Journal of Pediatric Urology (2014) 10, 869—874

Journal of Pediatric urology

Infant robot-assisted laparoscopic upper urinary tract reconstructive surgery

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Received 14 July 2013; accepted 24 January 2014
Available online 12 March 2014

KEYWORDS
Robotics;
Pyeloplasty;
Ureteroureterostomy;
Pediatrics;
Infant

Abstract *Objective:* Our aim was to assess the outcomes of infant robot-assisted laparoscopic (RAL) upper urinary tract reconstruction.
Materials and methods: The medical records of all infants who underwent RAL upper urinary tract reconstruction were reviewed. Patients less than 1 year of age at surgery were included. Patient demographics, intraoperative details, narcotic usage, and complications were reviewed.
Results: Ten infants met the study criteria. There were five right and five left-sided procedures. Eight pyeloplasties (4 right, 4 left) and two ureteroureterostomies (1 right single system, 1 left duplex system) were performed. The median age was 8 months (range 3—12 months). Median weight was 7.7 kg (range 5.8—10.9 kg). Median operative time was 128 min (range 95—205 min). There was no significant blood loss or intraoperative complications. One (10%) patient received a regional block. Eight (80%) patients did not receive postoperative narcotics. Median hospital stay was 1 day (range 1—2). Median follow-up was 10 months (range 3—18 months). Complications included one urinary leak, one ileus, and one urinary tract infection. Hydronephrosis improved in all patients.
Conclusions: Infant RAL upper urinary tract reconstruction is technically feasible, safe, and effective. It can be applied for duplication anomalies and single system obstructions in infants.

Introduction

Robot-assisted laparoscopic (RAL) surgery offers the potential to perform complex reconstructive surgical procedures to a wider population. For urological procedures, including pyeloplasty and ureteroureterostomy (UU), RAL has been successfully performed and may provide an advantage over open surgery with minimal morbidity in the pediatric

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http://dx.doi.org/10.1016/j.jpurol.2014.01.029

population [1—4]. However, robotic surgery is not commonly performed in infants. Laparoscopic suturing is technically demanding with the potential for a long learning curve, which may limit its widespread application for reconstructive surgery in pediatric urology [5,6]. Robotic surgery helps mitigate the challenges of laparoscopic suturing.

Conventional laparoscopic surgery in infants is well established [7—9]. However, there is a paucity of reports evaluating robotic techniques in this population. The role of robotic surgery has yet to be defined in infants, in large part due to concerns regarding the more limited working space. Many question whether the benefits of robotics can be realized in the youngest and smallest patients. To our knowledge, only one study of robot-assisted urologic surgery exclusively in infants has been reported [10]. Herein, we present the largest series of infant RAL upper urinary tract reconstructive surgery and the first to include UU.

Materials and methods

Study population

The medical records of all children under 1 year of age at surgery who underwent RAL upper urinary tract reconstruction at a single pediatric institution from March 2009 to February 2013 were retrospectively reviewed. Chart review was performed after Institutional Review Board approval. All patients had preoperative renal ultrasound and diuretic renogram evaluations. Procedures included Anderson-Hynes dismembered pyeloplasty and ipsilateral UU. After discussion of all treatment options, families specifically consented to robotic procedures. All cases were performed with a transperitoneal approach. Operative indications included ureteropelvic junction obstruction, congenital mid-ureteral obstruction, and an obstructed ectopic ureter in a duplication anomaly. All procedures were performed using the daVinci S Surgical System. Data included age, weight, operative time, blood loss, stents, drains, length of hospital stay, postoperative analgesics, complications, and length of follow-up period. Cystoscopy was performed preoperatively to assess anatomy and place ureteral catheters. The fascia of all trocar sites was closed with absorbable suture. All patients had an indwelling urethral catheter, which was typically removed the following morning. Ureteral stents were placed during the anastomosis, when technically feasible. Operative time was recorded as time from skin incision for port placement to closure of skin incisions. Operative time did not include cystoscopy before skin incision.

Study objective

This retrospective, descriptive study was designed with the objective of assessing outcomes, including the feasibility, safety, and efficacy, of RAL surgery for upper urinary tract reconstruction in infants.

Surgical technique

Patients were placed in the flank position. All procedures were performed with an 8.5-mm camera trocar and two 8-mm trocars based on surgeon preference. The larger 8-mm instruments were preferred to get the maximum benefit of the endowrist technology in a small working space. The 5-mm instruments require a larger working space. Trocars were placed under direct vision. Conventional trocar placement and hidden incision endoscopic surgery (HIdES) techniques were utilized [11]. The colon was mobilized in all cases due to surgeon preference. Assistant ports were not utilized.

Anderson—hynes dismembered pyeloplasty

The retroperitoneum was exposed by reflecting the ipsilateral colon. A transmesenteric approach was not used because of surgeon preference. The renal pelvis, ureteropelvic junction, and ureter were mobilized. Gonadal vessels were preserved. A percutaneous Prolene suture was placed into the renal pelvis to provide traction and exposure. An incision was made into the renal pelvis above the ureteropelvic junction. The obstructed segment was used as a handle for manipulation and eventually excised. The ureter was spatulated to achieve a widely patent anastomosis. The anastomoses were performed with a modified double-armed running 5-0 or 6-0 polydioxanone (PDS). Tying two sutures together created the double-armed suture, leaving a suture length of 4—8 cm from the knot to each needle. The sutures were brought in holding the tails with a standard laparoscopic instrument through a working trocar. An indwelling ureteral stent was placed antegrade, percutaneously through an angiocatheter, during the anastomosis when technically feasible.

Ipsilateral duplex system UU

After access and trocar placement were achieved, the retroperitoneum was exposed, including reflecting the colon. The recipient left lower pole ureter and the obstructed dilated upper pole ureter were identified. The lower pole ureter was left in situ, with minimal dissection to preserve blood supply. Using robotic Potts scissors, a longitudinal ureterotomy was made in the mid-ureter of the lower pole system in order to match the diameter of the obstructed upper pole ureter. The upper pole ureter was divided transversely. The upper to lower UU anastomosis was performed using running 6-0 PDS with a double-armed needle. Redundant mid-ureter was excised but distal ureters were left undisturbed. The distal stump of the obstructed ureter was left open. A retrograde ureteral stent was placed at the time of cystoscopy into the recipient ureter.

Ipsilateral single system UU

After access and trocar placement were achieved, the retroperitoneum was exposed, including reflecting the colon. The congenital mid-ureteral obstruction and dilated proximal ureter were identified. The ureter was transected proximal and distal to the obstruction. The distal ureter was spatulated to achieve a widely patent anastomosis. The anastomosis was performed using running 6-0 PDS with a double-armed needle. An indwelling ureteral stent was