Journal of Pediatric Urology (xxxx) xxx xxx

Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes

Maria Veronica Rodriguez [a], Paola Pena [b,c], Eliana Vargas [d], Francisca Yankovic [b,c], Francisco Reed [b,c], Jose R. Ovalle [d], Pedro-Jose Lopez [b,c], Luis H. Braga [e], Juan C. Prieto [f,*]

[a]Urology Department at Doctors Hospital at Renaissance, 5501 S McColl Rd, Edinburg, TX 78539, USA

[b]Pediatric Urology Department of the Hospital Exequiel Gonzalez Cortes, Clínica Alemana, Gran Av. José Miguel Carrera 3300, Av. Vitacura 5951, Santiago, Chile

[c]Clínica Santa Maria, Bellavista 0415, Santiago, Chile

[d]Centro de Urología Pediátrica y Especialidades, C. Manuel Rodríguez Objío 26, Santo Domingo, Dominican Republic

[e]McMaster University, 1280 Main St W, Hamilton, Ontario, Canada

[f]Pediatric Urology Division at Methodist Children's Hospital and Children's Hospital of San Antonio, 7700 Floyd Curl Dr San Antonio, TX 78229, USA

* Correspondence to: Pediatric Urology Division at Methodist Children's Hospital and Children's Hospital of San Antonio, 7700 Floyd Curl Dr San Antonio, TX 78229, USA
m.rodriguezpadron@dhr-rgv.com (M.V. Rodriguez)
paola.pena.pinochet@gmail.com (P. Pena)
anol30@hotmail.com (E. Vargas)
fyankovic@gmail.com (F. Yankovic)
drfranciscoreed@gmail.com (F. Reed)
j.ovalles@hotmail.com (J.R. Ovalle)
pejotalopez@gmail.com (P.-J. Lopez)
braga@mcmaster.ca (L.H. Braga)
jcprietos@hotmail.com (J.C. Prieto)

Keywords
Duplicated collecting system;
Ureteroureterostomy;
Hydronephrosis

Abbreviations
UU, ureteroureterostomy; VUR, vesicoureteral reflux; UTIs, urinary tract infections; SFU, Society for Fetal Urology; UP, upper pole; LP, lower pole; VCUG, voiding cystourethrogram; RALU, robot-assisted laparoscopic ureteroureterostomy

Received 8 March 2024
Revised 4 August 2024
Accepted 7 August 2024
Available online xxx

Summary

Background
When indicated, ureteroceles and ectopic ureters in duplicated collecting systems can be managed via upper or lower urinary tract surgical approaches, or a combination of both. Open ureteroureterostomy (UU) has been described to address these conditions in the absence of lower pole (LP) vesicoureteral reflux (VUR). We report outcomes from multiple centers worldwide with mid-term follow-up.

Methods
Our study consists of a retrospective review of records and imaging of children who underwent open distal UU via inguinal incision for duplicated collecting system without lower pole VUR in institutions from North America, South America, and the Caribbean. Descriptive statistics and univariate analysis were utilized.

Results
The records of 127 patients who underwent open distal UU for double collecting system between 2009 and 2022 were reviewed. Of those, 65% were female (n = 82), with a mean age at operation of 18 months (range 3–180). Main presentation at surgery included prenatal hydronephrosis (64%, n = 81), followed by febrile urinary tract infections (28%, n = 36), and urinary incontinence or other (8%, n = 10). The patients with antenatal or incidental diagnosis of hydronephrosis were classified as preoperative Society for Fetal Urology (SFU) grade 3 (n = 64) and 4 (n = 54) (96%). Those who were classified with SFU grade 0–2 (4%) had symptomatic clinical presentations including febrile urinary tract infections (UTIs) (n = 3), urinary incontinence (n = 3), and a 12-year-old patient with recurrent abdominal pain (n = 1).

Mean operative time from skin incision to skin closure was 86 min (range 45–240). Mean hospital stay was estimated at 1.1 days (range 0.5–4). In our cohort of 127 patients, 3 (2%) developed Clavien-Dindo grade I (2 with ureteral stent displacement and 1 with a urine leak/managed conservatively), 6 (5%) with grade II (3 febrile and 3 non-febrile UTIs managed with oral antibiotics), and 2 (2%) with grade IIIb complications (urine leaks requiring surgical management), which were appropriately treated. None presented grade IV or V complications. A double J stent was used in 56 patients (44%), and a Penrose drain was left in 10 (8%). A total of 125 children (98%, n = 125/127) showed sonographic improvement of hydronephrosis, or resolution of symptoms with stable ultrasound findings. Successful outcome was similar for both ureterocele and ectopic ureter subgroups: 49/49 patients with ureterocele showed 100% improvement, 76/78 children with ectopic ureter showed improvement in 97% of the cases. On univariate analysis, outcomes were similar regardless of the use of ureteral stents (p = 0.11). Mean follow-up was 28.2 months (range 12–85).

