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# Robot-assisted extravesical ureteral reimplantation: Outcomes and conclusions from 78 ureters

Ardavan Akhavan, Daniel Avery, Thomas S. Lendvay\*

Division of Pediatric Urology, Seattle Children's Hospital, 4800 Sand Point Way, NE, Seattle, WA 98105, USA

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## KEYWORDS

Vesicoureteral reflux;  
Robotic surgery;  
Ureteral reimplantation;  
Urinary retention;  
Dysfunctional elimination syndrome

**Abstract** *Objective:* Extravesical robot-assisted laparoscopic ureteral reimplantation (RALUR) is a popular alternative to open surgery. We report our experience with RALUR and evaluate clinical variables as predictors for failure.

*Methods:* We retrospectively evaluated the records of patients who underwent RALUR by a single surgeon for treatment of primary vesicoureteral reflux. Clinical and demographic variables were determined. Clinical variables were compared with surgical outcomes using the Student two-tailed type 2 *t* test.

*Results:* Fifty patients underwent a combined 78 extravesical RALURs. Median (range) age was 6.2 (1.9–18.0) years; median (range) preoperative reflux grade was 3 (0–5). Dysfunctional elimination syndrome (DES) was present in 32 (64%). Ten (20%) patients had prior reflux, and two (4%) had prior ureteroneocystostomy on the ipsilateral side. Postoperative cystogram was performed in 100% at a median (range) of 55 (27–133) days. Median (range) follow-up was 286 (27–2238) days. Febrile urinary tract infection occurred in five (10%), none of whom had reflux on initial follow-up postoperative cystogram. All five had a history of DES and were female. Six complications occurred in five (10%) patients, including ileus (2), ureteral obstruction (2), ureteral injury (1), and perinephric fluid collection (1). Transient urinary retention occurred in one. Five of 22 (22.7%) patients undergoing unilateral surgery had contralateral de novo reflux. Six of 78 ureters (7.7%) had persistent reflux postoperatively. Neither persistent nor de novo reflux was associated with any of the clinical variables assessed.

*Conclusions:* RALUR is an effective and safe option for patients with primary vesicoureteral reflux requiring surgery.

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\* Corresponding author.

E-mail address: [Thomas.lendvay@seattlechildrens.org](mailto:Thomas.lendvay@seattlechildrens.org) (T.S. Lendvay).

## Introduction

Multiple options exist for the surgical management of vesicoureteral reflux in children. While open surgery is considered the “gold standard” for the treatment of reflux, the procedure can be associated with postoperative pain, hematuria, irritative voiding symptoms, ureteral obstruction, and residual or new-onset contralateral ureteral reflux [1]. Minimally invasive alternatives are becoming increasingly desirable due to improvements in outcomes and decreased morbidity. Extravesical robot-assisted laparoscopic ureteral reimplantation (RALUR) has gained acceptance as a means of minimizing the morbidity associated with formal open ureteral reconstruction. While intravesical RALUR has been described, technical challenges associated with a steep learning curve have limited its widespread adoption by most pediatric urologists. In contrast, extravesical RALUR has been utilized by an increasing number of institutions since the first series was reported by Peters [2] in 2004. Institutions have reported success rates ranging from 90% to 100% [3–5]. We initially reported the results of our first 13 cases and found an 85% success rate [6]. In the current study, we follow-up our initial series with the results of our first 50 cases and report our cumulative experience over the past 7 years.

## Methods

Institutional Review Board approval was obtained. The primary objective was to determine the surgical outcomes of patients who had undergone robotic ureteral reimplantation by a single surgeon at our institution. Success was defined as the absence of reflux in the ipsilateral ureter following repair. The secondary objectives included determining the presence of postoperative febrile urinary tract infection (UTI), de novo contralateral reflux, postoperative urinary retention, and immediate postoperative complications. Additionally, we sought to investigate any association between clinical variables and surgical outcomes. We performed a retrospective cohort chart review analysis. Inclusion criteria consisted of all patients who underwent extravesical RALUR by a single surgeon (TL) at our institution. All patients without a diagnosis of primary vesicoureteral reflux were excluded from the analysis. Patients with prior treatment for reflux, including subureteric injection of dextrahyaluronic acid or prior ureteroneocystostomy were included in the analysis. Variables assessed included gender, age at time of surgery, preoperative reflux grade, prior treatment for reflux, presence of duplex collecting system, baseline voiding dysfunction, laterality of repair, ureteral stent or suprapubic cystostomy placement at time of surgery, length of hospitalization, surgical complications, follow-up duration, postoperative reflux grade, postoperative urinary retention or febrile urinary tract infection.

## Patient care

All patients underwent extravesical RALUR in a Lich–Gregoir fashion, using the surgical technique described previously [7]. Prior to surgery, all patients were

prescreened for the diagnosis of dysfunctional elimination syndrome as defined by constipation requiring treatment, severe urge, urinary retention requiring treatment, and/or daytime incontinence in children already toilet trained. Those with significant dysfunctional voiding as evidenced by preoperative post-void residuals by bladder scan or cystogram >50% of expected bladder capacity were treated with suprapubic cystostomy at the time of surgery to allow for prolonged postoperative urinary drainage in case of retention. Postoperatively, all patients were admitted to the hospital for observation with a urethral or suprapubic catheter that was left to drain overnight. On postoperative day 1, voiding trials were attempted on all children. Children were discharged home when they met the criteria, including lack of fever for over 24 h, pain controlled by oral medication, toleration of regular diet, and parental comfort with disposition. Children who failed were given another attempt prior to discharge. Patients unable to void by discharge were sent home with a suprapubic tube or urethral catheter for drainage and reassessed at weekly follow-up for the first month, and monthly thereafter. If there was concern over ureteral obstruction, patients underwent unilateral or bilateral ureteral stenting during the time of surgery at the discretion of the attending surgeon. Early in the surgeon’s experience, many of the children undergoing bilateral repairs underwent unilateral stenting in order to allay any concerns over potential complete obstruction; however, as experience and confidence grew, stenting became reserved for patients who demonstrated immediate swelling of the ureter following repair and had exhibited signs of a potentially tight tunnel.

All patients underwent renal ultrasound and radionuclide cystogram approximately 1 month postoperatively to screen for obstruction and persistent or de novo contralateral reflux, respectively. All families were instructed to continue prophylactic antibiotics until reflux resolution was confirmed by postoperative cystogram.

## Statistical analysis

The Student two-tailed type 2 *t* test was used to correlate clinical variables with outcomes using Excel (Microsoft, Seattle, WA, USA). Statistical significance was defined as  $p < 0.05$ .

## Results

Fifty patients underwent a total of 78 ureteral reimplantations between 2006 and 2013. Patient demographics are listed in Table 1. Average/median (range) age was 7.2/6.2 (1.9–18.0) years; 32 had baseline diagnosis of dysfunctional elimination syndrome (DES). The distribution of reflux grades is demonstrated in Fig. 1. A total of four patients underwent repair on ureters without evidence of reflux on a voiding cystourethrogram (VCUG) immediately preceding the surgery. These patients (labeled grade 0) were undergoing surgery for repair of the contralateral side and either had a patulous ureteral orifice on cystoscopy preceding surgery. Median grade of preoperative reflux grade was 3. Eight children had a total of 15 duplex ureters that

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