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Contents

1. **Outpatient Gynecological Surgeries 1**
   Niharika Dhiman, Rimjhim Raina
2. **Emergence of Minimally Invasive Surgery in Gynecology 12**
   Nutan Jain
3. **Robotic Surgery in Gynecology 27**
   Rooma Sinha, Rohit Raina
4. **vNOTES: Vaginal Natural Orifice Transluminal Endoscopic Surgery 38**
   Suyash Naval
5. **Integration of Intraoperative Imaging with Surgeries 50**
   Kiran Pandey, Pavika Lal
6. **Fertility-preserving Surgery in Reproductive Medicine 59**
   Manjula S Patil
7. **Fertility-preserving Surgeries in Gynecological Cancers: A Multidisciplinary Framework for Clinical Practice 75**
   Satinder Kaur, Hemlata Garg

Index 83

CHAPTER 4

vNOTES: Vaginal Natural Orifice Transluminal Endoscopic Surgery

Suyash Naval

INTRODUCTION

The use of endoscopic abdominal visualization is almost 100 years old. Decker originally described vaginal pelvic visualization in 1944. Culdoscopy involves placing a scope in the posterior cul de sac with the patient in knee–chest position.[1-4] This was originally used for diagnosis but later adapted for diagnosing ectopic pregnancy and tubal ligation. However, few gynecologists used the technique, and abdominal and transvaginal surgeries dominated the profession. Abdominal laparoscopy and robotic surgery have been the primary methods of gynecologic surgery with the turn of the 21st century. Since laparoscopy has replaced most abdominal surgeries, patients heal faster, have less discomfort, and look better.[5,6] Unfortunately, transvaginal hysterectomies decreased as laparoscopic procedures and instruments improved. Vaginal hysterectomies fell from 25% in 1998 to 17% in 2010 and are on a decline. This is despite the American College of Obstetricians and Gynecologists and American Association of Gynecologic Laparoscopists (AAGL) recommending transvaginal hysterectomy for benign gynecological disease for patient safety and recovery. Younger resident gynecologists do fewer transvaginal procedures in their training period. As a result, there is a decline in transvaginal surgery.[5-7]

Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) is a minimally invasive surgical technique that can be called a newer advancement of endoscopic surgery. The NOTES approach uses natural orifices, such as the stomach, rectum, esophagus, and bladder, to access the abdominal cavity.[1,2,8-10] Traditionally, the vagina is utilized in gynecologic endoscopic surgery due to its lesser susceptibility to postoperative infections, enhanced visibility, ability to be closed, and improved healing after the surgery.

In the decade of the 2010s, vNOTES has emerged as a successful new technique in gynecology. It utilizes the principles of single incision/single port laparoscopic surgery which are applied transvaginally.[5,6,11,12]

This chapter will focus on the basics of the technique of vNOTES and its application to several gynecological surgeries.

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ADVANTAGES OF vNOTES

Several authors have compared vNOTES with standard laparoscopic procedures.[6,11,12] Certain benefits of vNOTES observed over laparoscopy were:

- Shorter operative time
- Less pain
- Faster recovery
- More discharges within 12 hours
- No scars
- Feasible for obese patients.

Hence, vNOTES has the advantage of better visualization and more operative space over traditional vaginal surgery especially in cases with narrow vagina, high apex, obesity, large size of pelvic pathology, and indicated adnexectomy.[5,11,13]

PATIENT SELECTION AND CONTRAINDICATIONS

vNOTES surgery is a suitable choice for most procedures[5,6,12] *except*:

- Malignancy
- Severe endometriosis
- Obliterated cul de sac
- Pelvic abscess/active infection

vNOTES hysterectomy for cancer endometrium with sentinel lymph node biopsy has been demonstrated in a clinical trial setting.

