Case Report

Retroperitoneal Sentinel Lymph Node Biopsy by Vaginally Assisted Natural Orifices Endoscopic Transluminal Endoscopic Surgery in Early Stage Endometrial Cancer: Description of Technique and Surgeon’s Perspectives after the First Experience

Marie-Pierre Mathey a, Fabien Romito a, Daniela E. Huber a, b

a Department of Gynaecological Surgery, Hospital de Sion, Sion, Switzerland; b Department of Obstetrics and Gynecology, Hôpitaux Universitaires de Genève (HUG), Geneva, Switzerland

Keywords
Endometrial cancer · Retroperitoneal sentinel lymph node biopsy · Vaginally assisted natural orifices endoscopic transluminal endoscopic surgery · Minimal invasive surgery · Gynecological surgery

Abstract
Endometrial cancer is the most commonly diagnosed gynecological malignancy. Feasibility and safety of laparoscopy are no longer to be demonstrated in patients with uterine-confined endometrial carcinoma. Vaginally assisted natural orifices endoscopic transluminal endoscopic surgery (vNOTES) is a new endoscopic approach over the past decade with significant evidence in benign pathology. Publications exploring VNOTES surgery in gynecological cancer were published first in 2014. We hereby report our first experience with vNOTES surgery in endometrial cancer. A 64-year-old patient presented with postmenopausal bleeding. Endometrial biopsy identified a G1 endometrioid adenocarcinoma. MRI suspected deep invasion of myometrium with no abnormal lymph node. She underwent a total hysterectomy with bilateral adnexectomy and retroperitoneal pelvic sentinel node biopsy by vNOTES. The final histopathology confirmed G1 endometrial adenocarcinoma FIGO II (proximal focal invasion of cervical stroma and superficial invasion of myometrium). The patient was discharged 2 days postoperatively with
Introduction

Endometrial cancer is the most diagnosed gynecological malignancy in the USA and in developed countries and represents up to 90% of all uterine corpus cancers. Often diagnosed at early stages because of abnormal uterine bleeding, its incidence increased in the last years by an average of 0.5% per year with life expectancy, sedentary life, and obesity [1].

Surgery is the mainstay treatment for endometrial cancer patients, followed by radiation and/or chemotherapy based on the stage of the disease. Technical progresses and results of randomized studies allowed a shift from traditional open surgery toward minimally invasive approaches for management of early endometrial cases [2]. In patients with apparent uterus confined disease and low-grade tumors, the current recommendations state that minimally invasive surgery (laparoscopic and robotic) is the preferred approach when technically feasible. Sentinel node biopsy is an alternative option for retroperitoneal staging in these patients [3, 4]. Furthermore, laparoscopy offers a higher identification rate of the sentinel node, with less morbidity and lower false-negative rate than open surgery [5–7].

Natural orifices endoscopic transluminal endoscopic surgery (NOTES) is a minimally invasive surgical procedure that utilizes natural orifices to access to the peritoneal cavity. Several advantages compared to standard laparoscopy are described such as faster postoperative recovery, reduced pain, decreased postoperative wound infections, and no abdominal trocar port complications [8]. The benefits and feasibility of the vaginal NOTES (vNOTES) approach for benign gynecological pathologies including hysterectomy, benign ovarian, or tubal pathologies have already been proven by a series of randomized controlled trial [9–12]. In 2014, the first vNOTES case for early stage endometrial cancer FIGO IA G1 with transperitoneal lymphadenectomy was described, with no intra- or postoperative complications [13]. We hereby present our first experience with VNOTES sentinel node biopsy by retroperitoneal access in early stage G1 endometrial cancer.

Methods

Data statement: respecting the SCARE 2020 criteria, we collected the following data of 1 patient operated in October 2021.

Case Description

A 64-year-old patient, nonobese, with postmenopausal bleeding presented to our institution. Endometrial biopsy identified a G1 endometrioid adenocarcinoma and the MRI concluded for superficial myometrial invasion with no abnormal lymph node. We performed a total hysterectomy with bilateral adnexectomy and retroperitoneal sentinel node biopsy by vNOTES.

