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Case Report

Infant Robotic Bilateral Upper Urinary Tract Surgery

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We describe a case of robot-assisted laparoscopic bilateral upper urinary tract surgery in a 4-month-old infant for complex bilateral upper urinary tract duplication anomalies.

Keywords: *Infant; Pediatrics; Robotics*

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INTRODUCTION

Minimally invasive urological surgery is well established with conventional laparoscopy [1]. There are limited reports of pediatric robotic upper urinary tract surgery. We present the first case of a robot-assisted laparoscopic bilateral upper urinary tract procedure in an infant.

CASE REPORT

The patient was a 4-month-old female with a history of prenatal bilateral hydroureteronephrosis. On day 1 of life, the renal ultrasound showed severe bilateral upper pole urinary tract dilation and a large right-sided ureterocele. There was no vesicoureteral reflux (VUR) on a cyclical voiding cystourethrogram (VCUG). The patient was started on antibiotic prophylaxis. At 8 weeks of age, a diuretic renal scan demonstrated the following relative function: right upper pole (RUP), 16%; right lower pole (RLP), 31%; left upper pole (LUP), 24%; and left lower pole (LLP), 29%. However, the formal radiologist interpretation reported that the RUP function was exaggerated because the renal parenchyma could not be easily separated from liver activity. The LUP drained with a postdiuretic T ½ of 16 minutes and the RUP with a T ½ of 71 minutes. The patient was initially scheduled for an upper urinary tract approach due to the absence of VUR. The initial plan was to perform a left upper to lower ureteroureterostomy (UU) because the LUP renal moiety function remained preserved. However, prior to the scheduled surgical date, the patient presented with fever. Urinalysis was consistent with infection. Leukocytosis was noted. Renal ultrasound revealed a large amount of debris throughout the urinary tract (Fig. 1). Incision of the ureterocele and percutaneous LUP nephrostomy tube placement were performed. An ectopic LUP ureteral orifice in the urethra was confirmed. Postoperative VCUG revealed RUP grade 5, RLP grade 3, and LLP grade 2 VUR. Staged upper and lower urinary tract procedures were planned. The surgical plan was determined on the basis of shared decision making with the parents. A robot-assisted laparoscopic left upper to left lower UU and RUP partial nephroureterectomy were scheduled, with plans for lower urinary tract reconstruction at a later date.

1. Surgical technique

Cystoscopy was performed to place a double-pigtail indwelling ureteral stent into the LLP ureter and an open-ended ureteral catheter into the RLP ureter. The patient was repositioned on her flank for a left upper urinary tract procedure. Access was obtained through a midline umbilical incision. One 8.5-mm robotic camera umbilical trocar, one 8-mm trocar below the xiphoid, and one 8-mm trocar in the left lower quadrant were placed (Fig. 2). Our pediatric institution routinely utilizes an 8.5-mm camera because it is smaller. We have noticed that the optics of the 8.5-mm camera are not equivalent to those of the 12-mm robotic camera, but it does not compromise the surgical procedure. The robot was docked ipsilaterally to the side