Conclusions
Open distal UU is a good alternative for the definitive surgical management of ectopic ureters and ureteroceles without LP VUR. This multicentric and mid-term follow-up study demonstrates that open distal UU offers high success rates, low morbidity, short operative times and hospital stays, and satisfactory aesthetic outcomes. Additionally, the surgery is performed extra-peritoneally and may not require the use of stents or drains, depending on surgeon preference. Further investigations are being conducted to determine the role of UU in the settings of double collecting systems associated with ipsilateral LP VUR.

https://doi.org/10.1016/j.jpurol.2024.08.005
1477-5131/© 2024 Journal of Pediatric Urology Company. Published by Elsevier Ltd. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

Introduction

The surgical management of duplicated collecting systems has evolved since 1965 when Buchtel described a novel ureteroureterostomy (UU) through an abdominal paramedial transverse incision [1,2]. Since then, the advent of minimally invasive surgery has welcomed the use of laparoscopic and robotic UU as alternative approaches to open surgery with equivalent success rates and improved cosmesis. Early experience with minimally invasive UU showed longer operative times and hospital stays in comparison to open procedures [3,4]. However, most recent data on minimally invasive UU techniques have shown significant improvements in success rates, operative times, hospital stays, etc. Herein, we present our multicentric and mid-term experience with open distal UU performed through a small extraperitoneal inguinal incision.

The decision to perform an upper tract ablative or lower tract reconstructive surgery for double collecting systems is driven by a combination of factors including concomitant structural anomalies, differential renal function, clinical manifestations, and the experience of the surgeon with the different approaches. Such congenital anomalies are categorized as coexistent obstructive ureteroceles and ectopic ureters with or without vesicoureteral reflux (VUR). These conditions may present with febrile urinary tract infections (UTIs), urinary incontinence (especially in females with ectopic insertions), abdominal pain, etc. Severe urinary tract dilation may predispose to febrile UTIs or ultimately upper tract deterioration and renal functional loss [5–7].

Our goal was to obtain an international perspective of open distal UU among four experienced academic centers (members of the Sociedad Iberoamericana de Urología Pediátrica (SIUP)) and to evaluate our surgical outcomes in children with pathologic duplicated collecting systems associated with ureterocele or ectopic ureters without LP VUR. We hypothesized that the open distal inguinal UU offers a safe and effective way to address duplicated collecting systems with a high success rate, low morbidity, and prompt hospital discharge.

Materials and methods

We retrospectively reviewed records and imaging of children who underwent open distal UU for duplicated collecting systems without LP VUR in institutions from North America, South America, and the Caribbean from 2009 to 2022. We recorded patient demographics as well as pre-operative, intra-operative, and post-operative variables after institutional review board approval in Texas (IRB 10052-1). Research Ethics Committees approved the study in the other centers. Our database search included patients that underwent surgical correction of duplicated collecting systems associated with either ureterocele or ectopic ureter, irrespective of gender, race, or case complexity. Each center had a UU database with basic demographics and data. A universal database was designed and distributed for completion among the centers. All participating surgeons are senior faculty at their institution and were included as co-authors on this paper. Surgical complications were graded using the Clavien-Dindo classification system. Patients with lower pole VUR, contralateral VUR, incomplete data/imaging, and short follow-up (less than 12 months) were excluded.

Success of the open distal UU was determined by post-operative sonographic improvement of hydronephrosis (e.g. SFU grade 4 to 3-2, or SFU grade 3 to 2-1) and/or resolution of symptoms (with improved or stable ultrasound findings). Descriptive statistics, such as mean and standard deviations (SD) were used for continuous variables. Univariate regression analysis was used to determine if the use of a ureteral stent would have an impact in postoperative outcomes. Significance for all statistical tests was set at a p-value $\leq$0.05. Statistical analysis of the data was performed with SPSS version 29.0.1.1.

Open distal UU was performed in the supine position with or without a sacral bump. A 2–3 cm muscle-splitting inguinal incision was made to enter the lateral extraperitoneal space [1]. The dissection was completed lateral to the rectus abdominis and medial to the shelving edge of the inguinal ligament. After incision of the aponeurosis, the duplicated ureters were identified in the retroperitoneum between the external iliac vessels and the obliterated umbilical artery. Subsequently, the upper pole (UP) and LP ureters were dissected circumferentially to the level of the peritoneal reflection proximally and to the common ureteral sheath distally (Fig. 1A). At this point, the UP ureter was transected to a level deemed appropriate to reach the LP ureter without tortuosity or redundancy. The distal UP ureteral stump was transected above the common ureteral sheath and ligated with an adsorbable suture. The LP ureter was incised for a distance equivalent to the diameter of the UP ureter (Fig. 1B), and then an "end to side" UP to LP UU was performed using absorbable running or interrupted sutures to achieve a tension-free and watertight anastomosis according to the surgeon's preference (Fig. 1C & D). One of the participating centers does not use double J stents or Penrose drains. In the other centers, ureteral stents may be used according to surgeon's preference (or intraoperative findings) and are left in place for 4–6 weeks. One of the centers routinely leaves Penrose drains in the retroperitoneum for 48 h. At the conclusion of the operation, the inguinal incision was closed in a standard fashion (Fig. 2 A & B) [1].

