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Robot-assisted laparoscopic extravesical ureteral reimplant: A critical look at surgical outcomes

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Summary

Background

Published reports of outcomes of robot assisted laparoscopic ureteral reimplantation (RALUR) show mixed results that, on average, are inferior to open ureteral reimplant. We present a retrospective analysis of a prospective series of children who had RALUR from 2013 to June 2015. We hypothesized that surgical outcomes are based on identifiable risk variables. We provide a critical analysis of the relationship between patient characteristics and several surgical and non-surgical outcomes.

Methods

We reviewed the records of children who had Robot-Assisted Laparoscopic (RAL) Ureteral Reimplant (UR) at Nationwide Children's Hospital. Patient age and gender, preoperative presentation, presence of preoperative bladder and bowel dysfunction (BBD), VUR grade and laterality, indication for operation, operative time, surgical outcome, surgical complications, post-operative prevalence of UTI, and pre- and post-operative status of BBD were recorded. We also recorded techniques for ureteral dissection, and closing the detrusorrhaphy. Surgical outcome was defined by post-operative VCUg. We define BBD based on publications by the standardization committee of International Children's Continence Society (ICCS). All statistical calculations were performed with STATA version 11.

Results

We performed extravesical RALUR on 54 children for a total of 72 ureters. Overall the study children were 74% female. The mean and median age was 5.2 and 4.9 years, respectively. Mean overall hospital length of stay (LOS) was 1.64 days. The mean LOS was 1.26 for unilateral (RALUUR) and 2.39 days for bilateral (RALBUR) surgeries and was significant ($p < 0.05$). Overall surgical success was 85.2% of ureters and 84.7% of children. Stratified by unilateral and bilateral surgeries, unilateral success was 91.7%, and bilateral success was 77.8% of ureters, and 72.2% of children. In the 3 failures in the RALUUR group the mean postoperative VUR grade was 1.3 from a pre-op mean grade of 3.3, whereas in the RALBUR group, the mean VUR grade among the failures was 3.0 from a mean pre-op VUR grade of 3.7. Urinary leak from ureteral injury, and urinary obstruction were more common in the RALBUR group. Post-operative urinary retention occurred in 4 children in the RALBUR and none in the RALUUR groups. Four with VUR after RALBUR and one child after RALUUR had open ureteral reimplant. Post-op UTI and non-surgical readmissions were higher in the RALBUR group.

Conclusions

Bilateral RALUR is associated with higher failure rates, higher complication rates, higher re-operation rates, and more postoperative UTIs and nonsurgical readmissions compared with unilateral RALUR.

Table Study outcomes.

Group	Surgical success	Reoperation for VUR	Surgical complications	Non-surgical readmission	Urinary retention	Worsening BBD
RALUUR ($n = 36$)	33 (91.7%)	1 (2.7%)	2 (5.6%)	0	0	2 (5.6%)
RALBUR ($n = 18$)	13 (72.2%)	4 (22.2%)	4 (22.2%)	3 (16.7%)	4 (22.2%)	10 (55.6%)
Total ($n = 54$)	46 (85.2%)	5 (9.3%)	6 (11.1%)	3 (5.6%)	4 (7.4%)	12 (22.2%)

Risk variable	RALUUR	RALBUR
Age <3 years	↑ Risk of surgical complication	↑ Risk of surgical failure, surgical complication, and reoperation
VUR > grade III	No ↑ risk	↑ Risk of surgical failure and reoperation
Worsening BBD	No ↑ risk	↑ Risk of surgical failure, surgical complication, non-surgical readmission, and reoperation
Breakthrough UTI	No ↑ risk	↑ Risk of non-surgical readmission

Introduction

Surgical treatment for children with primary VUR has traditionally been reserved for those with breakthrough UTIs while on antibiotics, acquired renal scarring, and/or worsening or severe reflux [1]. To date the gold standard for surgery is the open ureteral reimplant. In the past decade, surgeons have been trying to change this paradigm with minimally invasive laparoscopic ureteral reimplant. Although some have reported good results with pure laparoscopic extravesical reimplant [2] and vesicoscopic intravesical reimplant [3,4], robot-assisted laparoscopic extravesical ureteral reimplantation (RALUR) [1,2] has become more popular. Although there are some practical and theoretical advantages to RALUR [6,7], current literature provides mixed results regarding surgical success and complication rates. Dating back to 2008, early studies documented over 97% success rates without complications [5]. However, a more recent multi-institutional study has shown lower success rates, along with increased complication and reoperation rates [6]. We present a retrospective analysis of a prospective series of patients who had RALUR over a 2.5-year period from January 2013 to June 2015. We hypothesized that the surgical outcomes might be based on measurable or identifiable risk variables. We provide a critical analysis of the relationship between patient characteristics and several surgical and non-surgical outcomes.

