For our patients, the sole median duration of surgery for vNOTES procedures was 29 min. Since the area for placing the vaginal port had already been opened after the uterus was removed, installation of the vNOTES port system was facilitated. Salphingo-oophorectomy and HUSLS do not require time for appropriate lightening of the pelvis via vaginal endoscope.

Another issue is that removing the ovaries along with the uterus is a very important step in the VH session [20]. It is essential in some circumstances, such as postmenopausal women with atypical endometrial hyperplasia, adnexial masses, confirmed deleterious BRCA1 and BRCA2 germline mutations or a strong family history of either ovarian or breast cancer [20,21]. The transvaginal route has been used by gynecologists for more than a century and is still the first choice for patients [22]. The need for oophorectomy should not be a reason to abandon a vaginal hysterectomy plan. Since then, various methods have been developed to perform oophorectomy during VH. Success is possible with proper lightening of the surgical field, whether via the open, vaginal or laparoscopic route [9]. vNOTES is the most attractive option as being scarless. Hefni et al. reported that the main advantage of vaginal endoscopic oophorectomy during VH is the lack of need for laparotomy and hence a

shorter and more comfortable convalescence [23]. They used a 5-mm bipolar vessel sealing device similar to ours. While some research reported as energy-based vessel sealing devices decrease operating time, blood loss, and hospital stay [24], there is still insufficient evidence for one vessel-sealing technology to be considered superior to another [25]. Therefore, monopolar and conventional bipolar devices can be used in vNOTES as like as laparoscopy. Regardless of which instrument used, it is essential to be removed ovaries carefully. Because occasionally leave a piece of ovary can cause ovarian remnant syndrome [23]. I think it is more risky during vaginal oophorectomy comparing to laparoscopic or abdominal route. The vNOTES system maintains the approach to the ovary as near as possible and removes it safely. In our study, we did not observe any cases of ovarian remnant syndrome.

Magos et al inserted a laparoscope into the upper vagina and visualized the adnexa during VH [26]. BSO was carried out with standard laparoscopic instruments introduced through the vagina without pneumoperitoneum [26]. We believe that using low-pressure pneumoperitoneum is more advantageous, especially for patients with intraabdominal adhesions. Even a low gas pressure (10 mmHg) provides better visibility of the pelvic structures.

In addition, performing HUSLS under endoscopic vision is another notable advantage of vNOTES. It is a native tissue apical suspension technique. The normal vaginal axis can be maintained by attaching the vault to the bilateral uterosacral ligaments. Surgeons should always start the procedure by checking the ureters. Similarly, Scollo et al., published a modification of vNOTES USLS [27]. They didn't incise peritoneum near the ureter to prevent ureteral kinking, instead, they pull the first USL suspension suture, then pass the second suture. We attribute the absence of any ureteral kinking to performing ureteral peritoneal releasing with vNOTES [7]. However, transvaginal uterosacral ligament vaginal vault suspension carries up to an 11 % risk of ureteral kinking, which is a consequence of poor visibility [28,29].

Additionally, there was no prolapse recurrence during the two-year period. Lowenstein et al reported the use of vNOTES uterosacral ligament suspension following hysterectomy with no prolapse recurrence [30]. Another 35 cases of vNOTES uterosacral ligament suspension for the treatment of apical compartment prolapse achieved optimal resolution of prolapse symptoms [31]. There are positive data for uterosacral ligament suspension, including a minor complication rate and a high patient satisfaction rate [28]. On the other hand, McCall's Culdoplasty can be another option for apical suspension after VH for stage I- II apical prolapse. The anatomical correction was found much better with HUSLS compared to McCall's Culdoplasty [32]. HUSLS suspends the vault in the normal vaginal axis. [32]. However, it takes longer time and can be challenging for someone who not familiar with vaginal endoscopic surgery compared to McCall's culdoplasty. So the procedure should be individualised and performed with several precautions [32].

The retrospective design, data from a single center and the lack of a control group are the main limitations of this study. Furthermore, we could not obtain information about patients' postoperative sexual function with the PFDI-20 scale.

Conclusion

The vNOTES technique is a safe and feasible choice when salphingoophorectomy with VH cannot be performed. The procedure can be completed safely under epidural anesthesia by performing HUSLS for apical support along with adnexectomy. In this way, patients combine the advantages of scarless minimally invasive surgery with the advantages of epidural anesthesia.

Prior presentation

This study was not presented before.

Table 3
Change in Pelvic Floor Distress Inventory (PFDI-20) before and after surgery (n = 42).