The patient was placed in dorsal lithotomy position with her legs resting on knee supports. Draping allowed conversion to standard laparoscopy if needed. After injecting 4 mL of
1.25 mg/mL ICG at 3 and 9 o’clock superficial and deep into the cervix, a paracervical incision was made in the lateral vaginal fornix with a cold scalpel (Fig. 1). Sharp and afterward blunt digital dissection through this incision allowed the access to the obturator fossa after the opening of sacrogenital fascia. A 7.5-cm Gelpoint vPath small (Applied Medical) was inserted through this incision to create a retroperitoneal space by insufflating CO₂. The optic and all endoscopic instruments were inserted transvaginally through the Gelpoint. We entered transvaginally to the caudal part of the left obturator fossa and started by identifying the obturator nerve, artery, and vein. The left retroperitoneal space was further developed, and the sentinel node was identified using fluorescence imaging with a rigid 30° 10 mm telescope. As endoscopic instruments, a standard reusable 5-mm bipolar grasper and a 44-cm Caiman Vessel Sealing System (Aesculap, Inc.) were used.

The afferent lymph vessel was identified and the sentinel node was isolated from the surrounding tissues by careful dissection. Similar to the laparoscopic approach, two left sentinel nodes were resected and removed transvaginally on the left side. The same procedure was performed on the right side with identification of one lymph node, confirmed by anatomopathological examination. We were able to clip both uterine arteries before leaving the retroperitoneal space, which allowed almost no bleeding during the hysterectomy.

Vaginal fornix closure was made using a Polyglactin 910 simple continuous suture (Vicryl 2.0). Afterward, we performed a circumcision of the cervix with an electrosurgical scalpel. After opening of the vesicouterin space and the Douglas pouch, we transected the uterosacral ligaments. A 9.5-cm Gelpoint vPath was inserted, and we performed a simple hysterectomy with bilateral adnexectomy. All specimens were removed transvaginally, and vaginal closure was made with a unidirectional continuous autolocking suture (Stratafix Spiral PDS Plus 0). A urinary catheter was removed at the end of the surgery. We encountered no complication and blood loss was less than 100 mL. The total procedure time was 1 h 53 min.

A standardized postoperative protocol was performed corresponding to rapid mobilization, preventive anticoagulation, normal diet, simple analgesia such as paracetamol and ibuprofen. The patient was discharged on day 2 with no complications after 3-month follow-up.

The final histopathology did not identify any node metastasis and confirmed a G1 endometrial adenocarcinoma with superficial myometrial invasion, but proximal focal cervical stroma infiltration pT2 pN0, FIGO II. The patient underwent an adjuvant radio- and brachytherapy.

**Discussion**

Kalloo et al. [14] first described NOTES surgery in 2004 in the porcine model using the transgastric endoscopic approach to the peritoneal cavity. Feasibility of transvaginal extra-peritoneal lymphadenectomy by vNOTES was first assessed in porcine models in 2008 [15],...
and vNOTES was introduced in gynecology in 2012 for benign ovarian pathology. Since then, the
technique developed exponentially and was implemented by many gynecologist surgeons for
various procedures: hysterectomy, myomectomy, adnexal surgery, colposuspension, etc. (Fig. 2).

An international expert base statement guides surgeons with safe adoption of vNOTES
approach and focuses on oncological applications of vNOTES surgery in order to collect
outcomes and feasibility data. Consensus was reached in all domains except that of patients’
selection [16].

Contraindications to vNOTES are not totally established but may include history of inflam-
matory disease, active lower genital tract infection, obliterated pouch of the Douglas, recto-
vaginal endometriosis, history of a rectal surgery or mesh sacrocolpoplexy, ovarian cancer,
history of pelvic radiotherapy, multiple cesarean sections, or virginity [9, 16]. An enlarged
uterus or the previous laparoscopic surgery has no contraindications.