Results

In this international, multi-institutional study, a total of 138 children underwent open inguinal UU for duplicated collecting systems between 2009 and 2022. Out of those 138 patients, three did not have follow up ultrasounds available for review, and eight had concomitant VUR; therefore, they were excluded from the analysis. Demographic data is summarized in Table 1: out of the remaining 127 patients, 82 (65%) were female with a mean age at operation of 18 months (range 3–180). In regards to laterality, open UU was evenly performed on each side. Three patients in this cohort presented with bilateral duplicated collecting systems; however, all of them only underwent unilateral correction since there was no surgical indication to correct the contralateral side.

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

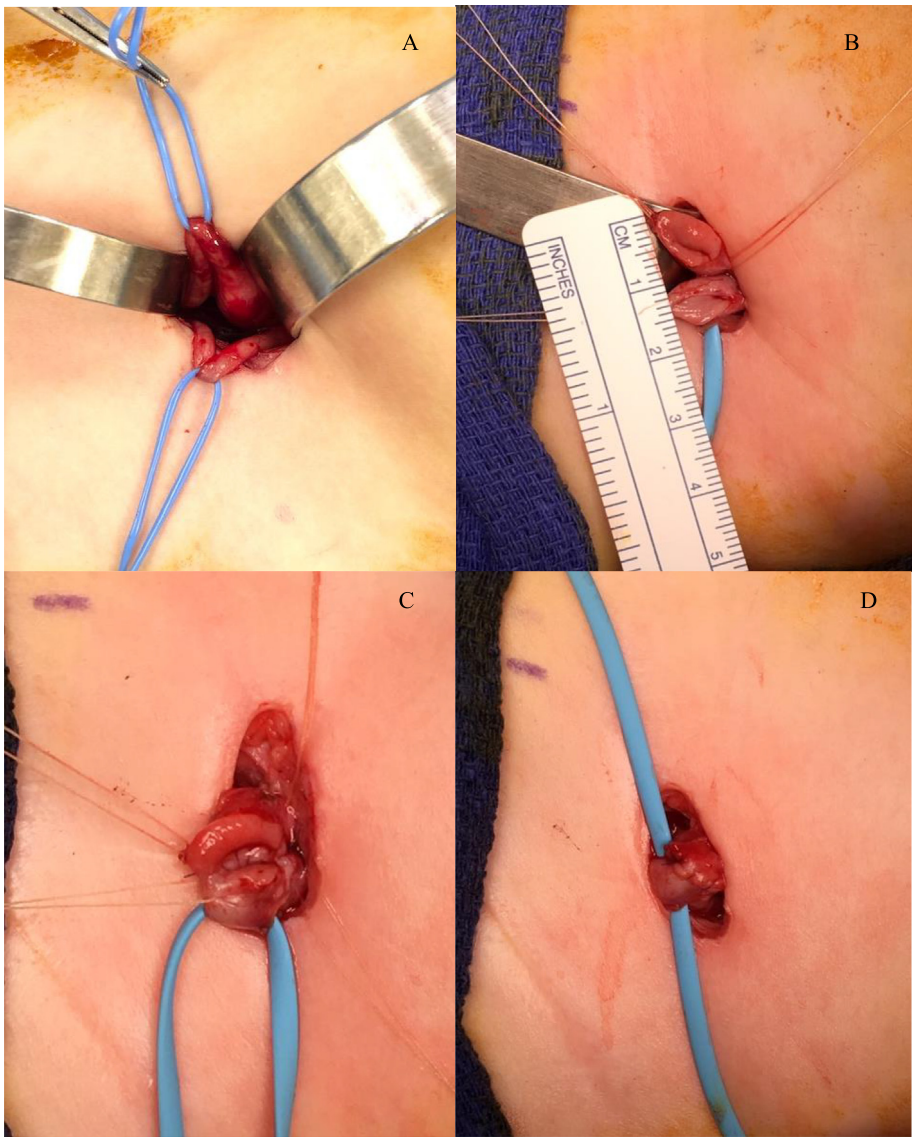


Fig. 1 Open inguinal ureteroureterostomy in a patient with duplicated collecting system. Dissection of the upper pole (UP) and lower pole (LP) ureters to the level of the peritoneal reflection proximally, and to the common ureteral sheath distally (1.A). Incision of the LP ureter for a distance equivalent to the diameter of the UP ureter (1.B). "End to side" UP to LP UU tensionfree and water tight anastomosis (1C & 1D).