	Preoperative (mean ± SD)	Postoperative (mean ± SD)	P
POPDI-6	10.6 ± 1.9	2.1 ± 1.8	0.011
CRADI-8	2.7 ± 1.3	0.8 ± 1.2	0.011
UDI-6	8.2 ± 4.3	0.8 ± 0.6	0.014
PFDI-20	20.4 ± 6.6	2.8 ± 1.2	0.012

POPDI-6: Pelvic Organ Prolapse Distress Inventory 6, CRADI-8: Colorectal Anal Distress Inventory 8, UDI-6: Urinary Distress Inventory 6, SD: Standard deviation
P < 0.05 was considered statistically significant.

IRB approval

This study was approved by the Istanbul Medipol University IRB on February 1, 2024. Approval number: 216.

Funding sources

This study was conducted, and the manuscript was written without any financial support from a pharmaceutical or medical company.

CRediT authorship contribution statement

Adeviye Elçi Atılğan: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ismail Bıyık:** Data curation. **Asiye Uzun:** Methodology. **Şükriye Leyla Altuntas:** Data curation. **Fatma Kılıç:** Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Dyer O. Transvaginal mesh: FDA orders remaining products of US market. *BMJ* 2019;365:1839. <https://doi.org/10.1136/bmj.11839>.
- [2] Stockwell EL. vNOTES Usls. *J Minim Invasive Gynecol* 2022;29(11):S160–1. <https://doi.org/10.1016/j.jmig.2022.09.525>.
- [3] Geiss IM, Riss PA, Hanzal E, Dungal A. A simple teaching tool for training the pelvic organ prolapse quantification system. *Int Urogynecol J Pelvic Floor Dysfunct* 2007;18(9):1003–5. <https://doi.org/10.1007/s00192-006-0276-6>. Epub 2007 Jan 12.
- [4] de Arruda GT, Dos Santos HT, Virtuoso JF. Pelvic floor distress inventory (PFDI)-systematic review of measurement properties. *Int Urogynecol J* 2021;32(10):2657–69. <https://doi.org/10.1007/s00192-021-04748-4>.
- [5] Kowalski JT, Mehr A, Cohen E, Bradley CS. Systematic review of definitions for success in pelvic organ prolapse surgery. *Int Urogynecol J* 2018;29(11):1697–704.
- [6] Dindo D, Demartinez N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in cohort of 6336 patients and results of a survey. *Ann Surg* 2004;240:205–13.
- [7] Lu Z, Chen Y, Wang X, Li J, Hua K, Hu C. Transvaginal natural orifice transluminal endoscopic surgery for uterosacral ligament suspension: pilot study of 35 cases of severe pelvic organ prolapse. *BMC Surg* 2021;21(1):286. <https://doi.org/10.1186/s12893-021-01280-6>.
- [8] Boysen H, McRae LA. Tubal sterilization through the vagina. *Am J Obstet Gynecol* 1949;58:488–94.
- [9] Paldi E, Timor-Tritsch I, Abramovici H, Peretz BA. Operative culdoscopy. *Br J Obstet Gynecol* 1975;82:318e320.
- [10] Cheng MC, Khew KS, Chen C, Ratnam SS, Seng KM, Tan WK. Culdoscopic ligation as an outpatient procedure. *Am J Obstet Gynecol* 1975;122:109e112.
- [11] Wynter HH, Gutiérrez Nájara AJ. Tubal ligation through the posterior fornix with the aid of the culdoscope. *Int Surg* 1971;56(4):235.
- [12] Chowdhury NN. Culdoscopic tubal ligation. *J Indian Med Assoc* 1972;59(8):369–74.
- [13] Freund FG, Bonica JJ, Ward RJ, Akamatsu TJ, Kennedy Jr WF. Ventilatory reserve and level of motor block during high spinal and epidural anesthesia. *Anesthesiology* 1967;28:834–7.
- [14] Watanabe Y, Kaneda T. Anesthetic Management Using Epidural Analgesia for Emergency Laparoscopic Cholecystectomy in a Patient with Lupus Anticoagulant Positivity and Prolonged Activated Partial Thromboplastin Time. *Case Rep Anesthesiol*. 2022 Jan 18;2022:6310630. doi: 10.1155/2022/6310630.
- [15] Hajong R, Khariang PD, Baruah AJ, Anand M, Khongwar D. Laparoscopic cholecystectomy under epidural anesthesia: a feasibility study. *N Am J Med Sci* 2014;6(11):566–9. <https://doi.org/10.4103/1947-2714.145468>.
- [16] Kelly D, Kraus PA, Brull SJ. Laparoscopic pelvic lymphadenectomy during epidural anesthesia. *J Clin Anesth* 1995;7(8):648–51. [https://doi.org/10.1016/0952-8180\(95\)00096-8](https://doi.org/10.1016/0952-8180(95)00096-8).