INSTRUMENTATION

- All standard laparoscopy instruments and vaginal surgery instruments are required for vNOTES.
- For vNOTES hysterectomy, it is preferred to use an advanced bipolar system with vessel sealing technology. The instrument described here is 5 mm LigaSure (Medtronic).
- 10 mm 0° or 30° telescope can be used for all procedures.
- Other essential instrumentation includes a wound protector, a latex surgical glove, or a premade vNOTES port.

ANESTHESIA AND PATIENT POSITION

The patient is given general anesthesia followed by a dorsal lithotomy position. During the surgery, 15° Trendelenburg position is provided to facilitate retraction of the bowel[5,6] **(Fig. 1)**.

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Fig. 1: Lithotomy with Trendelenburg position of the patient. Surgical team position between the legs of the patient.

ASSEMBLY OF vNOTES PORT

There are essentially two parts of the vNOTES port:

1. Wound protector (Medtronic/Applied Medical/Lagis Enterprise/Veol Medical Technologies)
2. Glove port/premade vNOTES port like GelPOINT (Applied Medical) or Lagis port/shield (Lagis Enterprise Co. Ltd.)

For making a glove port, we use a size 7 orthopedic-grade latex glove (Ansell). The tips of the fingers of the glove are cut with scissors. The size of the cut is about 4 mm and 8 mm for a 5 mm port and 10 mm port to be inserted through it, respectively. For most procedures, 3 ports are inserted through the incised fingers, one 10 mm port for the telescope and two 5 mm ports. The CO_2 insufflation tube is connected to one of the 5 mm ports or can be inserted into one of the remaining fingers of the glove. All ports are secured by tying a thread to avoid any leakage. After the wound protector is inserted transvaginally, the wrist of the glove is applied to the outer ring of the wound protector which is then rolled over the perineum till it snugly fits[14] **(Fig. 2)**. Alternatively, a premade NOTES port can be applied[15] **(Fig. 3)**.

vNOTES VISION AND ANATOMICAL ORIENTATION

The vision obtained by vNOTES is reversed to that of laparoscopic vision and therefore the anatomical orientation is also reversed. As a result, under the vNOTES view, all the right-sided anatomical structures appear on the left side of the screen and vice versa **(Fig. 4)**. Surgical team can gain this orientation quickly with dry laboratory practice.

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Fig. 2: vNOTES glove port.

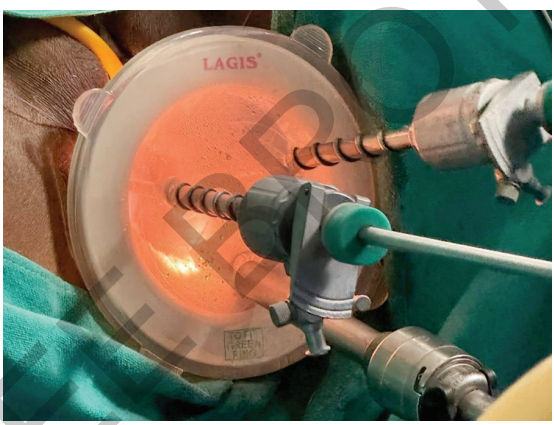


Fig. 3: vNOTES Lagis port.

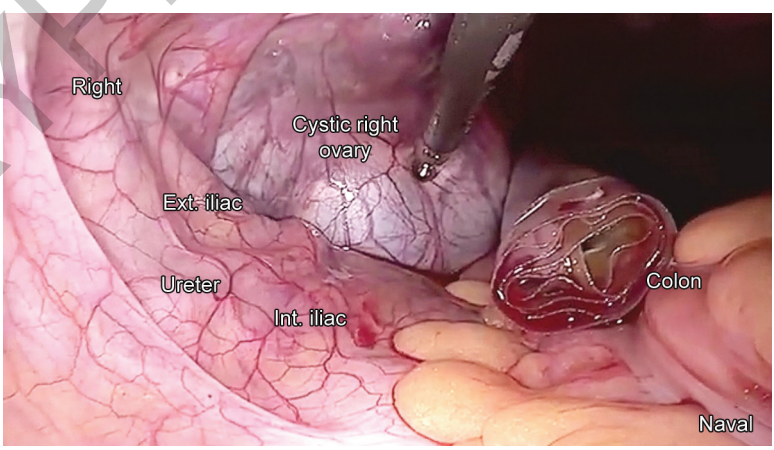


Fig. 4: vNOTES view of pelvic anatomy with reverse orientation.