Main presentation at surgery included prenatal hydronephrosis (64%, n = 81), followed by febrile urinary tract infections (28%, n = 36), and urinary incontinence or other (8%, n = 10). The patients with antenatal or incidental diagnosis of hydronephrosis were classified as preoperative SFU grade 3 (n = 64) and 4 (n = 54) (96%). Those who were classified with SFU grade 0–2 (4%) presented with febrile UTIs (n = 3), urinary incontinence (n = 3), and a 12-year-old patient with recurrent abdominal pain (n = 1).

Our cohort included patients with a diagnosis of ureterocele (n = 49) and ectopic ureter (n = 78). Seven patients in the ureterocele group underwent previous endoscopic puncture of the ureterocele. The preoperative workup was different for each clinical scenario determined by each institution. Hydronephrosis was evaluated in each center using the SFU grading system before surgery and postoperatively at approximately 3, 6 and 12 months. Those patients with less than 12 months of follow-up or less than two postoperative ultrasounds were excluded from analysis. Further follow-ups were at the discretion of the surgeon. Other study modalities such as voiding cystourethrogram (VCUG) or nuclear renal scans were not routinely obtained postoperatively. Two of our participating centers perform postoperative VCUG only on those children who present with febrile UTIs. No patient developed hypertension and/or proteinuria during the follow up.

Perioperative and postoperative open distal UU outcomes are presented in Table 2: mean operative time from skin to skin was 86 min (range 45–240) among all patients. There was no difference in operative times with different age groups; infants (<12 months old) had a mean operative time of 85.5 min (range 45–180) vs. older children with a

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

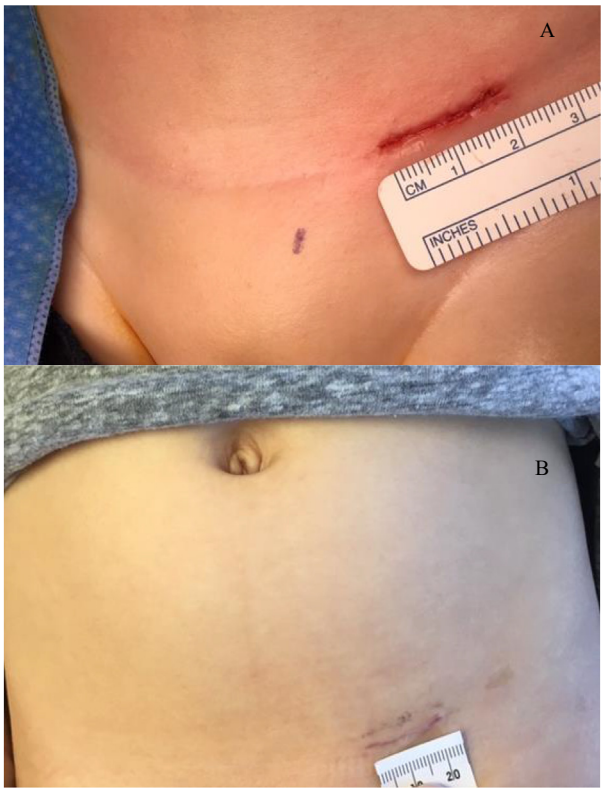


Fig. 2 Open inguinal ureteroureterostomy. Depicted is a small (2–2.5 cm) herniorrhaphy incision (2.A) immediately postoperatively and (2.B) and at 3 months follow-up.

mean of 87 min (range 58–240). A double J stent was used in 56 patients (44%), and a Penrose drain was left in 10 (8%). The double J stent was placed either in the LP ureter (n = 23) or trans anastomotic from the UP ureter to the LP ureter (n = 33) according to surgeon's criteria and intraoperative feasibility.

Mean hospital stay was 1.1 days (range 0.5–4). Hospital stay ≤24 h was recorded in 102 (80.3%, n = 102) patients with 36 (28%, n = 36) categorized as ambulatory procedures.

In our cohort of 127 patients, 3 (2%) developed Clavien-Dindo grade I, 6 (5%) developed grade II, and 2 (2%) developed grade IIIb complications which were appropriately treated. The grade I complications that were reported included two patients with a stent displacement migrating through the bladder neck into the urethra. They were repositioned with the assistance of urethral catheters pushing the stent into the bladder under fluoroscopy at bedside. The other grade I complication was a urinary leak that was managed conservatively with a Penrose drain (previously placed intraoperatively), and the leak resolved in 6 days. The grade II complications included three febrile (all females) and three non-febrile UTIs (all males) that were managed with oral antibiotics; two of the patients who presented with a febrile UTI had a ureteral stent in place. A total of ten patients underwent postoperative VCUG. Vesicoureteral reflux was identified in three patients and has been managed conservatively (watchful waiting) in all of them. Two of those patients were females with grade 2 VUR and history of preoperative endoscopic UP ureterocele puncture; the other patient was a female with an UP ectopic ureter who was found to have de novo contralateral grade 1 VUR. These patients did not present with recurrent febrile UTIs through the completion of this study.