The surgical approach for vNOTES to perform lymphadenectomy can be intra- or retroperi-
toneal, before or after hysterectomy [17–19]. A recent Chinese retrospective study assessed a
prospective study about standard laparoscopy versus vNOTES for early stage endometrial cancer.
Between 2017 and 2020, 23 out of 74 patients underwent VNOTES hysterectomy with sentinel
node biopsy. The sentinel nodes were harvested transperitoneally, after the hysterectomy, using

Fig. 2. a–c Laparoscopic pictures showing the good exposure with vNOTES for retroperitoneal lymphadenectomy and new point of view and variation in the traditional anatomical landmarks.
carbons nanoparticles injected 15 min before surgery. If no stained node was identified in the pelvic and para-aortic area, a side-specific pelvic lymphadenectomy was performed by vNOTES. The authors concluded to the absence of difference in sentinel node detection and perioperative outcome between the two groups, but a decrease of hospital stay, a better cosmetic result, and a faster recovery for the vNOTES approach [2]. No conversion to classic laparoscopy was reported.

In case of vNOTES sentinel node biopsy or lymphadenectomy, the spatial orientation of the anatomical structures is different compared to the standard laparoscopy or the open surgery. However, because of the very little anatomical variation of pelvic vessels and nerves, an experienced surgeon adapts without difficulty to the new point of view [20]. Main limitations of vNOTES are the restricted surgical access in case of a narrowed vagina, instrument-optic conflicts, and difficult triangulation that may be circumvented by a curved scope or instruments [2].

For our patient, the access to the obturator fossa was easy. After the incision of the sacrogenital fascia and introduction of the v-path, we identified the obturator nerve, vein, and artery. Following the course of the obturator nerve, we identified the arterial and venous iliac bifurcation. The ureter, umbilical, and uterine artery were subsequently identified. Because the access is next to the cervix, the afferent lymphatic vessels are directly seen and the true sentinel node (the closest dyed node to the tumor) was identified.

In standard laparoscopy, the obturator fossa is accessed cranially and we approach the tumor and the sentinel node on the opposite direction of the lymphatic drainage. We frequently see multiple dyed nodes and should follow the dyed lymphatic vessels and nodes until the cervix to assure that the true sentinel node is identified. By this access, parallel to the lymphatic vessels and close to the tumor, vNOTES allows to follow the afferent vessels and to easily identify the first dyed node. As in 85% of cases, the sentinel node is located below the iliac vessels, and this approach offers an excellent access [2]. The retroperitoneal vNOTES approach might have thus an additional advantage to reduce the number of harvested lymph nodes by limiting the number of secondary lymph nodes, which has no sentinel node.

About lymphatic nodes situated above the iliac vessels, at the aortic bifurcation, or in the para-aortic region, the vaginal approach seems more difficult, but feasible according to the Chinese team and Baekelandt. Baekelandt proposed this new retroperitoneal transvaginal vNOTES approach as it enables a better exposure of retroperitoneal structures and less indocyanine leakage than transperitoneal [21]. Exposure of the major vessels and anatomic landmarks is critical to success [22].

In endometrial cancer with clinical negative lymph nodes, an extemporaneous examination of lymph nodes is not mandatory, as results will not change the course of the surgery or the management of the patient. Two randomized studies confirmed that radical pelvic dissection does not improve the outcome in patients with endometrial cancer, but lymphadenectomy allows the identification of nodal involvement [5]. In patients with apparent uterine confined disease, sentinel node mapping is an alternative to lymphadenectomy [23–25]. Ultrastaging of sentinel lymph nodes can identify metastasis undetected through conventional histology, leading to upstaging in 5–15% cases [26, 27].

