DOI: 10.1111/tog.12860
The Obstetrician & Gynaecologist
http://onlinetog.org

Commentary

vNOTES (vaginal Natural Orifice Transluminal Endoscopic Surgery): is this the future of gynaecological surgery?

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Accepted on 19 July 2022.

Please cite this paper as: Yoong W, Sampson V, Mwenechanya L, Baekelandt J. vNOTES (vaginal Natural Orifice Transluminal Endoscopic Surgery): is this the future of gynaecological surgery? *The Obstetrician & Gynaecologist* 2023; https://doi.org/10.1111/tog.12860

Introduction

Natural Orifice Transluminal Endoscopic Surgery (NOTES) is an emerging minimally invasive surgical technique that employs natural orifices, such as the rectum and vagina, for surgical access, thus obviating the need for any external skin incisions. The transvaginal route, known as vaginal Natural Orifice Transluminal Endoscopic Surgery (vNOTES), is the most accessible and most commonly used.

It utilises a colpotomy entry, followed by carbon dioxide insufflation (to create pneumoperitoneum) and insertion of endoscopic instruments (including laparoscope and energy devices) through the vagina (Figure 1). Gynaecological vNOTES procedures that have been described in the literature include adnexal surgery, ovarian cystectomy, myomectomy and hysterectomy.[1] vNOTES has attracted attention as it is associated with reduced morbidity, improved cosmesis and decreased length of hospital stay compared with laparoscopic surgery. This route combines the conventional vaginal approach and single port endoscopy and has derived from surgical skills gained from both vaginal and endoscopic surgery.

Technique in brief

vNOTES procedures are typically performed under general anaesthesia with the patient placed in the Trendelenburg position. The vaginal mucosa is initially circumscribed around the cervix and mobilised from the uterus – similar to the first steps of a vaginal hysterectomy. An Alexis® O-Retractor (Applied Medical; Rancho Santa Margarita, CA, USA) is introduced behind the colpotomy incision and pneumoperitoneum then created with an insufflation pressure of 10mm Hg, allowing good visual and operative access.[1] Su and colleagues[2] from Taiwan first described the concept of attaching a surgical glove onto the rim of an Alexis® O-Retractor and incising the finger ends to admit a standard 10-mm trocar (which is used for CO_2 insufflation and laparoscope insertion) and various endoscopic instruments (Figure 2). While such homemade devices can be effective and cost saving, the current practice is to use specially designed airtight access platforms such as GelPOINT® V-Path (Applied Medical; Figure 3) in order to provide a seal around the vaginal cuff to maintain insufflation pressure and allow introduction of instruments. Following surgery, specimens are retrieved through the vagina and the colpotomy incision closed with absorbable sutures. Compared with traditional laparoscopy, the low-pressure maintenance pneumoperitoneum used in vNOTES (6–10 mmHg versus 12–16 mmHg, respectively) means that less anaesthetic ventilation is required, and there is a lower risk of insufflation-induced bradycardia and carbon dioxide resorption.[3] The lower insufflation pressure and less invasive approach have resulted in the reporting of less severe postoperative visual analogue pain scores, and most patients are comfortable with paracetamol and non-steroidal anti-inflammatory drugs.

Comparisons with conventional procedures

A systematic review of five retrospective cohort studies (total 1002 women) comparing vNOTES (n = 264) with either

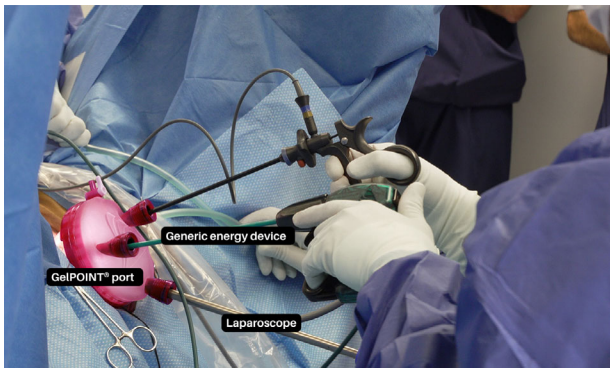

Figure 1. Vaginal natural orifice transluminal endoscopic surgery (vNOTES) with the patient in the Trendelenburg position (image reproduced with permission from Applied Medical).

Figure 2. Early modification using a surgical glove attached to an Alexis® O-Retractor to maintain pneumoperitoneum (image courtesy of Dr Schahrazed Rouabhi, London, with permission).

laparoscopic assisted vaginal hysterectomy (LAVH; n = 517) or total laparoscopic hysterectomy (TLH; n = 221) revealed similar efficacy, complication rates, readmission rates and postoperative pain scores but shorter operative time, length of stay and lower estimated loss of blood volume in women undergoing the former procedure.[4] The only randomised trial on this technique was single-blinded and comprised 35 women allocated to each of the vNOTES and TLH arms:

