SKILL AND TALENT

Hybrid-NOTES transvaginal hemi-nephrectomy for duplicated renal collecting system in the adult patient

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Abstract

Introduction: Duplication of the ureter and renal pelvis is the most common anomaly of the upper urinary tract. Upper pole heminephrectomy is a treatment option when duplication anomalies are associated with ureteral ectopia or ureterocele with an associated nonfunctioning or infected upper pole moiety.

Material and method: We describe a NOTES hybrid transvaginal upper pole heminephrectomy in a 24-year old with recurrent infections in a poorly functioning right upper pole moiety. The procedure was performed with a bariatric trocar in the vagina, and a multichannel single-port device (Triport, Olympus Surgical) in the umbilicus. An ultrasonic scalpel was used for the heminephrectomy. The specimen was retrieved through the vagina.

Results: Operative time was 150 min and blood loss 50 cc. One week later the patient developed urinoma at the surgical site and was re-explored laparoscopically. The cut edge of the heminephrectomy defect was fulgurated and a drain placed. The patient recovered uneventfully following re-exploration.

Conclusions: We describe the technique for transvaginal Hybrid-NOTES heminephrectomy. This approach requires further development with respect to instrumentation, and surgical expertise. The combined umbilical and vaginal approaches restored triangulation and facilitate dissection, but more experience is required to determine safety, efficacy and reproducibility.

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PALABRAS CLAVE
Cirugía transvaginal; NOTES-híbrido; Heminefrectomía

Heminefrectomía NOTES-híbrido transvaginal por duplicidad del sistema colector renal en el paciente adulto

Resumen

Introducción: La duplicación del uréter y la pelvis renal es la anomalía más común del tracto urinario superior. La heminefrectomía polar superior es el tratamiento de elección cuando la anomalía se asocia con ectopia ureteral o ureterocele en un sistema no funcionante o infección crónica del riñón.

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**Introduction**

Ureteral duplication is a relatively common congenital anomaly of the genitourinary tract. The incidence is 1 in 125 cases, or 0.8%. Often, this anomaly is associated with a poorly functioning upper pole moiety, typically the result of obstruction. Upper pole heminephrectomy is the standard surgical management when obstruction is accompanied by repeated urinary infection or other complications. Historically, open surgery was the standard approach, which involved significant recovery time, associated pain, and scarring.

Seventeen years ago, Winfield and associates performed the first laparoscopic partial nephrectomy. Since then, advances in surgical technique, equipment, and instrumentation have expanded the role of minimally invasive surgery in renal surgery, even in complex procedures.

More recently, laparoendoscopic single site surgery (LESS) and natural orifice transluminal surgery (NOTES) have been explored. The so-called ”Hybrid-NOTES” is a term to describe a NOTES surgical approach with the aid of a transluminal port. The vaginal canal has been utilized for the introduction of instruments, cameras, as well as for extraction of the specimen.

To date, there are no medical reports about the application of Hybrid-NOTES to perform a heminephrectomy or partial nephrectomy. Herein, we describe our technique for laparoscopic upper-pole heminephrectomy using a Hybrid-NOTES transvaginal approach in adult patients.

**Materials and methods**

Based on our previous experience performing Hybrid-NOTES transvaginal nephrectomy, we performed an upper pole hemi-nephrectomy in an adult woman patient with a duplicated renal collecting system. The patient was a 21-year-old female patient with history of repeated urinary tract infections and right flank pain. Computed tomography (CT) imaging revealed a duplicated collecting system of the right kidney. The upper pole moiety was hydrourephrotic with thin atrophic parenchyma (Fig. 1).

**Resultados**: El tiempo operatorio fue 150 minutos y el sangrado 50 cc. Después de una semana la paciente desarrolló un urinoma en el lecho quirúrgico, que precisó exploración por vía laparoscópica. El lecho de la heminefrectomía fue fulgurado y se colocó un drenaaje. La paciente se recuperó sin eventualidad tras la reintervención.

**Conclusiones**: Se describe la técnica de heminefrectomía transvaginal con técnica NOTES-híbrido. Este abordaje requiere mayor desarrollo, tanto de la instrumentación como de la técnica. La combinación de los abordajes umbilical y transvaginal restablece la triangulación y facilita la disección, pero se requiere más experiencia para determinar su seguridad, eficacia y reproducibilidad.

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delivered from behind the hilum; vessels supplying the upper pole were divided between hem-o-lock clips. With the scope through the umbilicus and retraction from the vagina, additional ureteral tissue was resected, and the specimen was retrieved vaginally (Fig. 3). A surgical drain was placed and exteriorized through the vagina.