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vNOTES HYSTERECTOMY

vNOTES hysterectomy is divided into two types:

1. *Vaginally Assisted NOTES Hysterectomy (VANH)*: Initial steps of surgery from colpotomy to division of uterosacral (USL) ligaments are performed like in traditional vaginal hysterectomy. The rest of the steps are performed by vNOTES.[15]
2. *Total Vaginal NOTES Hysterectomy (TVNH)*: All the steps of hysterectomy from colpotomy to completion of hysterectomy are performed by vNOTES.[11]

The technique described here is VANH by ATRIUM (aided by TRanscervical Instrumental Uterine Manipulation) technique.[14,16]

Step 1—Colpotomy: Circumcising incision over cervicovaginal junction

Step 2—Opening P pouch and A pouch: The posterior pouch is opened to enter the peritoneal cavity. The anterior pouch is opened after bladder dissection and retraction to enter the peritoneal cavity.

Step 3—Division of USL ligaments: Bilateral USLs are ligated and divided as in traditional vaginal hysterectomy. The sutures are used later to suspend the USLs to the vaginal cuff.

Step 4—Insertion of wound protector and assembly of glove port: The flexible ring of wound protector is inserted transvaginally beyond the edge of the vagina. The wrist of the glove is applied to the outer ring of the wound protector which is then rolled over till it snugly fits the perineum. The wound protector retracts the bladder, rectum, and lateral pelvic wall. It also creates space in the vagina for easy passage of instruments.

Step 5—Hysterectomy on the left side aided by instrumental uterine manipulation: The cervix is deflected to the right side by a toothed needle holder/grasper, and left uterine pedicle is isolated by dissection. The uterine pedicle is sealed by LigaSure and divided. Then the needle holder/grasper is passed transcervically into the uterus. It is pushed inside and deflected to the right side. This manipulation of the uterus exposes the pedicles on the left side **(Fig. 5)**. All the pedicles are sequentially sealed and divided to complete the hysterectomy on the left side. Salpingectomy is also done during these steps similarly.

Step 6—Hysterectomy on the right side aided by instrumental uterine manipulation: The same steps of surgery are repeated on the left side to complete the hysterectomy.

Step 7—Specimen retrieval and removal of vNOTES port: The specimen is grasped and removed transvaginally through the wound protector. A large specimen can be put in an endo bag and brought out transvaginally by

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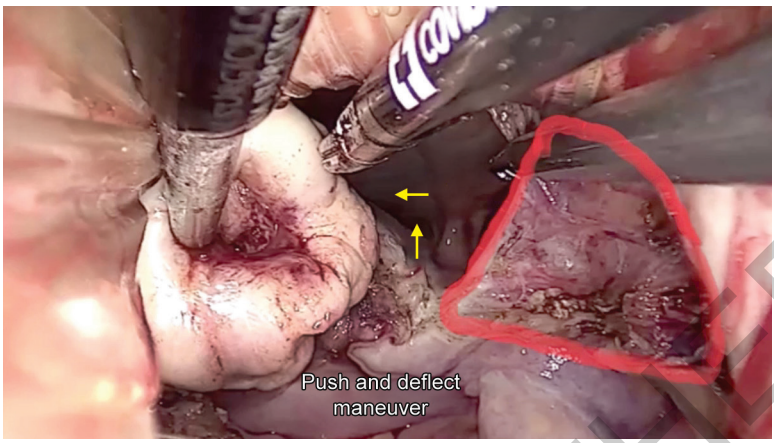


Fig. 5: Transcervical instrumental uterine manipulation. The uterus is deflected to the right side to expose left-side pedicles.

debulking with a surgical knife. Following this, the wound protector and vNOTES port are removed.