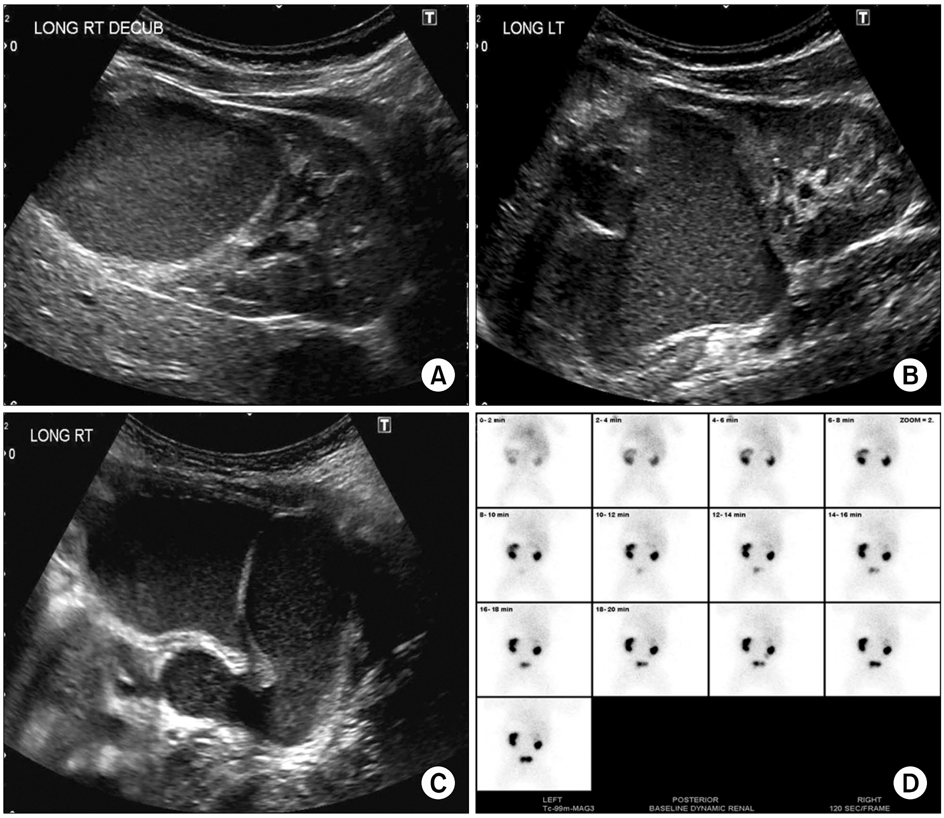

FIG. 1. Preoperative ultrasound demonstrating purulent urine throughout the urinary tract. (A) Right upper pole renal moiety with pyonephrosis. (B) Left upper pole renal moiety with pyonephrosis. (C) Right ureterocele with purulent urine. (D) Tc-99m-MAG3 renogram.

FIG. 2. Postoperative appearance of trocar sites 6 weeks after surgery.

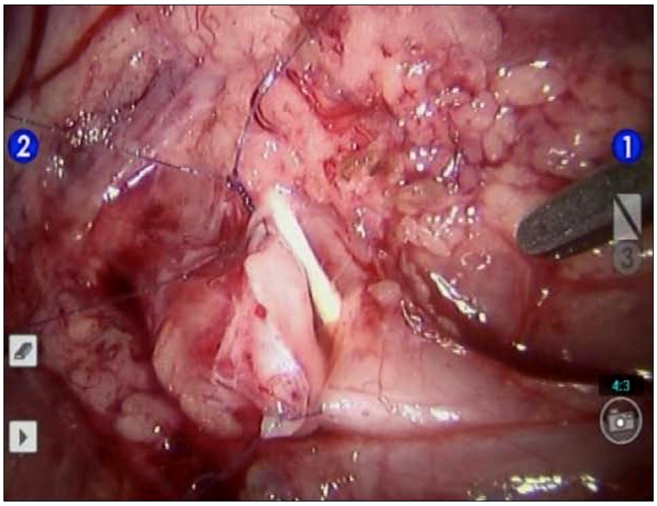

FIG. 3. Intraoperative appearance of left upper to lower ureteroureterostomy after posterior wall anastomosis had been completed.

of surgery. The left retroperitoneum was exposed, including reflecting the colon. The lower pole ureter was left *in situ*, with minimal dissection to preserve the blood supply. Using robotic Potts scissors, a longitudinal ureterotomy was made in the midureter of the lower pole system, matching the diameter of the obstructed upper pole ureter. The upper pole ureter was divided transversely. The upper to lower UU anastomosis was performed by using running 6-0 PDS with a double-armed needle, which was made by tying two sutures together. The suture length was 4 and 6 cm from the needle to the knot for the two arms (Fig. 3). Redundant obstructed midureter was excised. The distal ureters were left undisturbed in the pelvis. The stump of the ectopic upper pole ureter was left open. The trocars were removed and sterile dressings were applied.

The patient was repositioned on her flank for a right upper urinary tract procedure. The umbilical camera and subxiphoid trocars were replaced. A new 8-mm trocar was placed in the right lower quadrant (Fig. 2). The robot was docked ipsilaterally to the side of surgery. The upper pole vessels were identified and divided with a 5-mm LigaSure Blunt (Fig. 4). A percutaneous Prolene suture was placed in the upper pole parenchyma to provide traction and exposure. The upper pole ureter was opened. The floor of the collecting system was identified. The upper pole parenchyma was excised after identifying the avascular plane between the upper and lower pole moieties. The dilated upper pole ureter was mobilized and transected below the level of the lower pole renal hilum. The upper pole ureter was then mobilized from above the hilum, until it was completely delivered, without passing instruments behind the lower pole vessels. The refluxing stump of the upper pole ureter was controlled with two 0-PDS Endoloops. Surgicel and FloSeal were placed on the bed of the resection. Trocar site fascial incisions were closed with 4-0 Vicryl. The RLP ureteral catheter was removed. There were no intraoperative complications or significant blood loss. The total operative time from initial cystoscopy to skin closure was 458 minutes. The console time for UU was 115 minutes and that for partial nephroureterectomy was 145 minutes. A 6-Fr urethral catheter was left indwelling and removed on postoperative day 1. The patient tolerated clamping of the LUP nephrostomy tube on postoperative day 1. No other drains were used. Scheduled postoperative acetaminophen was used for pain management, initially intravenously and subsequently transitioned to oral. Postoperative narcotics or ketorolac were not administered. The patient was discharged on postoperative day 1.