**Results**

No intraoperative complications were identified. Operative time was 150 min, blood loss was 50 cc, and the surgical drain was removed on postoperative day four with minimal output.

On the seventh day, the patient was re-admitted with abdominal pain, and CT scan revealed a urinoma at the surgical site. The patient was re-explored laparoscopically, with the use of a 3 mm × 5 mm port, 2 outside the previous umbilical incision, and one in the umbilical scar, the cut edge of the renal parenchyma was fulgurated and a drain was placed. The patient recovered uneventfully. She was discharged 48 hours later, and returned to normal activities on the third day. CT scan at the sixth month of follow-up revealed no evidence of collection, and the lower pole moiety demonstrated normal function and drainage. Final pathology revealed pyelonephritis, fibrosis and absence of tubules.

**Discussion**

Laparoscopy has become an accepted technique for nephrectomy and partial-nephrectomy. Extensive laparoscopic experience and developing technology has led to interest in alternative approaches, including LESS, NOTES, and Hybrid-NOTES. These techniques offer potential benefits, most notably for improved cosmetics. Originally described for complete nephrectomy, we describe the first report of the Hybrid-NOTES technique for upper-pole heminephrectomy.

Since the first description of laparoscopic partial nephrectomy by Winfield et al. in 1992 in an adult patient, and later by Jordan and Winslow in children with success, several series have reported similar experiences with laparoscopic partial nephrectomy. Partial and heminephrectomy, necessitation hilar and ureteral dissection, as well as extirpative and reconstructive surgical techniques are particularly challenging. With experience, this can be performed safely via traditional laparoscopy. Recently, advances in laparoscopic surgery have focused on further reducing procedural morbidity and moving toward a scarless outcome. NOTES and laparoendoscopic single-site surgery (LESS) are two such approaches that share this underlying goal.
In 2002, Gill reported an initial series using a natural orifice (vagina) for intact specimen extraction after performing a standard four-port laparoscopic radical nephrectomy. In March 7, 2009 we performed the first Hybrid-NOTES transvaginal nephrectomy. We demonstrated the feasibility of renal surgery in a patient with kidney tumor using vaginal access not only for specimen extraction but also as a portal for working instruments (4). In recent years, LESS surgery has evolved rapidly to the point of being used for multiple urologic applications. Various centers have already reported their experience with a range of ablative and reconstructive LESS urologic procedures, with encouraging early results.

In our initial Hybrid-NOTES clinical cases, important milestones were reached. Firstly, the technique of transvaginal trocar placement was refined. Secondly, the suitability of a rigid platform, including optics and instruments, for transvaginal NOTES surgery was confirmed clinically. In the third place, we incrementally increased the use of the transvaginal port for actual operative steps, including dissection and control of the renal artery and/or vein transvaginally. Finally, and most important, we gained increased confidence with regard to intraoperative visual orientation and laparoscopic dissection from the transvaginal route. Until vaginal access techniques are standardized, transabdominal visual guidance during vaginal port placement is advisable, and transvaginal mobilization of the upper-pole kidney requires use of extralong, articulating, or flexible instruments.

We also found that the use of the 5 mm scope with a flexible tip facilitates visual orientation, and the camera should be interchanged between the umbilicus and the vagina, according to which entry affords the best visualization of the operative field to ensure a safe procedure.

Although we did complete the operation via the Hybrid-NOTES approach, we also had a postoperative urinoma in the surgical site. This complication is not inherent to the surgical approach, but it is a well-known potential complication of partial or hemi-nephrectomy. At the time of surgery, fulguration of the base of the resection was considered; however, there was concern of perforating into the lower pole moiety collecting system and it did not appear necessary. During the re-intervention, the base of the resection was fulgurated. A ureteral catheter was placed and retrograde instillation of methylene blue showed the integrity of the collecting system. Urinomas, when small, can be treated with the placement of a CT-guided percutaneous drain and will mostly resolve without the need for further intervention. Our patient had persistent flank pain and a urinoma at the site of surgery on a CT scan, sufficient reasons for reintervention.

When developing new surgical techniques, it is essential that complications are reported to allow for critical evaluation of novel approaches. Given more experience, we believe that in the future, transvaginal hybrid NOTES may be an alternative for urologists in the performance of various procedures on the upper urinary tract.

**Conclusion**

We describe the technique for transvaginal Hybrid-NOTES heminephrectomy. This approach requires further development with respect to instrumentation and surgical expertise. The combination of umbilical and vaginal approaches restores triangulation and facilitates dissection, but more experience is required to safely determine efficacy and reproducibility.

**Conflict of interest**

The authors declare that they have no conflict of interest.
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