Step 8—Closure of vaginal cuff: The vaginal cuff is closed as in traditional vaginal surgery by 1-0 polyglactin or equivalent barbed sutures. It is advisable to suspend the vaginal cuff with USL ligaments.

Technique of TVNH: It can be difficult to perform anterior and posterior colpotomies and transect the USL ligaments in a non-prolapsed uterus with no descent especially in cases with narrow vagina. These challenges can be met with a TVNH.[11] The range of motion is limited by the smaller vNOTES-port utilized for this technique. It is advised to have prior VANH experience.

Step 1—Cervicovaginal circumcision: The vagina is where the vNOTES-port is inserted. To maintain a sufficient pneumovagina, carbon dioxide is insufflated at a pressure of 10 mm Hg. Bellowing of the vaginal wall can be avoided by using an insufflation-stabilizing bag. A monopolar hook—ideally with an integrated suction at the instrument's tip—is used to circumcise the cervix after an atraumatic forceps is used to provide traction on it **(Fig. 6)**. Using a swab in an atraumatic grasper, the vaginal mucosa and bladder are pulled up at the anterior fornix while maintaining tension on the cervix along the uterocervical fascia. The posterior fornix undergoes the same process.

Step 2—Posterior pouch dissection: Following blunt dissection, the peritoneum of the Douglas pouch is visible. The posterior colpotomy is then carried out using cold scissors, and the cervix is pulled caudally and ventrally using the atraumatic forceps **(Fig. 6)**.

Step 3—Anterior pouch dissection: Following vesicocervical septum transection and blunt dissection to identify the peritoneum between the

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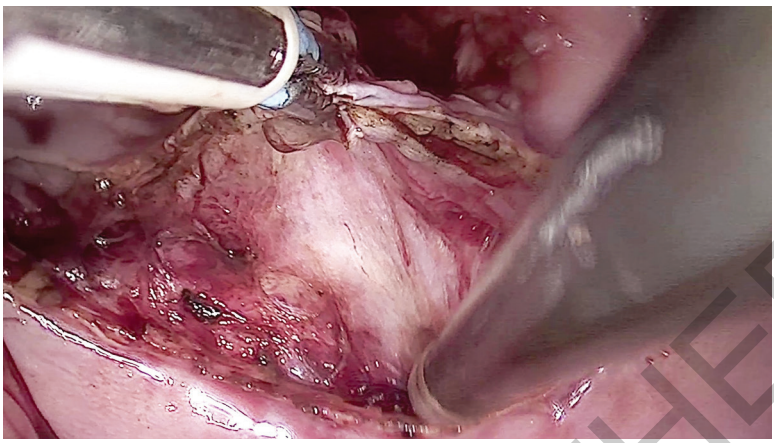


Fig. 6: Cervicovaginal circumcision and posterior pouch dissection.

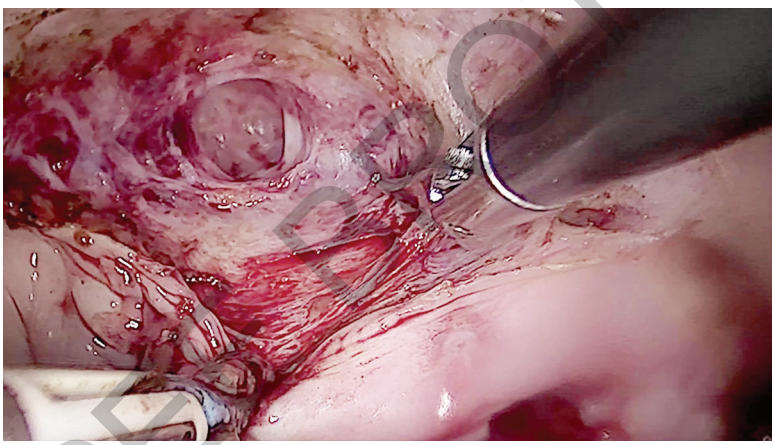


Fig. 7: Anterior pouch dissection.

bladder and uterus, the anterior pouch is opened with cold scissors, pulling the cervix dorsally and caudally with the atraumatic forceps **(Fig. 7)**.