Concerns about the contamination of retroperitoneal space by malignant cell displaced from the uterine cavity and its impact in late outcomes were raised by some authors [28]. It has been described that vaginal contamination with glandular tumor cells in patients with endometrial cancer occurs either before or during the surgical procedure, leading to vaginal recurrences. Stolnicu et al. [29] propose to wash the vagina before and after the surgical procedure or to use a special device to prevent tumor cell spillage. Before starting the procedure, Tantitamit et al. [30] preconize the suture of the exocervix to prevent tumor’s spreading. We did not find any other suggestion in other studies, but cerclage before the beginning of the procedure might be another option. The question whether these protective maneuvers have
sense or not is still not answered. Previous hysteroscopy and curettage or positive peritoneal washing before hysterectomy does not worsen the prognosis of patients with endometrial cancer [31, 32].

Although any surgical approach might be proposed in endometrial cancer (abdominal, vaginal, laparoscopic, robotic), minimal invasive surgery is recommended for uterine confined disease, even for a patient with high-risk carcinomas without compromising oncological outcome [33–35]. Laparotomy remains the preferred option in metastatic disease, large uterus, or patients intolerant to Trendelenburg position or pneumoperitoneum.

vNOTES, such as standard vaginal surgery, offers greater benefits to obese and extreme obese patients [36]. Endometrial cancer patients are often overweight, with metabolic comorbidities and advanced age. This population correlates with a higher risk of vascular injury during surgery, venous thromboembolism, postoperative wound infections, and operative constraints for the surgeon [37–40]. vNOTES enables moderate Trendelenburg position and the pneumoperitoneum is lowered to 8–10 mm Hg, two technical advantages for these patients [41].

Approximately 3–10% of patients suffering from endometrial cancer are unsuitable for surgery [30]. vNOTES could improve this statistics by lowering the complications and surgical morbidity by combining the advantages of minimal invasive surgery, good exposition of the abdominal cavity, and advantages of a vaginal approach without limitation by the nondescent of the uterus [36, 42, 43].

Nevertheless, some patients describe apprehension toward vNOTES, especially younger patients before 36 years old, with only 36% that would favor this approach. This might be due to the concern about their sexual life or future pregnancy. Comprehensive analysis of women’s perception is essential to understand their choice in regard to classic abdominal laparoscopy versus vNOTES and to reassure them with a long-term follow-up about transvaginal surgery, showing no incidence of sexual symptoms or dyspareunia [5–7].

**Conclusions**

The vaginal access broadens the indications of NOTES surgery for oncological gynecological surgery allowing an accurate staging of endometrial cancer [13]. This new surgical approach may overcome patient-related limits of the standard laparoscopy or laparotomy procedures. It requires technical skills, proficiency, and familiarization with new planes of view. However, the learning curve shows an exponential improvement in surgical performance in hands of skilled surgeon [44]. Nevertheless, it requires to reskill to vaginal surgery a generation of young “laparoscopic only” gynecologists. Further studies are required to corroborate the feasibility of retroperitoneal approach for staging of uterine cancers based on a larger panel of patients.

**Statement of Ethics**

This is a case report about 1 patient in 2021. Our institution (Hôpital de Sion) exempted us to submit the case from an ethical approval. Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.
Funding Sources

There was no funding for this case report. All the authors worked in their free time on this paper.

Author Contributions

Marie-Pierre Mathey: carried out the structure of the article and the literature review, and corrected the final version. Fabien Romito carried out the description of the surgical procedure. Daniela E. Huber followed the patient, corrected several times, and approved the final version.

Data Availability Statement

The data that support the findings of this study are openly available in Research Registry (https://www.researchregistry.com/browse-the-registry. Guarantor Dr Mathey Marie-Pierre).