Material and methods

After expedited IRB approval we reviewed the records of all children who had robot-assisted laparoscopic (RAL) ureteral reimplant (UR) at our institution. All surgeries were performed ($n = 46$) or directly supervised ($n = 8$) by a single surgeon. Surgical indications included breakthrough UTI, persistent high-grade VUR with and without renal dysplasia or renal scarring, as well as a few because of either poor compliance with preventative antibiotics or parent choice against further medical therapy. Patient age and gender, preoperative presentation, presence and severity of preoperative bladder and bowel dysfunction (BBD), grade and laterality of preoperative VUR, indication for operation, total operative and robotic console time, surgical outcome of VUR by post-operative VCUG, surgical complications, post-operative prevalence of UTI, and post-operative BBD status were recorded. We also recorded intraoperative technical data such as techniques used for ureteral dissection, and technique and suture material used for closing the Detrusor tunnel. Surgical outcome was defined by the results of the post-operative VCUG. We excluded those without a post-operative VCUG. All VCUGs were done with X-ray contrast to provide accurate grade, which we report based on the grading system used by the IRS [7]. We define BBD consistent with recent publications by the standardization committee of the International Children's Continence Society (ICCS) [8,9]. We used the validated Vancouver symptom score (VSS) [10], as well as the updated Rome III Criteria [11] to preoperatively and postoperatively establish the presence and progression of bladder and bowel dysfunction in all children. We recorded the

incidence of post-operative UTI at two time points, 4 weeks and 3 months after surgery. The former we consider has more to do with perioperative bladder dysfunction caused by surgery, and the latter more related to underlying bladder dysfunction. All statistical calculations were performed with STATA version 11.

Each surgery was performed under general anesthesia. Intraoperative cystoscopy was performed in the majority of children. Access to the abdominal cavity was obtained by either Hassan technique or Veress needle. Both 8.5 mm and 12 mm 3D robotic cameras were used based on surgeon choice. The majority of children had 8 mm lateral working ports on the right and left sides. A 5 mm assistant port was placed based on surgeon preference. Hook or scissor electrocautery dissection was performed based on surgeon preference. Ureteral mobilization was performed cephalad to the broad ligament or vas deferens early in the series and caudad to these structures later in the series. Vessel loop control of the ureter was performed in the majority, but umbilical tape was used early in the series. Surgery was performed in either the supine frog-legged position for younger children, or the lithotomy position for older children based on the surgeon's assessment of the ability to get the robotic column close enough to the foot of the operating table. Ureteral dissection was performed by adhering to the principles of nerve sparing RALUR as described by Casale et al. [5]. Detrusorrhaphy was performed with a combination of cautery and sharp dissection. The length of the subureteral tunnel and width of lateral Detrusor flaps were made at the discretion of the surgeon based on the diameter of the ureter, with every attempt to make at least a 4:1 length to ureteral diameter tunnel. One or more hitch stitches brought through the suprapubic abdominal wall were employed to expose the posterolateral wall of the bladder. When dissecting the ureter from the bladder and performing the Detrusorrhaphy, the distal most attachments were left intact so as not to require advancing suture. An interrupted closure of the new subureteral tunnel was employed in the majority of children. Post-operatively all children were admitted to the hospital. A single 30–50 mg/kg dose of intravenous cephazolin was used in the majority of children. Children with penicillin allergy were given 10 mg/kg of intravenous clindamycin. A single one-shot caudal block with 1 mL/kg 0.2% ropivacaine was used in the majority of children. No epidural catheters were placed. All Foley catheters placed at the time of surgery were removed the next day after surgery.

Results

Between January 2013 and July 2015 we performed 72 extravesical RALUR on 54 children. Thirty-six children had unilateral (RALUUR) surgery and 18 children had bilateral (RALBUR) surgery. Child demographic and clinical information is shown in Table 1. Mean and median age for the study population was 5.2 and 4.9 years, respectively. Median age was lower in the bilateral group, which skewed the median age lower than the mean overall. VUR grade distribution and the presence of preoperative bladder and bowel dysfunction were not different between the two groups. Presentation with febrile UTI was higher in the unilateral

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