THE INTERNATIONAL SOCIETY FOR GYNECOLOGIC ENDOSCOPY
PROMOTING VAGINAL SURGERY

TheTrocar
Official Online Journal of ISGE

TheTrocar Volume 5 Issue 1 Page 17-27 **ISSN: 2736-5530**

What is vNOTES hysterectomy and why it is important.

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Abstract

There are two ways to remove the uterus - through the abdominal wall or through the vagina. Each hysterectomy technique is simply a modification of these two. The benefits of vaginal hysterectomy are well known, but the frequency of vaginal hysterectomies has dropped drastically since the development of laparoscopic hysterectomies. The vNOTES – Transvaginal Natural Orifice Transluminal Endoscopic Surgery – technique is constantly being developed to increase the number of patients treated vaginally. In addition, the vNOTES technique is reviving the popularity of simple vaginal hysterectomies because they share some similar surgical steps. Studies have shown that vNOTES hysterectomies have several advantages over all other hysterectomy methods. Both vaginal and vNOTES hysterectomy should be (re)introduced into the practice of every minimally invasive gynecological surgeon and offered as a first choice for all eligible patients.

Key words: vNOTES, laparoscopy, vaginal, hysterectomy, single incision

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DOI: 10.36205/trocar5.2024002

Received 2024-03-09– Accepted 2024-03-15

Introduction

There are two ways to remove the uterus - through the abdominal wall or through the vagina. Each hysterectomy technique is simply a modification of these two. The benefits of vaginal hysterectomy are well known, but the number of vaginal hysterectomies has dropped drastically since the development of laparoscopic hysterectomies. [1]

For all abdominal hysterectomies, the surgeon must make at least one scar on the abdominal wall. This is completely avoidable in vaginal surgery. Vaginal hysterectomy is a very original minimally invasive gynecological operation and a very original single-incision hysterectomy. Despite this, it has not gained fame as minimally invasive surgery, but rather as something old-fashioned and inferior. Several studies have shown that after vaginal hysterectomy there is less need for analgesia, less postoperative pain, shorter hospital stay, faster recovery, fewer postoperative febrile episodes, and a faster return to daily activities.[1] So why have we lost our passion and skills to perform this technique?

One problem may be that training in vaginal hysterectomy is deficient early in a surgeon's career. During residency, the total number of hysterectomy cases per surgeon has remained the same. The goal of developing laparoscopic hysterectomy skills has led to a decrease in the number of open abdominal, but unfortunately also vaginal hysterectomy cases. [2]

Another problem may be that vaginal surgery is more challenging in difficult situations. The challenge comes from working in a narrower space compared to abdominal surgeries, and there are issues with visibility and access. To overcome these challenges, laparoscopic instruments such as manipulators, multifunctional instruments, and cameras, as well as dissection rules and surgical steps, have been developed. However, considering the benefit to the patient, our main goal should have been to develop operations towards the vaginal route, not the other way around.

Now vNOTES – Transvaginal Natural Orifice Transluminal Endoscopic Surgery – aims to achieve this goal by combining the advantages of vaginal and laparoscopic surgery. vNOTES operations are constantly being developed to increase the number of patients treated vaginally. In addition, the vNOTES technique is reviving the popularity of simple vaginal hysterectomies because they share some similar surgical steps.

vNOTES operations have developed rapidly in Europe and are increasingly being implemented around the world. Transvaginal

NOTES hysterectomy has become a significant competitor to all other hysterectomy methods. This article discusses the vNOTES hysterectomy technique, indications, contraindications, complications, and learning curve based on research findings.

Terms and abbreviations

The abbreviation NOTES stands for Natural Orifice Transluminal Endoscopic Surgery. NOTES operations are classified by anatomical organ of entry: vNOTES - transvaginal, gNOTES - transgastric, aNOTES - transanal, uNOTES - transurethral.[3]

Vaginal NOTES hysterectomy (VNH) can be done in several ways. VANH is a vaginally assisted NOTES hysterectomy, the surgical technique is described below. TVNH - total transvaginal NOTES hysterectomy means that the entire operation is performed laparoscopically through the vagina. Robotic assisted vaginal hysterectomy (RVANH) and robotic total transvaginal hysterectomy (RTVNH) are technically the same surgery, only performed by a robot.[4][5][6]

Patient selection

vNOTES hysterectomy can be offered to a wide range of patients whenever hysterectomy is indicated.

