

vNOTES hysterectomy with a homemade glove port: Initial experience in Singapore

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Dear Editor,

Vaginal natural orifice transluminal endoscopic surgery (vNOTES) is an established surgical method of performing hysterectomy via the vaginal route and is one of the latest editions to the realm of minimally invasive surgery. Since the first vNOTES performed by Su et al. in Taiwan in 2012, vNOTES has been gradually gaining popularity as more surgeons become familiar with the technique.¹ Since our initial foray into performing vNOTES hysterectomy at Singapore General Hospital, we have been able to perform even more successful cases and across a wider spectrum of patients.² This is a discussion of our surgical outcomes and subgroup-tailored techniques in performing vNOTES since our index cases.

We conducted a retrospective review of patients that underwent vNOTES hysterectomy for benign gynaecological conditions at Singapore General Hospital from March 2021 to December 2023. Since our initial foray in performing vNOTES hysterectomy, patients are determined to be candidates for vNOTES hysterectomy if they are candidates for laparoscopic surgery. SingHealth Centralised Institutional Review Board approval was not required for the use of anonymised patient data. Length of stay, operative duration and complication rates were the main outcomes assessed. Continuous variables were summarised using median and range. Categorical variables were represented by percentages. Surgical complications encountered were classified according to the Clavien-Dindo Classification.³ Patients were followed-up until the first clinic visit (3 weeks) for any post-operative complications.

From March 2021 to December 2023, 92 cases of vNOTES hysterectomy were performed. The clinical demographic and perioperative outcomes of our study are shown in Table 1.

Our cohort consisted of a multiethnic population. The median and maximum age of patients were 47 and 75 years, respectively. Fifty-two patients

(56.5%) had a body mass index (BMI) of 25 and above and were considered as obese according to our local Asian classifications. Twenty patients (19.2%) were virgo intacta, and 40 cases (43.4%) had previous abdomino-pelvic surgeries. vNOTES hysterectomy for ovarian cysts and fibroids were the most common indication for surgery. Metabolic disease and asthma were the most common medical comorbidities of our cohort. Median estimated blood loss was 100 mL. Median operative duration was 115 min. Ten patients had uterine weight greater than 300 g with 3 cases being more than 500 g. Median duration of hospitalisation (including operative day) was 2 days. All patients were well on first post-operative clinic review. We reported a total of 3 patients that experienced complications. The first patient developed postoperative bleeding from the vaginal vault on postoperative day 2 which was managed conservatively. The second patient required conversion to laparotomy to facilitate delivery of a large ovarian cyst (26.9 cm x 14.1 cm x 16.5 cm) and repair of an inadvertent enterotomy and cystostomy. The third case required closer monitoring in the surgical intensive care unit due to failure to extubate in the operating theatre likely related to morbid obesity (BMI 55.9), poorly controlled asthma and obstructive sleep apnea.

Over the years, we have explored the role of vNOTES and concluded that it is a feasible approach in various patient populations with careful adjustments to surgical technique.

Patients with previous abdominal surgery represent a challenging subgroup for vNOTES surgeons due to the presence of adhesions. For patients with prior lower segment caesarian section (LSCS), which forms an ever-increasing subgroup in our local population as more women opt for LSCS, we perform a posterior colpotomy followed by bladder adhesiolysis and dissection of the uterovesical fold under direct laparoscopic guidance. For patients with previous anterior

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Table 1. Patient characteristics and perioperative outcomes.