Table 1 Demographic information for patients with duplicated collecting systems undergoing open ureteroureterostomy (n = 127).

Variables		
All patients n		127
Diagnosis n (%)	Ureterocele	49 (38.5%)
	Ectopic ureter	78 (61.4%)
Mean age (months)		18.4 (range 3–180)
Sex n (%)	Female	82 (65%)
	Male	45 (35.4%)
Presentation	Hydronephrosis	81 (64%)
	UTI	36 (28%)
	Urinary incontinence or others	10 (8%)
Side n (%)	Right	63 (49.6%)
	Left	64 (50.3%)
SFU grade n (%)	0-II	3 (3.7%)
	III-IV	78 (96.2%)

SFU, Society for Fetal Urology classification; UTI, urinary tract infection.

The patients that presented with grade IIIb complications had urinary leaks. One of the leaks occurred at the level of the UU anastomosis and was managed with a double J ureteral stent placement; the other patient underwent re-do suturing of the anterior wall of the UU in the immediate postoperative period; both had satisfactory results. None presented with Grade IV or V complications. The mean follow-up period was 28.2 months (range 12–85).

Success after open distal UU was achieved in 125 children (98%, n = 125/127): 116 (93%) patients demonstrated sonographic improvement of hydronephrosis (Fig. 3), and 9 (7%) patients demonstrated resolution of symptoms with stable sonographic findings. Upper pole hydroureteronephrosis worsened after surgery in two patients. The hydronephrosis has remained stable on postop follow-up ultrasounds and the patients have remained asymptomatic for which no further intervention has been required. No renograms were performed, so we cannot comment about deterioration of ipsilateral renal function. These patients will continue long-term monitoring as determined by their surgeon. There was no difference in success rates between the ureterocele and ectopic ureter subgroups: all patients with ureterocele (n = 49/49) and 76 patients with ectopic ureter (97%, n = 76/78) revealed improvement. On univariate analysis, the success rate was not influenced using ureteral stents (p = 0.11).

Discussion

To date, this multi-center international collaboration study provides one of the largest published cohorts of children

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

Table 2 Perioperative and postoperative outcomes in patients with duplicated collecting systemsundergoing open ureteroureterostomy (n = 127).

Variables		All patients (n = 127)
Mean operative time (min)		86 (range 45–240)
Mean hospital stay (days)		1.1 (range 0.5–4)
Mean follow up (months)		28.2 (range 12–85)
Ureteral stent n (%)		56 (44%)
Penrose drain n (%)		10 (8%)
Surgical success n (%)	Total n	125 (98%)
	Sonographic improvement of hydronephrosis	116 (92.8%)
	Resolution of symptoms with stable sonographic findings	9 (7.2%)
Complications by Clavien-Dindo Classification n (%)	Grade I (Stent displacement, urine leak)	3 (2%)
	Grade II (UTI)	6 (5%)
	Grade IIIb (Urine leak)	2 (2%)
	Grade IV-V	none

UTI, urinary tract infection.

who underwent open distal UU for duplicated collecting systems with either obstructive ureterocele or ectopic ureter without VUR. The surgical decision to opt for an upper versus lower tract approach (or combination of both) for the management of double collecting systems in children is driven by different factors including the presence of concurrent anomalies such us VUR, differential renal function, clinical manifestations, and the surgeon's expertise with the different approaches. The main goals in the management of double collecting systems include preserving renal function and preventing recurrent febrile UTIs.

Keene and Subramaniam compared upper vs. lower tract approaches in a group of children undergoing UP heminephrectomy vs. bladder reconstructive procedures and noted a decrease in the rate of secondary procedures with the lower tract approach (5% vs 21%), especially in patients with associated reflux and obstructive ureteroceles that had heminephrectomy as the initial approach vs. bladder reconstructive surgery ($p = 0.01$) [23]. Similar results were observed in a case series comparing subjects undergoing heminephrectomy vs UU or common sheath ureteral reimplantation. The ablative UP procedure resulted in a greater number of secondary procedures such as ureterocele excision or transurethral resection of a polyp [24].