References

1. National Cancer Institute. The surveillance epidemiology and end results (SEER). SEER fact sheet: endometrial cancer; 2021.
2. Wang Y, Deng L, Tang S, Dou Y, Yao Y, Li Y, et al. vNOTES hysterectomy with sentinel lymph node mapping for endometrial cancer: description of technique and perioperative outcomes. J Minim Invasive Gynecol. 2021 Jun;28(6):1254–61.
3. Kitchener H, Swart AM, Qian Q, Amos C, Parmar MKB, Accident Source Term Evaluation Code Study Group. Efficacy of systematic pelvic lymphadenectomy in endometrial cancer (MRCASTEC trial): a randomised study. Lancet. 2009 Jan 10;373(9658):125–36.
4. Persson J, Salehi S, Bollino M, Lönnerfors C, Falconer H, Geppert B. Pelvic sentinel lymph node detection in high-risk endometrial cancer (SHREC-trial)-the final step towards a paradigm shift in surgical staging. Eur J Cancer. 2019 Jul;116:77–85.
5. Rossi EC, Kowalski LD, Scalici J, Cantrell L, Schuler K, Hanna RK, et al. A comparison of sentinel lymph node biopsy to lymphadenectomy for endometrial cancer staging (FIRES trial): a multicentre, prospective, cohort study. Lancet Oncol. 2017 Mar;18(3):384–92.
6. Polan RM, Rossi EC, Barber EL. Extent of lymphadenectomy and postoperative major complications among women with endometrial cancer treated with minimally invasive surgery. Am J Obstet Gynecol. 2019 Mar;220(3):263–e8.
7. Walker JL, Piedmonte MR, Spirtos NM, Eisenkop SM, Schlaerth JB, Mannel RS, et al. Recurrence and survival after random assignment to laparoscopy versus laparotomy for comprehensive surgical staging of uterine cancer: gynecologic oncology group LAP2 study. J Clin Oncol. 2012 Mar 1;30(7):695–700.
8. Li CB, Hua KQ. Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) in gynecologic surgeries: a systematic review. Asian J Surg. 2020 Jan;43(1):44–51.
9. Nuøns 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 Jul;28(7):1351–6.
10. 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 gynecological disease: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol. 2017 Jan;208:6–15.
11. Badiglian-Filho L, Chaves Faloppa C, Narciso de Oliveira Menezes A, Mantoan H, Kumagai LY, Baiocchi G. Vaginally assisted NOTES hysterectomy with adnexectomy (vNOTES) compared with conventional laparoscopy. A retrospective observational cohort study. Int J Gynaecol Obstet. 2021 May;153(2):351–6.
12. Yang CY, Shen TC, Lin CL, Chang YH, Huang CC, Lin WC. Surgical outcomes of hysterectomy by transvaginal natural orifice transluminal endoscopic surgery (vNOTES) compared with laparoscopic total hysterectomy (LTH) in women with non-prolapsed and benign uterine diseases. Taiwan J Obstet Gynecol. 2020 Jul;59(4):565–9.
13. Lee CL, Wu KY, Tsao FY, Huang CY, Han CM, Yen CF, et al. Natural orifice transvaginal endoscopic surgery for endometrial cancer. Gynecol Minim Invasive Ther. 2014;3:89–92.
Kaloo AN, Singh VK, Jagannath SB, Niyama H, Hill SL, Vaughn CA, et al. Flexible transgastric peritoneoscopy: a novel approach to diagnostic and therapeutic interventions in the peritoneal cavity. *Gastrointest Endosc.* 2004 Jul;60(1):114–7.

Nassif J, Zacharopoulou C, Marescaux J, Wattiez A. Transvaginal extraperitoneal lymphadenectomy by natural orifices transluminal endoscopic surgery (NOTES) technique in porcine model: feasibility and survival study. *Gynecol Oncol.* 2009 Feb;112(2):405–8.

Kapurubandara S, Lowenstein L, Salvy H, Herijgers A, King J, Baekelandt J. Consensus on safe implementation of vaginal natural orifice transluminal endoscopic surgery (vNOTES). *Eur J Obstet Gynecol Reprod Biol.* 2021 Aug 26;216–22.