	vNOTES (n=92)
Median age, years (range, SD)	50 (23–81, 13.4)
BMI (range, SD)	25.8 (15.6–55.9, 5.5)
BMI ≥25	52 (56.5)
BMI <25	40 (43.5)
Race, no. (%)	
Chinese	53 (57.6)
Indian	19 (20.7)
Malay	12 (13.0)
Others	8 (8.7)
Parity, no. (%)	
Virgin	20 (19.2)
Non-virgin	72 (80.8)
Normal vaginal delivery, no. (%)	
0	47 (51.1)
≥1	45 (48.9)
Previous abdominal surgery, no. (%)	
Yes	40 (43.4)
No	52 (56.5)
Type of abdominal surgery, no. (%)	
Lower segment caesarian section	16 (17.4)
Cystectomy	9 (9.8)
Colectomy	4 (4.3)
Cholecystectomy	6 (6.5)
Exploratory laparotomy	1 (1.1)
Sleeve gastrectomy	2 (2.2)
Hernia repair	2 (2.2)
Others	5 (5.4)
Indication for surgery, no. (%)	
Ovarian cyst	27 (29.3)
Fibroids	21 (22.8)
Genetic risk reduction (BRCA1/2, RAD51C/D, BRIP1, Lynch syndrome)	16 (17.4)
Gender reassignment	9 (9.9)
Atypical hyperplasia	9 (9.9)
Adenomyosis/endometriosis	3 (3.3)
Cervical intraepithelial neoplasia with fibroids	3 (3.3)
Genetic risk reduction and adenomyosis	1 (1.1)
Ovarian cyst and adenomyosis	1 (1.1)
Ovarian torsion	1 (1.1)
Pyometra	1 (1.1)
Medical comorbidities, no. (%)	
Hyperlipidaemia	32 (37.8)
Hypertension	30 (32.6)
Type 2 diabetes mellitus	16 (17.4)
Asthma	13 (14.1)
Ischaemic heart disease	3 (3.3)
Paroxysmal atrial fibrillation	3 (3.3)
Chronic kidney disease	3 (3.3)
Gastroesophageal reflux disease	3 (3.3)
Stroke/transient ischaemic attack	2 (2.2)
Median operative duration, minutes (range, SD)	115 (45–475, 59)
Median estimated blood loss, mL (range, SD)	100 (0–700, 224.9)
Median length of stay, days (range, SD)	2 (1–12, 1.72)
Median uterine weight, g (range, SD)	94 (24–872, 145.2)
Perioperative complications	3 (3.2)
< Clavien-Dindo III	1 (33.3)
≥ Clavien-Dindo III	2 (66.6)

BMI: body mass index; SD: standard deviation; vNOTES: vaginal natural orifice transluminal endoscopic surgery

resections or suspected endometriosis, we perform an anterior colpotomy or lateral approach to minimise the risk of rectal injury.^{4,5} Adhesiolysis is then performed prior to the sealing of uterine vessels. The ureters are traced prior to the mobilisation of the uterus to avoid ureteric injury.

vNOTES in virgo intacta patients is technically challenging due to a narrow vagina and introitus. This is made even more challenging in our local Asian population due to our natural Asian anatomy of having a narrower introitus as compared to the Western population. We performed vNOTES for 20 virgo intacta patients without any major complications through the use of a small virgin speculum and small lateral retractors, to provide adequate exposure without causing major vaginal tears. Anterior and posterior colpotomy were performed under laparoscopic guidance to improve anatomical visualisation during routine colpotomy.

Performing vNOTES in patients with large uterus can be challenging due to difficulty with uterine manipulation, visual access and specimen retrieval. In some cases, large fibroids sited at the lower anterior corpus and extrauterine fibroids with caudal extension to the cervix could also complicate routine colpotomy.⁶⁻⁸ Some studies have also noted increased blood loss in patients with large uteri undergoing vNOTES due to regurgitant bleeding from the large uterus and failure to ligate all engorged vessels associated with a large uterus.⁷ To achieve comparable blood loss rates and operative durations in patients with large uteri, we took greater precautions to ensure proper ligation of the engorged vessels by utilising a good energy sealing device. Only 1 case required conversion to laparotomy to facilitate specimen retrieval. The decision for conversion was also partly due to the inadvertent enterotomy and cystostomy.

Performing colpotomy is technically challenging in patients with high BMI (>35) due to crowded introitus. With rising rates of obesity in Singapore, we anticipate an increase in vNOTES performed for patients with high BMI in the following years. We opted to perform the initial circumferential incision under laparoscopic guidance before proceeding with the remaining segments of surgery. We also elected to perform some of the initial stages of surgery vaginally before introducing pneumoperitoneum and performing the remaining segments of surgery.

This study presents our initial experience in performing vNOTES for a wide and varied patient population. With increased experience in vNOTES hysterectomy, we will eventually be able to conduct comparative studies to better evaluate the efficacy of vNOTES against other surgical alternatives and reduce selection bias. With a larger study population, we also aim to conduct multivariate analyses and logistic regressions to identify potential predictors of adverse outcomes to guide the recommendation of vNOTES in different patient populations.

Ethics statement

Not applicable.

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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