- [17] Topel HC. Gasless Laparoscopic Assisted Hysterectomy with Epidural Anesthesia. *J Am Assoc Gynecol Laparosc*. 1994 Aug;1(4, Part 2): S36. doi: 10.1016/s1074-3804(05)80986-7.
- [18] Costantino GN, Vincent GJ, Mukalian GG, Kliefoth Jr WL. Laparoscopic cholecystectomy in pregnancy. *J Laparoendosc Surg* 1994;4(2):161–4. <https://doi.org/10.1089/lps.1994.4.161>.
- [19] Bridenbaugh LD, Soderstrom RM. Lumbar epidural block anesthesia for outpatient laparoscopy. *J Reprod Med* 1979;23(2):85–6.
- [20] Clayton RD. Hysterectomy. *Best Pract Res Clin Obstet Gynecol* 2006;20(1):73–87. <https://doi.org/10.1016/j.bpobgyn.2005.09.007>. Epub 2005 Nov 7.
- [21] Berek JS, Chalas E, Edelson M, Moore DH, Burke WM, Cliby WA, et al. Society of Gynecologic Oncologists Clinical Practice Committee. Prophylactic and risk-reducing bilateral salpingo-oophorectomy: recommendations based on risk of ovarian cancer. *Obstet Gynecol* 2010;116(3):733–43. <https://doi.org/10.1097/AOG.0b013e3181ec5fc1>.
- [22] Moen MD, Noone MB, Elser DM. Urogynecology Network. natural orifice hysterectomy. *Int Urogynecol J Pelvic Floor Dysfunct* 2008;19(9):1189–92. <https://doi.org/10.1007/s00192-008-0659-y>.
- [23] Hefni MA, Davies AE. Vaginal endoscopic oophorectomy with vaginal hysterectomy: a simple minimal access surgery technique. *Br J Obstet Gynecol* 1997;104(5):621–2. <https://doi.org/10.1111/j.1471-0528.1997.tb11544.x>.
- [24] Kroft J, Selk A. Energy-based vessel sealing in vaginal hysterectomy: a systematic review and meta-analysis. *Obstet Gynecol* 2011;118(5):1127–36. <https://doi.org/10.1097/AOG.0b013e3182324306>.
- [25] Abi Antoun M, Etrusco A, Chiantera V, Laganà AS, Feghali E, Khazzaka A, et al. Outcomes of conventional and advanced energy devices in laparoscopic surgery: a systematic review. *Minim Invasive Ther Allied Technol* 2024;33(1):1–12. <https://doi.org/10.1080/13645706.2023.2274396>.
- [26] Magos AL, Boumas N, Sinha R, et al. Transvaginal endoscopic oophorectomy *Am J Obstet Gynecol* 1995;172:123–4.
- [27] Scollo P, Pecorino B, Ferrara M, Mereu L. Uterosacral ligament suspension sec shall by vaginal natural transluminal endoscopic surgery (vNOTES). *J Obstet Gynaecol Can* 2022;44(6):703. <https://doi.org/10.1016/j.jogc.2022.02.126>.
- [28] Barber MD, Visco AG, Weidner AC, Amundsen CL, Bump RC. Bilateral uterosacral ligament vaginal vault suspension with site-specific endopelvic fascia defect repair for treatment of pelvic organ prolapse. *Am J Obstet Gynecol* 2000;183(6):1402–10. <https://doi.org/10.1067/mob.2000.111298>.
- [29] Margulies RU, Rogers MA, Morgan DM. Outcomes of transvaginal uterosacral ligament suspension: systematic review and metaanalysis. *Am J Obstet Gynecol* 2010;202(2):124–34. <https://doi.org/10.1016/j.ajog.2009.07.05>.
- [30] Lowenstein L, Baekelandt J, Paz Y, Lauterbach R, Matanes E. Transvaginal natural orifice transluminal endoscopic hysterectomy and apical suspension of the vaginal cuff to the uterosacral ligament. *J Minim Invasive Gynecol* 2019;26(6):1015. <https://doi.org/10.1016/j.jmig.2019.04.007>. Epub 2019 Apr 10.
- [31] Lowenstein L, Matanes E, Lauterbach R, Mor O, Burke YZ, Weiner Z, et al. Feasibility and learning curve of transvaginal natural orifice transluminal endoscopic surgery for hysterectomy and uterosacral ligament suspension in apical compartment prolapse. *Female Pelvic Med Reconstr Surg* 2021;27(1):e171–6. <https://doi.org/10.1097/SPV.0000000000000875>.
- [32] Verma A, Kashyap M, Gupta A. High uterosacral ligament fixation versus McCall's Culdoplasty for vaginal vault suspension in utero-vaginal prolapse surgery. *Cureus* 2022;14(7):e27368. <https://doi.org/10.7759/cureus.27368>.