Leblanc E, Narducci F, Bresson L, Hudry D. Fluorescence-assisted sentinel (sentinel noded) and pelvic node dissections by single-port transvaginal laparoscopic surgery, for the management of an endometrial carcinoma (EC) in an elderly obese patient. *Gynecol Oncol.* 2016 Dec;143(3):686–7.

Hsyt WT, Huang CY, Lee CL. Sentinel pelvic lymph node dissection by natural orifices transvaginal endoscopic surgery approach after indocyanine green dye detection in early endometrial cancer of posthysterectomy patient. *Gynecol Minim Invasive Ther.* 2019 Aug 29;8(3):135–7.

Oh SH, Park SJ, Lee EJ, Yim GW, Kim HS. Pelvic lymphadenectomy by vaginal natural orifice transluminal endoscopic surgery (vNOTES) for early-stage endometrial cancer. *Gynecol Oncol.* 2019 Apr;153(1):211–2.

Hamabe A, Harito T, Ogino T, Tanida T, Noura S, Morita S, et al. Analysis of anatomical variations of intrapelvic vessels for advanced pelvic surgery. *BMC Surg.* 2020 Mar 16;20(1):47.

Baekelandt JF. New retroperitoneal transvaginal natural orifice transluminal endoscopic surgery approach to sentinel node for endometrial cancer: a demonstration video. *J Minim Invasive Gynecol.* 2019 Nov;26(7):1:231–2.

Comba C, Demirayak G, Simsek C, Atas BS, Özdemir İA. Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) total retroperitoneal sentinel lymph node biopsy for an endometrial cancer patient with prior colon cancer surgery. *Int J Gynecol Cancer.* 2021 Aug 11.

Khoury-Collado F, Murray MP, Hensley ML, Sonoda Y, Alektiar KM, Levine DA, et al. Sentinel lymph node mapping for endometrial cancer improves the detection of metastatic disease to regional lymph nodes. *Gynecol Oncol.* 2011 Aug;122(2):251–4.

Kim CH, Khoury-Collado F, Barber EL, Soslow RA, Makker V, Leitao MM Jr, et al. Sentinel lymph node mapping with pathologic ultrastaging: a valuable tool for assessing nodal metastasis in low-grade endometrial cancer with superficial myo invasion. *Gynecol Oncol.* 2013 Dec;131(3):714–9.

Ballester M, Dubernard G, Lécuru F, Heitz D, Mathevet P, Marret H, et al. Detection rate and diagnostic accuracy of sentinel-node biopsy in early stage endometrial cancer: a prospective multicentre study (SENTI-ENDO). *Lancet Oncol.* 2011 May;12(5):469–76.

Suh DH, Kim M, Kim HJ, Lee KH, Kim JW. Major clinical research advances in gynecologic cancer in 2015. *J Gynecol Oncol.* 2016 Nov;27(6):e53.

Hogberg T, Signorelli M, de Oliveira CF, Fossati R, Lissoni AA, Sorbe B, et al. Sequential adjuvant chemotherapy and radiotherapy in endometrial cancer: results from two randomised studies. *Eur J Cancer.* 2010 Sep;46(13):2422–31.

Gadducci A, Cosio S, Fabrini MG, Fanucchi A, Barsotti C, Cristofani R, et al. Patterns of failures in endometrial cancer: clinicopathological variables predictive of the risk of local, distant and retroperitoneal failure. *Anticancer Res.* 2011 Oct;31(10):3483–8.

Stolinia S, Terinte C, Ioanid N, Silva E. Presence of tumor cells in the vagina during surgical treatment could be the source of vaginal recurrence in patients with endometrial carcinoma: a pilot prospective study. *Ann Diagn Pathol.* 2020 Jun;46:151503.

Tantitamit T, Lee CL. Application of sentinel lymph node technique to transvaginal natural orifices transluminal endoscopic surgery in endometrial cancer. *J Minim Invasive Gynecol.* 2019 Jul;26(5):949–53.