Step 4—USL ligament transection: To transect the left USL, the Manhes forceps pushes the cervix caudally and to the right. Bipolar coagulation and a cutting or sealing tool are used for this. The right USL goes through an identical process.

Step 5—Setting up and repositioning the vNOTES-port: The entire process can be carried out intravaginally with the vNOTES-port in a tiny uterus. Visualization will be enhanced in a bigger uterus by inserting the inner ring of the port into the peritoneal cavity following the transection of the USLs.

The remaining steps are same as mentioned for VANH (from step 5 to step 8).

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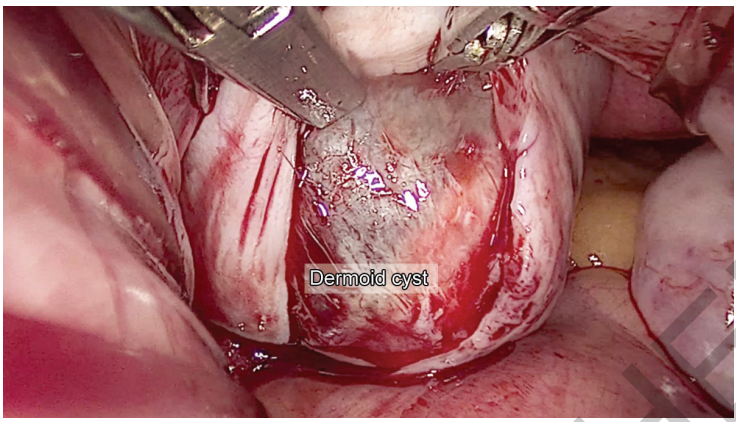


Fig. 8: vNOTES ovarian cystectomy for a dermoid cyst.

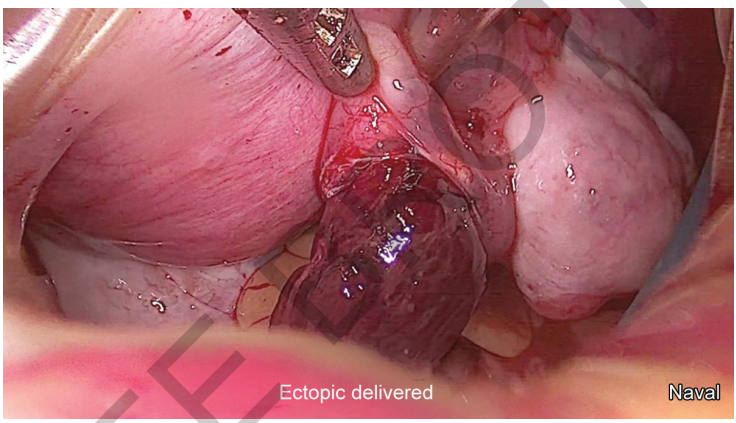


Fig. 9: vNOTES salpingotomy for ectopic pregnancy.

vNOTES ADNEXAL SURGERY

The principles of vNOTES remain the same for doing adnexal surgery except for a few differences.[5,13]

Only posterior colpotomy of about 3–4 cm is made. An extra-small-sized wound protector is inserted through it. The technique of insertion and the assembly of the glove port are the same.[5]

Generally, the pathological adnexa will fall automatically in the cul de sac. The required adnexal surgery is done following standard steps **(Figs. 8 and 9)**. The specimen is put in an endo bag and retrieved transvaginally. The vaginal incision is closed with 1-0 polyglactin after removal of the vNOTES port.