Traditionally, UP heminephrectomy has been the most common surgical procedure to address symptomatic duplicated collecting systems with poorly or non-functioning UP moieties. One of the main concerns with this operation is the potential functional loss of the remaining moiety or total atrophy of the kidney [8]. Excessive traction or unintended vascular injury of the renal hilum can lead to parenchymal ischemia and ultimately partial or complete loss of function of the remaining moiety. In 2005, a retrospective series of 60 pediatric patients undergoing open heminephrectomy resulted in a 6.8% decrease of function of the remaining healthy moiety [9]. Furthermore, Malik et al. later reported a 4.9% rate of atrophy or significant renal function loss after robot-assisted laparoscopic heminephrectomy in a cohort of 16 children [10]. Our study did not systematically address preoperative and postoperative differential renal function; however, postoperative renal ultrasound did not show any evidence of atrophy or increased echogenicity of the lower pole moiety in our patient cohort.

Some complications associated with UP or LP heminephrectomy can be attributed to the remnant ureteral stump whether due to postoperative stump bleeding, or recurrent febrile UTIs with new onset VUR, the pathology can prompt reoperation for removal of the distal ureteral stump. The distal affected ureter is left intact to avoid excessive manipulation with potential inadvertent devascularization of the ureter associated with the healthy moiety. The need for secondary ureterectomy was reported in 13% of cases in this heminephrectomy series [10].

Another treatment modality is the ureteral clipping, which is a simpler technique associated with less intraoperative morbidity in comparison to the other more complex reconstructive or ablative alternatives. This technique is indicated in the settings of duplicated collecting systems with UP ectopic ureters and nonfunctioning UP moieties. However, concerns have been raised about ligating and leaving an obstructed system behind with a potential risk for flank pain and febrile urinary tract infections. Romao et al. presented a prospective series of nine patients with urinary incontinence, where eight out of nine developed UP hydronephrosis after laparoscopic clipping. None required interventions at ± 27 months after surgery [11]. Another ureteral clipping study by Lopes et al. showed a prospective cohort of 35 patients in which 1 developed pyonephrosis requiring laparoscopic nephrectomy, and another presented with postoperative febrile UTI and persistent hydronephrosis of the moiety clipped requiring antibiotic therapy and nephrostomy tube placement for acute drainage [12].

Open distal UU through a paramedial abdominal transverse incision (transecting the rectus abdominis muscles) was initially reported by *Buchtel* in 1965 [2]. High success rates have been reported with this approach (94–98%). One of the concerns associated with the UU is the reported so-called "yo–yo" uretero-ureteral reflux into the recipient moiety, which in theory defeats the purpose of the primary repair by creating de novo VUR. However, recurrent febrile UTIs have not been consistently linked to the phenomenon

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

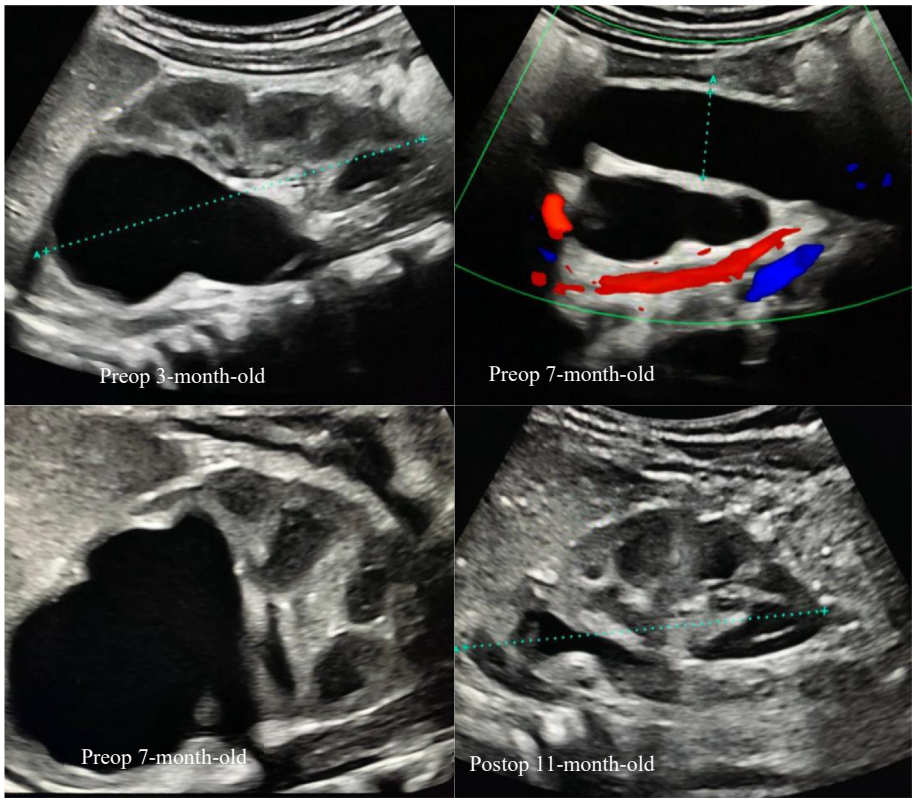


Fig. 3 Preoperative evidence of progressive upper pole hydroureteronephrosis in a patient with right sided duplicated collecting system followed by significant sonographic improvement of upper pole hydronephrosis after open distal ureteroureterostomy.

and postoperative sonographic ureteral dilatation has not been demonstrated in several studies [1,5,13].