Tebeu PM, Popowski Y, Verkooijen HM, Bouchardy C, Ludicke F, Usel M, et al. Positive peritoneal cytology in early-stage endometrial cancer does not influence prognosis. *Br J Cancer.* 2004 Aug 16;91(4):720–4.

Namazov A, Gemer O, Helpman L, Hag-Yahia N, Eitan R, Raban O, et al. The oncological safety of hysterectomy in the diagnosis of early-stage endometrial cancer: an Israel gynecologic oncology group study. *Eur J Obstet Gynecol Reprod Biol.* 2019 Dec;243:120–4.

Fader AN, Java J, Tenney M, Ricci S, Gunderson CC, Temkin SM, et al. Impact of histology and surgical approach on survival among women with early-stage, high-grade uterine cancer: an NRG oncology/gynecologic oncology group ancillary analysis. *Gynecol Oncol.* 2016 Dec;143(3):460–5.

Janda M, Gebski V, Forder P, Jackson D, Williams G, Obermair A, et al. Total laparoscopic versus open surgery for stage 1 endometrial cancer: the LACE randomized controlled trial. *Contemp Clin Trials.* 2006 Aug;27(4):353–63.

Colombo N, Creutzberg C, Amant F, Bosse T, González-Martín A, Ledermann J, et al. ESMO-ESGO-ESTRO endometrial consensus conference working group. ESMO-ESGO-ESTRO consensus conference on endometrial cancer: diagnosis, treatment and follow-up. *Int J Gynecol Cancer.* 2016 Jan;26(1):2–30.

Warren L, Ladapo JA, Borah BJ, Gunnarsson CL. Open abdominal versus laparoscopic and vaginal hysterectomy: analysis of a large United States payer measuring quality and cost of care. *J Minim Invasive Gynecol.* 2009 Sep;16(5):581–8.

Todo Y, Kato H, Kanoeuchi M, Watari H, Takeda M, Sakuragi N. Survival effect of para-aortic lymphadenectomy in endometrial cancer (SEPAL study): a retrospective cohort analysis. *Lancet.* 2010 Apr 3;375(9721):1165–72.
38 Falcone F, Balbi G, Di Martino L, Grauso F, Salzillo ME, Messalli EM. Surgical management of early endometrial cancer: an update and proposal of a therapeutic algorithm. *Med Sci Monit*. 2014 Jul 26;20:1298–313.

39 Mat E, Kale A, Gundogdu EC, Basol G, Yildiz G, Usta T. Transvaginal natural orifice endoscopic surgery for extremely obese patients with early-stage endometrial cancer. *J Obstet Gynaecol Res*. 2021 Jan;47(1):262–9.

40 Buzzaccarini G, Noventa M, D’Alterio MN, Terzic M, Scioscia M, Schäfer SD, et al. vNOTES hysterectomy: can it be considered the optimal approach for obese patients? *J Invest Surg*. 2021 Jun 22:1–2.

41 Kaya C, Yıldız Ş, Alay İ, Aslan Ö, Aydiner İE, Yaşar L. The comparison of surgical outcomes following laparoscopic hysterectomy and vNOTES hysterectomy in obese patients. *J Invest Surg*. 2021:1.

42 American College of Obstetricians and Gynecologists. Committee opinion No. 444: choosing the route of hysterectomy for benign disease. *Obstet Gynecol*. 2009 Nov;114(5):1156–8.

43 Chrysostomou A, Djokovic D, Edridge W, van Herendael BJ. Evidence-based guidelines for vaginal hysterectomy of the International society for gynecologic endoscopy (ISGE). *Eur J Obstet Gynecol Reprod Biol*. 2018 Dec;231:262–7.

44 Lauterbach R, Matanes E, Amit A, Wiener Z, Lowenstein L. Transvaginal natural orifice transluminal endoscopic (vNOTES) hysterectomy learning curve: feasibility in the hands of skilled gynecologists. *Isr Med Assoc J*. 2020 Jan;22(1):13–6.