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Pediatric laparo-endoscopic single site partial nephrectomy: Feasibility in infants and small children for upper urinary tract duplication anomalies

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Abstract *Objective:* To assess the feasibility and outcomes of laparo-endoscopic single site (LESS) partial nephrectomy (PN) in infants and small children for upper urinary tract duplication anomalies.

Materials and methods: The medical records of all patients undergoing LESS PN at a single pediatric institution were retrospectively reviewed for patient demographics, perioperative details, and outcomes. A cystoscopy was initially performed to place an externalized catheter into the ureter of the ipsilateral normal renal moiety. An Olympus TriPort, an Olympus Endoeye flexible tip laparoscope, standard 3- or 5-mm instrumentation, and a LigaSure Blunt were utilized.

Results: Four children (two boys, two girls) underwent LESS PN. Three patients underwent upper pole PN and one underwent lower pole PN. All procedures were performed for poorly functioning obstructed renal moieties (one ureterocele, one ureteropelvic junction obstruction and vesicoureteral reflux, and two ectopic ureters). Median age was 6.2 months (range 2.5–16.4 months). Median weight was 7.7 kg (range 6.1–12.6 kg). Median operative time was 126 min (range 97–180 min). No patient received inpatient postoperative narcotics. Median follow-up was 9.9 months (range 6.2–19.1 months). No postoperative complications were noted. Postoperative renal ultrasound demonstrated successful resection in all patients.

Conclusions: LESS PN is technically feasible, safe, and effective for upper urinary tract duplication anomalies in infants and small children.

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Abbreviations: MIS, Minimally invasive surgery; LESS, Laparoendoscopic single site; PN, Partial nephrectomy; HN, Heminephroureterectomy.

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Introduction

The first reported use of laparoscopy for extirpative renal surgery was by Clayman et al. in 1991 [1]. Since then, laparoscopic techniques have been widely adopted within urology. Laparoscopic surgery is now commonly performed for many pediatric urologic conditions. Pediatric patients undergoing laparoscopic extirpative renal surgery have experienced shorter hospital stays, decreased pain medication requirements, and the potential for improved cosmesis [2,3].

Urologists have made significant advances in minimally invasive surgery (MIS). Efforts have continued to further minimize surgical morbidity and improve the postoperative cosmetic outcome to a virtually scar-free appearance. This evolution has led to the introduction of laparo-endoscopic single site (LESS) surgery. This innovative technique accesses the abdominal cavity using a single umbilical incision, through which different laparoscopic instruments are introduced in order to perform a multitude of extirpative and reconstructive surgical procedures. Ablative and reconstructive procedures that can be performed via conventional or robot-assisted laparoscopy have been successfully accomplished using LESS techniques [4–7]. The first two cases of single port surgery in urology were simple nephrectomy and ureterolithotomy performed by Rane et al. in 2007 [8]. Kaouk and Palmer [9] reported the first LESS surgery in three children for varicoceles in 2007. However, there are limited reports of LESS surgery performed in children. To our knowledge, we present the first experience of LESS partial nephrectomy (PN), including infants less than 1 year of age, for upper urinary tract duplication anomalies. This retrospective, descriptive, non-randomized study was performed to assess the feasibility and outcomes of LESS PN in infants and small children for upper urinary tract duplication anomalies.

Materials and methods

The medical records of all children who underwent LESS PN at a single pediatric institution from January 2012 to February 2013 were retrospectively reviewed. Chart review was performed after institutional review board approval. LESS surgery was introduced at our hospital in September 2010. Pediatric LESS PN was offered from January 2012. No patients undergoing LESS PN were excluded. All patients underwent a preoperative renal ultrasound. Preoperative voiding cystourethrograms and diuretic renal scans were performed. Indication for operative intervention included poor function of an obstructed renal moiety in upper urinary tract duplication anomalies. A cystoscopy was initially performed to place an externalized catheter into the ureter of the ipsilateral normal renal moiety, which was removed at the end of the laparoscopic procedure. The ureteral catheter was placed to help identify the normal ureter and prevent injury during the procedure. All procedures were performed via a transperitoneal approach through a single umbilical surgical site for obstructed upper or lower pole renal moieties. Data included age, weight, operative time, blood loss, drain utilization, length of hospital stay, postoperative analgesics, complications, and length of the follow-up period. Operative time was recorded as the

initiation of skin incision until the end of skin closure. Operative time did not include cystoscopy, which was approximately 5 min for ureteral catheter placement. Patient repositioning for the laparoscopic procedure was typically another 10–15 min.

Surgical technique

LESS PN was performed with an Olympus Endoeye (Tokyo, Japan) flexible tip laparoscope, Olympus TriPort, standard 3- or 5-mm instrumentation, and a 5-mm LigaSure Blunt (Covidien, Dublin, Ireland). The Olympus Endoeye is a 5-mm flexible tip laparoscope that delivers a 100-degree angulation and an 85-degree field of view. The first-generation Olympus TriPort is a multi-channel single port device that is placed via an open technique.

Patients were placed in flank position. Access was obtained via a midline, full-length, unmeasured, umbilical incision, which was based on the appearance of the skin of the umbilical ring, estimated at 1.5–2.0 cm. The fascia was opened under direct vision. The Olympus TriPort and Endoeye were introduced. Standard 3- or 5-mm instruments were utilized. Sharp and blunt dissection was employed to open the posterior peritoneum and expose the retroperitoneal space. A percutaneous Prolene holding suture was placed through the diseased renal parenchyma. The upper pole was approached and exposed primarily for diseased upper pole moieties. The LigaSure Blunt was used to control the renal vessels of the involved moiety and perform the majority of the dissection. The upper pole ureter was mobilized cranial to the renal hilum for diseased upper pole moieties. The lower pole was approached primarily for the case with ureteropelvic junction obstruction. The involved renal pelvis and ureter were mobilized and used as a handle for traction and exposure. The diseased renal parenchyma was amputated using the LigaSure Blunt. The avascular plane was identified and followed, between the upper and lower renal poles. Subsequently, redundant ureter was mobilized and amputated without violating the distal common sheath of the duplicated ureters. The distal ureteral stumps of the ectopic ureters, ureterocele, and the ureteropelvic junction obstruction and vesicoureteral reflux were left open, sealed with the LigaSure Blunt, and ligated with 0-polydioxanone Endoloops, respectively. The specimen was removed intact through the single port trocar site without extension of the skin incision. The umbilical fascia was closed with interrupted 3-0 Vicryl.

Local anesthesia was utilized for the umbilical incision. Regional blocks were administered on an individual basis, through shared decision-making between the surgeon, anesthesiologist, and family. Postoperative inpatient analgesia included Ketorolac and Acetaminophen administered in a non-uniform manner. Success was defined as absence of diseased renal moiety on postoperative renal ultrasounds.

Results

During the study period, four patients (two boys, two girls) underwent LESS PN. Three patients underwent right upper pole PN and one underwent right lower pole PN. Three of the four (75%) patients were infants. A single surgeon

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