In 2006, Gonzalez and Piaggio reported their initial experience with laparoscopic assisted UU with a low anastomosis approach and success rates comparable to our current series. Meanwhile, operative times (211 min vs. 86 min in ours) and length of hospital stay (3 days vs 1.1 days) were much longer when compared with our cohort. The benefits of preserving cosmesis by minimally invasive approaches are debatable when comparing 3–4 small incisions above the waistline vs. open UU that proposes a single 2–3 cm inguinal incision that avoids visible abdominal scars [14]. Most recently, a larger study that included children who underwent laparoscopic UU showed similar results to previous laparoscopic series regarding operative time (216 min) and a mean hospital stay (6.8 days). A steeper learning curve might be present with the laparoscopic technique vs. open, which could account for the differences noted [7]. Moreover, a recent retrospective UU series compared a cohort of patients that underwent open (n = 17), laparoscopic (n = 9) and a hybrid approach (laparoscopy dissection of the UP and LP ureters followed by open inguinal UU) (n = 7). There was no difference in surgical success among the three approaches; however, the sole laparoscopic surgery required longer operative time (150 min) when compared to the open and the hybrid techniques (120 min each). The complication rate was higher in the hybrid group including two patients with Clavien-Dindo IIIb complications that required UP hemi-nephrectomy [15].

Passerotti et al. pioneered the robotic UU in 2009 and concluded that it was a reliable and efficient technique for children with double collecting systems [16]. Other authors have also demonstrated satisfactory results with robot-assisted laparoscopic ureteroureterostomy (RALU). A comparative study between 12 open UU (using a 6 cm Pfannenstiel incision) vs. 8 RALU cases was done in 2019 by Villanueva and showed that operative time averaged 129 min vs. 130 min, respectively [3]. The robotic arm of the study used three separate 8 mm incisions that should be accounted for when comparing cosmesis to the open UU which uses a small single inguinal incision [3]. Another study in 2021 compared laparoscopic UU vs RALU with similar success rates but differing in OR times favoring the robotic technique: 112.5 min vs 90 min [4]. A comparative series between RALU and open UU showed similar outcomes regarding operative times and complication rates, with a slightly shorter length of stay favoring the robotic approach with a hospitalization of 0.5 days less than those who underwent open surgery [17]. In 2022 Neheman et al., analyzed a cohort of children undergoing outpatient pediatric urologic robotic surgery; the subgroup of patients that underwent RALU averaged an OR time of 215 min (console was 158 min) favoring our open UU series, where the averaged OR time recorded was 86 min (Port placement, docking and undocking the robot, might account for these differences) [18]. Similarly, in 2022 a RALU series showed a comparable length of stay to our open cohort (1 vs 1.1 day); however OR time was still shorter in our distal open UU cohort (86 vs 212 min) [19].

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

It has been a matter of debate whether to leave a poor, dysplastic or non-functioning UP renal moiety by performing UU. Several series have failed to demonstrate an association between the development of hypertension and/or proteinuria with preservation of dysplastic UP moieties [20,21]. Actually, in 1998, Husmann suggested that the development of hypertension in this patient population was mainly due to LP renal scarring after partial nephrectomy instead of the retained UP dysplastic moiety [8,22]. Our UU series included children with no distinction of the UP renal function; unfortunately, no nuclear functional studies were done systematically pre or postoperatively. However, no patient in our cohort developed hypertension or proteinuria during the almost three-year mean follow up.

There are several options to treat pathologic ectopic ureters and ureteroceles in children with double collecting systems. Open UU through an inguinal incision has passed the test of time and demonstrated that is an excellent alternative given the results presented in this study: high success rates (98%), low secondary procedure and complication rates, short surgical times and hospital stays, and satisfactory cosmesis provided through a small single incision hidden below the waistline. Furthermore, the surgery is simple, reproducible, performed extra-peritoneally, and the use of transcutaneous drains or double J stents is optional according to the surgeon's level of experience and intraoperative findings.

In our series, we did not have to abort UU due to a large diameter and/or tortuosity of the UP ureter. However, in a situation like that, the UP ureter should be dissected proximally to try to find adequate UP ureteral caliber and length to allow the anastomosis to the LP ureter. On a recent patient (post data collection), one of the surgeons participating in this study had to perform a temporary UP cutaneous ureterostomy due to massive dilation/tortuosity of the UP ureter (2.5—3 cm UP ureteral diameter).