A non-prolapsed uterus is not a contraindication for vaginal hysterectomy or vNOTES hysterectomy.[7][8] Kaya et al compared TLH (total laparoscopic hysterectomy) with vNOTES hysterectomy for undescended large uteri and found that the vNOTES hysterectomy group had significantly shorter operative time (45 vs 160 min), hospital stay (48 vs 72 hours) and a lower 24-hour pain score (VAS 2 vs. 3).[9]

There are several studies where vNOTES is successfully performed on large uteri. X. Wang et al reported about 39 cases with a mean uterine weight of 1141.8 grams (1000-1720 g), operative time 123.3 minutes (40-400 minutes), estimated blood loss 206.7 mL (10-1300 mL), postoperative pain score 2.1 (0-5) and mean length of stay 2.4 nights (1-11). There was one urethral injury and three conversions to single-port laparoscopy.[10] Another study by Nulens et al examined 114 cases with a mean uterine weight of 559 ± 425 g (281–3361 g) with a success rate of 99%. The mean surgical time was 63 ± 34 minutes and was positively related to uterine size. They reported three cases of bleeding, one minor late complication, one laparotomy for specimen extraction, and no conversion to laparoscopy.[11]

Obesity is also not a contraindication to vNOTES surgery and may even be the preferred method of hysterectomy for this patient population. Kaya et al conducted a

study comparing TLH and vNOTES hysterectomy in 83 obese women with a mean BMI (body mass index) of 31.6 kg/m2 and 31.9 kg/m2 in the study groups, respectively. They found a shorter operative time (67.5 vs 136 min), a shorter postoperative hospital stays, and a lower mean postoperative pain score in the vNOTES group. [12] There is one study of 103 morbidly obese women in 2023 by Burnett et al., in which vNOTES surgery was successfully performed in 96 patients. [13]

vNOTES hysterectomy can be offered to nulliparous patients if the vaginal size is suitable for vaginal surgery. Expert vNOTES surgeons have concluded that nulliparity is not a contraindication to vNOTES surgeries.[6] In a 2021 study by Nulens et al., they had 31% nulliparous patients.[11]

vNOTES hysterectomy is the preferred minimally invasive hysterectomy technique for patients who have previously had a laparotomy because most adhesions are usually located away from the primary vNOTES entry site. It is recommended to rule out cul-de-sac adhesions during preoperative ultrasound examination, as rectovaginal endometriosis is a contraindication for this technique.[6]

Previous caesarean scar adhesions can be safely divided using certain surgical techniques. Identifying the bladder border is the first step in preventing bladder injury. Traction to the uterus and mild countertraction to the bladder retractor helps to keep the bladder out of the operating field and increases the distance of the ureters from the uterus.[14] In difficult situations filling bladder with small amount of methylene blue or leaving in some urine may help. Also, uterine sound through urethra can be useful to identify the borders of the bladder. [15] A sharp dissection of the uterovesical fold is preferred and the scissor points must be tilted towards the uterus. [14] The lateral window technique has been described in several studies and can be performed in the vaginal or laparoscopic part of vNOTES surgery. [15][16]

The vNOTES technique is increasingly being used for several other benign indications, such as adnexal surgery [17], myomectomy [18], isthmocele repair [19] and prolapse. [20][21][22] There are several reports of successful vNOTES emergency surgeries such as ectopic pregnancy and adnexal torsion.[23] There is also growing interest in offering vNOTES surgeries for malignant indications such as endometrial and cervical cancer. [5][24][25][26][27]

Contraindications for vNOTES surgeries are mainly related to the access of abdominal cavity. The primary entry site for vNOTES surgeries is posterior vaginal fornix and cavum Douglas. Diseases like rectovaginal endometriosis, PID and surgeries that create

adhesions in primary entry site are contraindication to this technique. An extremely narrow vagina due to radiation therapy or virginity may create unreasonable obstacles to the safe performance of vNOTES.[6]

Surgical technique.

Both vaginal and laparoscopic instruments are required to perform vNOTES operations. [6] This surgery is usually performed under general anesthesia in lithotomy position, but spinal anesthesia has also been attempted. [28][6] Special multiple dose antibiotic regimen is recommended. [29]

vNOTES hysterectomy surgical steps are divided into three phases: A: vaginal; B: laparoscopic; C: vaginal. In Phase A the surgical theater is assembled according to usual vaginal surgery. Circumcision of the cervical mucosa, posterior and anterior colpotomy is performed, followed by division of the sacrouterine ligaments. A wound retractor and a silicone or self-made glove cup are then inserted to preserve the pneumoperitoneum. Patient is tilted into 20° Trendelenburg and laparoscopic part of the surgery is performed. As uterus is normally free from the anterior and posterior surfaces, this part of the operation is focused on separating the sides of the uterine body from the pelvic sidewall and adnexa. In phase C, extraction of specimen and closure of vagina is performed in vaginal setting. [6][29]

