Pure Natural Orifice Translumenal Endoscopic Surgery (NOTES) Transvaginal Nephrectomy


1. Case report

Following institutional review board approval, a 58-year-old woman with grade 4 vesicoureteral reflux, recurrent urinary tract infections, and an atrophic right kidney was selected for natural orifice translumenal endoscopic surgery (NOTES) transvaginal nephrectomy. Computed tomography of the abdomen and pelvis revealed an atrophic and scarred right kidney with contralateral renal hypertrophy (Fig. 1). Mercaptoacetyltriglycine-3 revealed a split renal function of 11% on the right. Serum creatinine was 1.36 mg/dl. The patient’s past medical history was unremarkable. Body mass index was 32.3 kg/m². The patient’s past surgical history included an extraperitoneal pubic bone biopsy and Nissen fundoplication with gastric biopsy. Pelvic examination demonstrated a grade 1 cystocele and a vaginal depth of 9 cm. Following a thorough explanation of the risks, benefits, and alternatives of intervention, consent was obtained for NOTES transvaginal nephrectomy.

Under general endotracheal anesthesia, the patient was positioned in lithotomy with all pressure points padded. The left arm was secured to an armboard, and the right arm was tucked over the patient’s chest (Fig. 2). A wedge was
placed under the patient's torso on the right side to accentuate the retroperitoneum.

A self-retaining vaginal retractor was employed, the cervix identified externally, and a tenaculum placed. A 3-cm colpotomy was made posteriorly and dissection carried to the peritoneal cavity. A blunt-tipped trocar was introduced transvaginally into the peritoneal cavity and pneumoperitoneum established. A standard flexible video gastroscope was introduced transvaginally into the abdominal cavity for diagnostic evaluation. Minimal to no pelvic adhesions were encountered (Figs. 3 and 4).

The GelPort laparoscopic system (Applied Medical, Rancho Santa Margarita, CA, USA) was deployed across the vaginal incision. The depth of the patient's vagina prevented reliable positioning of the inner ring of the GelPort, and a small but manageable air leak was encountered. Two 10-mm standard trocars and one 5-mm standard trocar were placed across the GelPort through which a 5-mm deflecting laparoscope (Olympus Surgical, Orangeburg, NJ, USA) and 45-cm articulating graspers and scissors (Novare Surgical, Cupertino, CA, USA) were placed. The operating table was tilted to passively reflect the ascending colon.

The posterior peritoneum was incised over the right iliac artery. While developing the plane between the retroperitoneum and the mesentery of the colon, the downward torque on the GelPort resulted in displacement of the posterior aspect of the port with a resultant significant air leak. For this reason, the GelPort was exchanged for the multichannel TriPort (Olympus Surgical, Orangeburg, NJ, USA). The plane of dissection between Gerota fascia and the ascending colon was identified. The duodenum was reflected using blunt dissection and pinpoint cautery. The ureter was identified atop the psoas muscle and lifted anteriorly to expose the posterior aspect of the kidney. The ureter was controlled with Hem-O-Lok (Weck Closure Systems, Research Triangle Park, NC, USA) clips and transected. The kidney was grasped and pulled laterally to define the renal hilum. Given the patient's comparatively long vaginal length, dissection through the TriPort could not be continued. The GelPort was then reinserted and dissection continued toward the renal hilum. Because the kidney was now being pulled anteriorly and medially, the previously encountered air leak was not a significant issue. With the renal hilum optimally exposed, an endovascular stapler was fired across the renal vein and renal artery. The remaining posterior and upper pole attachments were taken down using an extra-long (65 cm) monopolar J-hook with care taken to spare the adrenal gland. The kidney was placed into a laparoscopic retrieval bag and brought out through the existing vaginal incision.
tissue grasping and dissection [1]. Conversely, NOTES seeks to secure, and the use of rigid operative instruments for secure judicious placement of ancillary ports for optimized exposure, and imprecise and/or unreliable tissue handling [2]. Moreover, justifiable concern remains regarding the wisdom of elective viscerotomy. Although some of these limitations have been addressed through product development and surgeon ingenuity, there remain significant barriers to its pragmatic application [3,4]. Thus far, NOTES within urology has been limited to experimental animal models and diagnostic procedures in humans. Extirpative and reconstructive procedures have universally required transabdominal assistance to facilitate exposure and/or dissection [5–7].

In 2009, Sotelo and colleagues reported a multi-institutional experience with “hybrid” NOTES transvaginal nephrectomy in four patients [6]. Three patients required conversion to standard laparoscopy due to intraoperative complications including one rectal injury during vaginal entry, failure to progress in one patient, and persistent upper pole bleeding in one patient. The one remaining patient underwent successful hybrid NOTES transvaginal nephrectomy without conversion to standard laparoscopy. However, a multichannel single port was placed transumbically through which dissection and hilar division was performed. The patient required readmission and drainage of an intra-abdominal abscess. The authors concluded that although NOTES transvaginal nephrectomy is feasible in select patients, significant refinement in operative technique and improvement in instrumentation is required.

Earlier this year, our group reported the first NOTES transvaginal nephrectomy in which complete renal dissection, hilar division, and specimen extraction was performed exclusively through the vagina [5]. Because this patient had previously undergone significant pelvic surgery, we elected to place a 5-mm umbilical trocar such that vaginal access could be obtained under direct vision. There were no intraoperative or postoperative complications. Duration of hospitalization was <1 d with return to normal activities within 1 wk of surgery. Our ability to complete the procedure, despite encountering severe pelvic adhesions, was both encouraging and motivating.

Building on our prior experience, we were able to perform the previously described right simple nephrectomy successfully without the use of any transumbilical assistance or 2-mm instruments. This patient had not had any significant prior pelvic surgery, so we felt comfortable obtaining access to the peritoneal cavity blindly. We found entry to the peritoneal cavity to be straightforward and expedient. Despite our success, we continue to advocate transvaginal access under direct transumbilical vision in the setting of significant prior pelvic surgery.

We did encounter difficulty with secure port positioning in this patient given the relatively deep nature of her vagina. In our opinion, the existing ports that were originally designed or adapted for single-port surgery require further modification for transvaginal procedures to be successful. Instrumentation, although considerably more robust and ergonomic, requires further modification to reduce surgeon fatigue and discomfort during the lengthy dissection.

Based on our experience, NOTES transvaginal nephrectomy may be feasibly performed in select patients without transumbilical assistance. Although dissection remains tedious and time consuming, spatial orientation is quickly achieved. Ports and instrumentation require further modification for NOTES urologic surgery to be pragmatic. Additional study is required to better define the future role of transvaginal NOTES in the management of urologic diseases.

**Conflicts of interest:** The authors have nothing to disclose.
EU-ACME question

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Question:

The clinical application of natural orifice transluminal endoscopic surgery (NOTES) transvaginal nephrectomy has, up to the present, presented significant logistical barriers and raised questions regarding the differential benefit and safety of natural orifice surgery. Which of the following are true statements regarding NOTES nephrectomy:

A. Dissection of the lower, lateral pole of the kidney has proven to be the most difficult portion of the operation because of the proximity and angle of the pelvic brim.
B. In women with prior intra-abdominal surgery, transvaginal access may be safely obtained blindly, so long as the culpotomy is made posteriorly and the plane of vaginal dissection is directed anteriorly thereafter.
C. The selection criterion for NOTES nephrectomy remains undefined.
D. Natural orifice surgery should be universally performed under the auspices of an institutional review board, and thorough and rigorous consent is mandatory.
E. Both C and D.

References