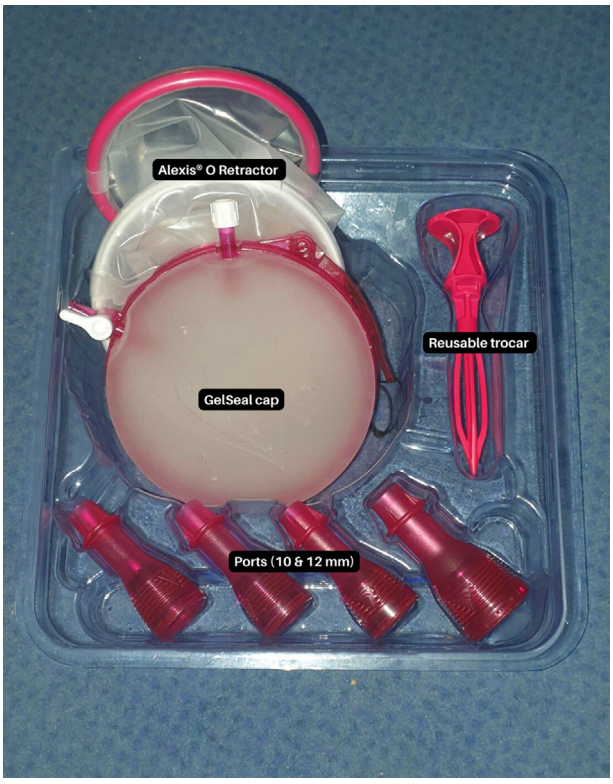

Figure 3. GelPOINT® V-Path kit, a specialised platform to provide an airtight seal around the vaginal cuff. The kit includes an Alexis® O-Retractor, GelSeal Cap, trocar and ports.

non-conversion to laparotomy, intra-operative complications, postoperative infection and readmissions were similar in the two groups, but operating time was significantly shorter (41 versus 75 min, $p < 0.001$), inpatient stay was shorter (0.8 versus 1.3 days, $p = 0.004$) and more women left the hospital within 12 hours (77 versus 43%, $p = 0.007$) in the vNOTES group.[5]

Similarly, two retrospective cohort studies of 66[6] and 114[7] patients comparing vNOTES and conventional laparoscopy in the management of benign adnexal pathology also indicated that the duration of surgery, length of stay and blood loss were significantly less in the former group. The sole randomised study comparing vNOTES with laparoscopic adnexectomy was a small pilot of 67 women by Baekelandt and colleagues,[8] which demonstrated similar success rate compared with laparoscopy but shorter duration of surgery, lower pain scores with less analgesic requirements and a trend for more adverse events (intraoperative spillage and postoperative bleeding) in the vNOTES group.

Cost-effectiveness

Two studies discussed financial costs comparing vNOTES with LAVH[9] and TLH.[5] Wang and co-authors[9] reported that

the mean hospital charge for a vNOTES case was approximately 5000 New Taiwan dollars (approximately GBP £130) more than LAVH, and this was primarily driven by the price of disposable Alexis® O-Retractors and energy devices, while Baekelandt et al.[5] estimated that vNOTES and TLH incurred similar cost variables. That theatre operating time was significantly shorter with vNOTES and that most patients undergoing the procedure were discharged 0.5 days earlier and needed less postoperative analgesia were often not factored into the cost calculations. Little is also known about the relative loss of income and productivity in women undergoing LAVH and TLH when compared with vNOTES as the latter group is likely to return to daily activity more rapidly.

Indications

Indications for a vNOTES procedure include, a) benign uterine and adnexal pathology such as ectopic pregnancy and ovarian cyst; and b) patients with high body mass index when conventional laparoscopy becomes challenging.

Exclusion criteria

According to the consensus-based statement developed among 39 international experts on vNOTES,[10] contraindications include, a) severe endometriosis obliterating the cul de sac or dense pelvic adhesions where colpotomy is fraught with the risk of inadvertent bladder or bowel injury, b) international continence society (ICS) classification Stage III or IV uterovaginal prolapse, c) previous rectal surgery, d) gynaecological malignancy, e) pelvic radiotherapy, f) history of a previous total hysterectomy, g) previous mesh sacrocolpopexy, and h) virginity.

Training and learning curve

Despite the clear advantages reported, there is little data available to assess the learning curve for vNOTES skill acquisition. Anecdotally, once colpotomy is achieved, the technique represents a natural endoscopic extension of surgical steps of a vaginal hysterectomy. For an experienced surgeon adept in both laparoscopy and vaginal surgery, it has been suggested that 20 cases comprises the initial learning curve.[11] The current shortage of experienced operators providing exposure to vNOTES training may deter interested gynaecologists from applying this technique in daily practice.

Robotic vaginal Natural Orifice Transluminal Endoscopic Surgery (RvNOTES)

Surgical boundaries are pushed even further with Robotic vaginal Natural Orifice Transluminal Endoscopic Surgery (RvNOTES), where the manoeuvrability of robotic surgery is allied with the natural orifice vaginal endoscopic approach. Initial data from case series are promising[12,13] with low conversion to open or laparoscopy salvage and minimal blood loss and post-operative pain. However, the extra cost, setup time and learning curve of RvNOTES requires further validation.

Conclusion

In summary, vNOTES procedures have gained attention worldwide and at the time of writing this commentary, over 3000 cases have been entered in the international NOTES Society (iNOTESs) case registry. The technique has helped overcome some of the limitations of vaginal and laparoscopic hysterectomy, i.e. better view and access in the case of vaginal hysterectomy and avoidance of abdominal incisions in the case of laparoscopic hysterectomy. Despite obvious benefits such as improved cosmesis, quicker recovery and reduced morbidity, there are factors which limit the widespread adoption of vNOTES. The shortage of experienced operators provides limited training opportunities and the learning curve of this novel procedure still needs to be fully assessed. While the authors are optimistic about the adoption of vNOTES in the future, it should be considered, at the moment, as a technique under evaluation for use in gynaecological surgery.

Disclosure of interests

WY is an Associate Editor for *The Obstetrician & Gynaecologist*; he was excluded from editorial discussions regarding the article and had no involvement in the decision to publish. WY, VS and LS received no funding. JB discloses consultancy with Applied Medical, CA, USA.

Contribution to authorship

WY initiated the project, did literature search and co-wrote the article. VS co-wrote the article. LM performed literature search and co-wrote the paper. JB peer reviewed the manuscript. All authors approved the final version.

Acknowledgements

The authors would like to thank Ms Sara Abazari from Applied Medical UK Ltd for her support during the writing of this commentary.

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