The biggest advantage of vNOTES hysterectomy for the surgeon is that the blood supply to the uterus is secured first. Regardless of how big and bulky the uterus is, the cervix is more or less the same size in all patients. At the beginning of the laparoscopic phase, there is direct access to the uterine vessels before any other step is performed. In conventional laparoscopy, the sequence is reversed. During any hysterectomy procedure, especially with a large uterus, the risk of bleeding remains high until the uterine vessels are closed. The vNOTES technique provides a huge advantage in reducing this risk.[30]

Not to mention the cosmetic result, because no visible scars remain on the abdominal wall after vNOTES surgery. Patient satisfaction with laparoscopic trocar site scars is influenced by several factors: larger size, umbilical position, emergency surgery, accidental trocar exit, fascia closure, and specimen extraction site - all of which are entirely avoidable in vNOTES operations. [31]

Several studies have been conducted on robotic vNOTES operations, confirming that this surgery can also be done with several different robotic platforms. [32][33][34][35][36][37][38][39]

Complications

Baekelandt et al published in 2021 a paper about complications of 1000 cases of vNOTES hysterectomies (73%), adnexal surgeries (18%) and salpingectomies (4%). The conversion rate was 0.4%, three cases to conventional laparoscopy and one to laparotomy. The intraoperative complication rate was 1%, postoperative 2,9% and total 3.9%. The total complication rate in hysterectomy cohort was 5.2% (intraoperative 1.4%, mainly cystotomies, and post-operative 3.8%), in the non-hysterectomy sub-group 0,4%. [40] A 2023 Cochrane review article concluded that adverse events in vNOTES hysterectomy trials were rare, but further research is recommended. [41]

Comparison to other hysterectomy methods

Many studies have shown that vNOTES hysterectomy has several advantages over other hysterectomy methods.

The biggest impact on the success of vNOTES operations has come from its comparison with TLH. The first well known HALON randomized study was published in 2019 by Baekelandt et al. In both groups, 35 TLH and 35 vNOTES hysterectomies were successfully performed without conversion. A significant difference was noticed in postoperative hospitalization time. Discharge home in less than 12 hours was possible in 77% of vNOTES patiens vs 43% in TLH group and the mean hospital stay was shorter in vNOTES group (0.8 vs.1.3 days). [42] A 2020 meta-analysis by Housmans et al showed that operative time, length of hospital stay, and estimated blood loss were significantly lower in vNOTES hysterectomy than in TLH, and there was no significant difference in intra- and postoperative complications, readmissions, and postoperative pain scores nor a change in hemoglobin levels.[43] Michener et al published another meta-analysis in 2021 comparing vNOTES hysterectomy to single port and multiple port laparoscopic hysterectomy. He concluded that vNOTES hysterectomy may have shorter operation times and improved EBL (estimated blood loss), transfusion rates, length of hospital stay, and pain scores compared with multiple port laparoscopic hysterectomy, but recommended further studies due to limited data.[44]

Imai K et al published in 2023 their results of postoperative complete recovery by comparing robotic vNOTES hysterectomy to robotic TLH. Both postoperative day 7 and 28 complete recovery rates were significantly higher in vNOTES group (62.7% vs 7.3% and 100% vs 56.1%)[32]

Comparison to VH (vaginal hysterectomy) also shows promising results. Aharoni et al found in 2021 that vNOTES hysterectomy had lower mean operative time and mean anesthesia time, and slightly longer median

hospital stay (3 vs. 2 days). When sacrouterine ligament suspension was added to both groups, vNOTES had lower incidences of intraoperative complications (6%vs.18%), intraoperative ureteral obstruction (0%vs.8%) and less estimated blood loss (58 ± 68 ml vs. 143 ± 87 ml). [20] Merlier et al compared VANH to VH and found that there was no difference in the rate of outpatient surgery (77% vs 75%), no difference in surgical outcomes, except for the significantly higher rate of salpingectomies or adnexectomies in the vNOTES group. [45]

Learning curve

What about implementing this new technique? Kim et al published in 2020 that port installation time and total operation time appeared to reach the proficiency by case 10.[46] Wang et al showed that 20 cases were required to achieve proficiency in vNOTES hysterectomy for large uteri (>1 kg). [10] Lowenstein et al published in 2021 that operating time of vNOTES hysterectomy together with sacrouterine ligament suspension diminished from mean 149 minutes (89-233) to mean 103 minutes (89-170) when comparing first 13 patients to the next 13 patients. [21]

Conclusions

vNOTES hysterectomy is one of the fastest growing hysterectomy methods in the world. Studies have shown several advantages for patients compared to all other hysterectomy methods. Both vaginal and vNOTES hysterectomy should be (re)introduced into the practice of every minimally invasive gynecological surgeon and offered as a first choice to all eligible patients.

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