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Is robot-assisted laparoscopic bilateral extravesical ureteral reimplantation associated with greater morbidity than unilateral surgery? A comparative analysis

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Summary

Introduction
Voiding dysfunction after bilateral extravesical ureteral reimplantation for vesicoureteral reflux has long remained a concern. Robotic approach with improved visualization that enables focused and minimal dissection may help with this concern.

Objectives
To compare postoperative outcomes after bilateral robot-assisted laparoscopic ureteral reimplantation to unilateral robot-assisted laparoscopic ureteral reimplantation.

Study design
This was a retrospective study using data abstracted from an institutional review board-approved registry prospectively maintained at our institution since 2012. Patient demographics, preoperative characteristics, and postoperative outcomes were analyzed. Patients with postoperative febrile urinary tract infection (UTI) underwent voiding cystourethrogram (VCUG). Surgical success is defined as absence of febrile UTI or febrile UTI with negative VCUG.

Results
92 patients with a median follow-up of 14 (25th and 75th IQR 5, 28) months. Median operative time (150 vs. 178 min, $p = 0.01$) and median hospital stay (33 vs. 37 h, $p = 0.01$) were longer in the bilateral cohort. Weight-adjusted morphine equivalents requirement was also higher in the bilateral group (0.45 vs. 0.59, $p = 0.019$).

Discussion
Early postoperative voiding dysfunction is influenced by anesthesia, postoperative pain, analgesics, age, surgical dissection, and preoperative voiding issues. Effective preoperative management of voiding dysfunction, minimizing surgical dissection and cautery, and minimizing opiate use will aid improving outcomes after surgery and enable bilateral surgeries on uretero-vesical junction. A robotic approach to facilitate such strategies could help outcomes after bilateral ureteral reimplantation. Limitations of this study include its retrospective design, the absence of routine postoperative VCUG after ureteral reimplantation, and unknown confounding variables.

Conclusion
Robot-assisted laparoscopic bilateral extravesical ureteral reimplantation is not associated with an increased risk of postoperative morbidity compared with unilateral surgery.

Table Summary of important pre-operative variables and post-operative outcomes.

	Unilateral ($N = 57$)	Bilateral ($N = 35$)	p-value
Age, years, median (25th and 75th IQR)	4 (2, 6)	3.75 (2, 5)	0.86
VUG grade median (25th and 75th IQR)	3 (2, 4)	3 (2, 3)	0.55
Toilet-trained children, *N* (%)	34 (59.6%)	21 (60%)	0.9
Preoperative voiding dysfunction, *N* (%)	13 (22.8%)	8 (22.9%)	0.99
Postoperative voiding dysfunction, new, *N* (%)	7 (12.3%)	5 (14.3%)	0.32
Voiding dysfunction resolved after surgery, *N* (%)	3 (5.2%)	4 (11.4%)	0.09
Postoperative febrile UTI and +ve VCUG, *N* (%) "Clinical and radiological failure = Surgical failure"	5/57 (8.7%)	3/35 (8.6%)	0.98

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Introduction

Vesicoureteral reflux (VUR) is a common anomaly affecting 1% of the pediatric population [1]. In the vast majority of cases, children with VUR are initially managed conservatively, as VUR often resolves or becomes clinically irrelevant as a result of maturing physiology and anatomy [2]. Surgical correction is recommended in select cases when febrile urinary tract infections (UTI) become significant because of recurrent morbidity or are demonstrably associated with renal scarring [3].

Open ureteral reimplantation, performed with either an intra- or extravesical approach, remains the gold standard of surgical correction. However, robot-assisted laparoscopic ureteral reimplantation (RALUR) surgery has gained popularity in recent years because of its comparable efficacy and favorable postoperative metrics, including shorter hospital stays and reduced postoperative analgesic requirements when compared with an open approach [4–8].