Following adnexal surgeries can be performed safely by vNOTES:

- Ovarian cystectomy
- Para-ovarian cystectomy

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- Adnexectomy
- Salpingectomy/salpingotomy for ectopic pregnancy
- Tuboplasty/tubal recanalization

Other vNOTES procedures:

Several other procedures have been reported:

- vNOTES myomectomy **(Fig. 10)**
- vNOTES supracervical hysterectomy
- vNOTES high USL ligament suspension **(Fig. 11)**
- vNOTES sacrocolpopexy
- vNOTES sentinel lymphadenectomy
- vNOTES isthmocele repair

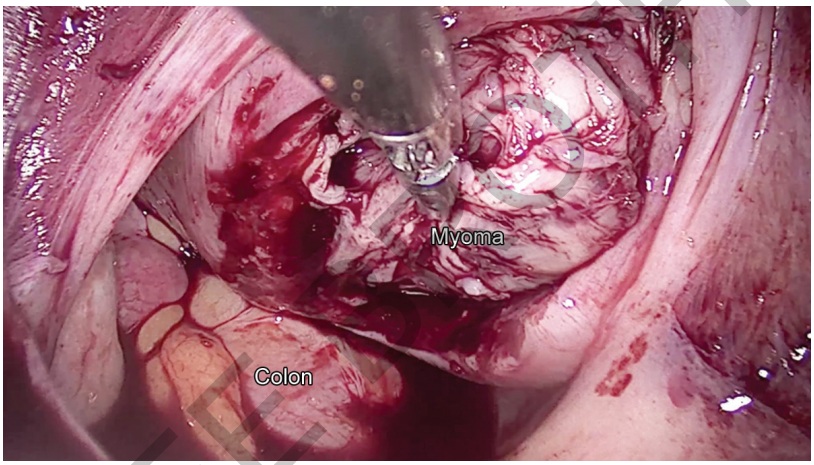


Fig. 10: vNOTES myomectomy for a posterior wall intramural myoma.



Fig. 11: vNOTES high uterosacral ligament suspension for vaginal prolapse.

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POSTOPERATIVE MANAGEMENT

The patient is mobilized 3 hours after the surgery. Oral intake is allowed 6 hours after the surgery. Discharge is given on day 2 in our protocol. However, vNOTES can be done in a daycare setting.

LIMITATIONS

Learning curve: Although short for a trained and proficient laparoscopic surgeon, there is a learning curve. Therefore, structured and systematic training in vNOTES is recommended.[17,18]

Triangulation and space: Although the triangulation in vNOTES is enough to perform most procedures comfortably, the limitation of space compared to laparoscopy can be challenging in difficult cases. Therefore, the importance of case selection needs no emphasis.[5,6,12,17,18]

Future development of instrumentation will allow vNOTES to overcome these limitations.

RECENT ADVANCES IN vNOTES

Robotic surgery has emerged to overcome the limitations of straight-stick laparoscopy. Similarly, the benefits of the wristed articulation have been reported to be valuable in robotic vNOTES. It is speculated to be useful in difficult vNOTES procedures.[19-21]

Our team has also reported pure vNOTES contained power morcellation to aid large-size specimen retrieval through a narrow vagina.[22] We have also innovated a technique to do gasless vNOTES hysterectomy and adnexal surgeries.[16]

CONCLUSION

vNOTES is a new and latest advancement in minimally invasive gynecological surgery. It has the potential to widen the scope of vaginal surgery which is the most preferred route in gynecology.[7] vNOTES in clinical practice can result in a better surgical and cosmetic outcome. However, experienced vaginal and laparoscopic surgeons should adopt it after efficient training.

Overall, the vNOTES procedures are safe, reproducible, and practical in modern gynecologic surgery. vNOTES is a valuable addition to minimally invasive surgical procedures and has distinct advantages over standard laparoscopy.[5,12,13,17,18] However, a complete review of their long-term results will require future research with a bigger patient population.

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