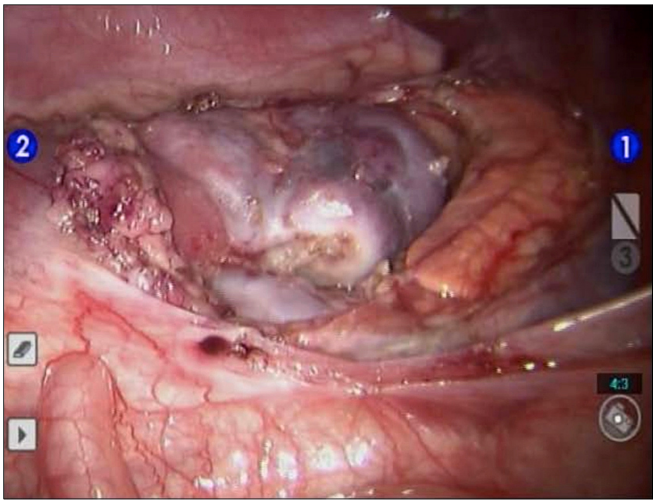

FIG. 4. Intraoperative appearance of the ischemic right upper pole renal moiety after the upper pole vessels were divided with the LigaSure.

The nephrostomy tube was removed 2 weeks after surgery. The left ureteral stent was removed 6 weeks after surgery (Fig. 2). Postoperative renal ultrasound showed decompression of the left upper system without ipsilateral lower pole hydronephrosis and a well-perfused RLP renal moiety without any significant perinephric fluid collection (Fig. 5). The patient will remain on antibiotic prophylaxis until the lower urinary tract reconstruction is performed after infancy during the toddler years.

DISCUSSION

To the best of our knowledge, we report the first case of a robotic bilateral upper urinary tract procedure in an infant. Kutikov et al. [2] concluded that robotic pyeloplasty is safe and effective in the only report exclusively in infants. There are limited reports of laparoscopic partial nephrectomies and ipsilateral UU in the pediatric population [1,3,4]. There has been a single report of pediatric robot partial nephrectomy [5]. Our patient was unique because she had reconstructive and extirpative procedures performed at the time of surgery for a bilateral complex upper urinary tract duplication anomaly.

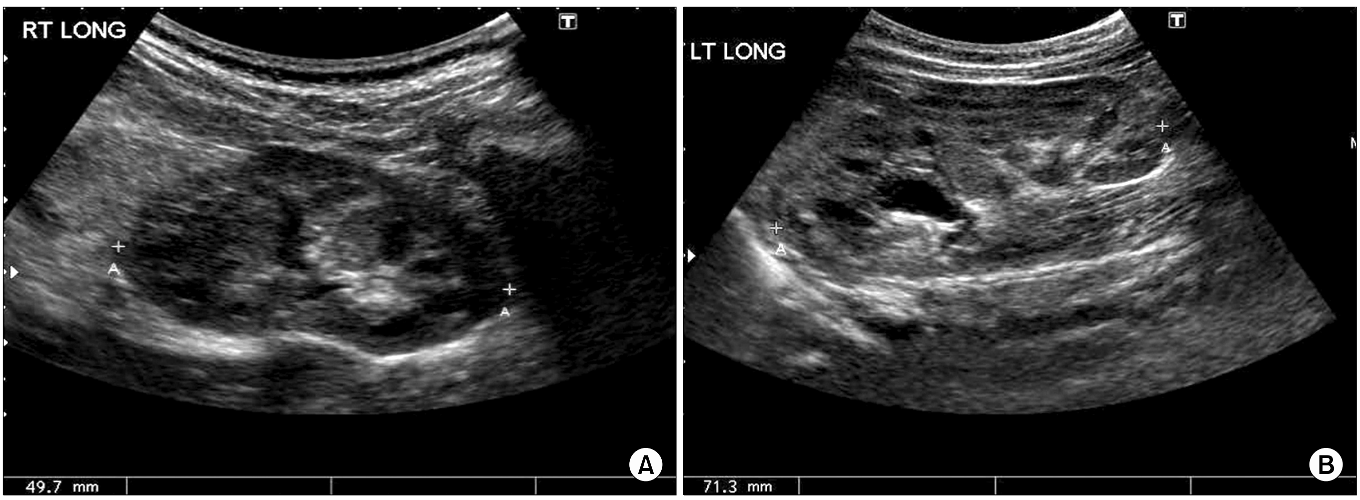

FIG. 5. Postoperative ultrasound 6 weeks after surgery. (A) Right kidney. (B) Left kidney.

As the learning curve of robot-assisted surgery is overcome in the pediatric population, a wider array of applications may be considered, including more challenging and complex procedures. The benefits of these procedures may be realized in even the youngest and smallest patients of the infant population. Our patient was felt to be a candidate for a robot-assisted laparoscopic procedure because of the benefits in suturing and the possibility of completing both procedures in a single operative session, thus avoiding the morbidity of a bilateral open flank incision. Surgeon fatigue, including the physical and mental strain often seen with longer procedures using standard laparoscopy, was reduced with the benefits of robotic assistance. This facilitated achieving a safe and effective procedure, despite technically demanding operations involving both upper urinary tracts in a very small working space with very minimal patient morbidity. The patient did not require postoperative narcotics for pain management and had a brief hospital stay for observation of less than 24 hours.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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