Early reports indicated that the extravesical bilateral reimplantation was associated with higher complication rates including increased rates of voiding dysfunction and prolonged post-surgical catheterization compared with unilateral reimplantation [9,10]. While more recent reports indicate that the robot-assisted laparoscopic (RAL) bilateral reimplantation may be safe compared with unilateral repairs in patients undergoing extravesical surgery [11,12], some centers report continuing technical challenges in performing the RALUR, with particular concerns regarding the bilateral RALUR. The described risks include ureteral injury, urinary obstruction, and urinary retention [13]. Herein, we present a larger, single-institutional experience with RALUR, specifically comparing the unilateral to bilateral extravesical approach to evaluate perioperative and clinically relevant postoperative parameters. This review was constructed to interrogate our hypothesis that the bilateral RALUR is not associated with a greater risk of urinary retention, complications, morbidity nor significant differences in perioperative parameters compared with unilateral RALUR.

Materials and methods

After obtaining approval from our Institutional Review Board, a registry comprising all patients undergoing RALUR surgery for VUR at a single tertiary pediatric hospital was created. In total 92 patients (127 ureters) were enrolled from 2012 to 2015: 57 unilateral and 35 bilateral ureteral reimplants. All data were retrospectively abstracted from the medical record by a third-party research assistant, who was not a member of the surgical team. Statistical analyses were performed based solely on de-identified information contained within the database. The data obtained from patients' charts included demographic information, preoperative voiding function, clinical presentation, clinical data on reflux and kidney function, procedure information, and postoperative outcomes including complications. Patients with reflux into an ectopic ureter or ureterocele, primary obstructed megaureter, secondary reflux caused by a neurogenic bladder, posterior urethral valve, or prune belly syndrome were excluded from the study. Patients included in this cohort had no concomitant procedures beyond the RALUR completed for vesicoureteral reflux.

Indications for surgery included persistent vesicoureteral reflux in association with recurrent pyelonephritis, breakthrough urinary tract infections despite antibiotic prophylaxis, presence of renal scarring by nuclear renography, or presence of high-grade reflux. All patients in this cohort underwent RALUR by fellowship-trained pediatric urologists with experience in robot-assisted urological surgery.

Our technique for RALUR was described previously with photographic images, and was utilized in the treatment of the current cohort [14]. Briefly, the RALUR begins with dissection of the ureterovesical junction (UVJ) by entering the retroperitoneum and then beginning ureteral mobilization distal to the round ligament or vas deferens. The UVJ dissection is limited to the portion distal to the UVJ, and is not carried out in a circumferential manner. The detrusor tunnel is measured to be four to five times the diameter of the ureter, as measured by the end of the robotic hook cautery that measures 5 mm while the bladder is empty. The bladder is then filled with 50 mL of normal saline, and the detrusor flaps are mobilized so that they are wide enough to be approximated over the ureter without tension with interrupted 5–0 poliglecaprone suture. Sutures are first placed at UVJ and then proceed distally towards the apex of the detrusor trough.

Our preference is to utilize the 8.5 mm trocar for the umbilical camera port, and two laterally placed 5 mm trocars and instruments. The principal variables of interest included the indications for surgical correction of VUR including preoperative VUR grade, presence of febrile UTIs, and presence or absence of associated voiding dysfunction. We then recorded the length of hospitalization, rates of postoperative urinary retention, presence of new postoperative voiding dysfunction, and incidence of postoperative febrile UTIs. For bilateral RALUR patients, a combined preoperative VUR score was calculated by averaging the two scores from each ureter. We also recorded peri- and postoperative complications by the Clavien-Dindo classification.

Pre- and postoperative voiding dysfunction was measured by specific questions that are templated in our electronic medical record and must be completed for all patient visits [15,16]. This record notes both the patient's voiding and bowel habits and symptoms. Data collected specifically address the following: daytime frequency, day or night time wetting, number of voids during day, holding maneuvers (e.g. squatting and Vincent's curtsy sign), urgency, and straining. Any child with daytime enuresis, voiding fewer than three times per day, urinary frequency greater than 10 times per day, and any holding maneuvers were a priori considered to have "voiding dysfunction." Additionally, we recorded bowel regularity and stool consistency. Stool consistency was frequently measured utilizing the Bristol Stool Scale—not for a numerical score, but to help the parent and child better describe their own stool burden and consistency based on visual cues. Questions were answered by parents when a child was deemed too young to articulate an answer (typically $<$4 years of age). For older children, the answers were obtained by the child and the parent based on a joint understanding and experience observing the child's voiding habits. Bowel bladder

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