It is a matter of debate where the stent should be positioned in this particular type of anastomosis. In our series, the stent was placed either in the LP ureter or trans anastomotic from the UP ureter to the LP ureter according to surgeon's criteria and intraoperative feasibility. The outcomes were equally satisfactory regardless the use of drains versus stents or the primary pathologic condition (ectopic ureter vs. ureterocele). The high success rate of open distal UU was uniform across the 4 centers in our study. However, it is relevant to mention that the surgeons participating in this multicentric study have vast experience in open minimally invasive surgery and work in large academic institutions that are tertiary referral centers in their countries. There may be a significant learning curve for this fine operation through a small incision and can be challenging for fellows in training or recently trained pediatric surgeons and urologists. We encourage extended incisions and/or use of double J stents or drains especially at the beginning of a surgeon's career. This study supports the fact that distal inguina l UU continues to play a role in worldwide pediatric urology especially in centers or countries where there is no access to minimally invasive technology such as RALU. Thorough teaching of the technique in academic centers makes it a straightforward, reproducible, and readily available technique that can be performed at any pediatric institution in the world. Drawbacks of our study include: retrospective analysis, lack of standardization or designed protocol, inconsistent pre and postoperative evaluation of differential renal function, irregular use of pigtails or external drains, inconsistent measurement of intraoperative UP and LP ureteral diameters, lack of assessment of perioperative pain and analgesia requirements, etc.

Ultimately, selecting an approach should account for parents' preferences, surgeon's expertise, success rates and morbidity associated with each technique, and institutional availability of minimally invasive technology, etc.

Conclusion

Open distal UU is good alternative for the definitive management of children with ureteroceles or ectopic ureters in pathologic double collecting systems without associated VUR. This multicentric and mid-term follow-up study demonstrates that open distal UU offers high success rates, low morbidity, short surgical times and hospital stays, and satisfactory aesthetic outcomes. Additionally, the surgery is performed extra-peritoneally and may not require the use of stents or drains depending on surgeon preference. Further investigations are being conducted to determine the role of UU in the settings of double collecting systems associated with ipsilateral LP VUR.

Source of funding

None.

Conflict of interest

None.

References

[1] Prieto J, Ziada A, Baker L, Snodgrass W. Ureteroureterostomy via inguinal incision for ectopic ureters and ureteroceles without ipsilateral lower Pole reflux. J Urol 2009;181(4):1844—50.
[2] Buchtel H. Uretero-ureterostomy. J Urol 1965;93:153—7.
[3] Villanueva C. Open vs robotic infant ureteroureterostomy. J Pediatr Urol 2019;15(4):390.e1—4.
[4] Chertin L, Neeman B, Stav K, Noh P, Koucherov S, Gaber J, et al. Robotic versus laparoscopic ipsilateral ureteroureterostomy for upper urinary tract duplications in the pediatric population: a multi-institutional review of outcomes and complications. J Pediatr Surg 2021;56(12):2377—80.
[5] Chacko J, Koyle M, Mingin G, Furness P. Ipsilateral ureteroureterostomy in the surgical management of the severely dilated ureter in ureteral duplication. J Urol 2007;178(4 Pt 2):1689—92.
[6] Wong N, Braga LH. Open ureteroureterostomy for repair of upper-Pole ectopic ureters in children with duplex systems: is stenting really necessary? J Pediatr Urol 2019;15(1):72.e1—7.
[7] Gerwinn T, Gnannt R, Weber D, Gobet R, Mazzone L. Laparoscopic ureteroureterostomy vs. Common sheath ureteral reimplantation in children with duplex kidney anomalies. Front Pediatr 2021;9:637544.
[8] Michaud J, Akhavan A. Upper Pole heminephrectomy versus lower Pole ureteroureterostomy for ectopic upper Pole ureters. Urol Rep 2017;18(3):21.

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005

[9] Gundeti M, Ransley P, Duffy P, Cuckow P, Wilcox D. Renal outcome following heminephrectomy for duplex kidney. J Urol 2005;173(5):1743–4.
[10] Malik R, Pariser J, Gundeti M. Outcomes in pediatric robot-assisted laparoscopic heminephrectomy compared with contemporary open and laparoscopic series. J Endourol 2015 Dec;29(12):1346–52.
[11] Romao R, Figueroa V, Pippi Salle J, Koyle M, Bagli D, Lorenzo A. Laparoscopic ureteral ligation (clipping): a novel, simple procedure for pediatric urinary incontinence due to ectopic ureters associated with non-functioning upper Pole renal moieties. J Pediatr Urol 2014;10(6):1089–94.
[12] Lopes R, Fernandez N, Koyle M, Dos Santos J, Perez J, Romao R. Clinical outcomes of the upper urinary tract after ureteral clipping for treatment of low functioning or nonfunctioning renal moieties. J Urol 2018;199(2):558–64.
[13] Lashley D, Mcaleer I, Kaplan G. Ipsilateral ureter-oureterostomy for the treatment of vesicoureteral reflux or obstruction associated with complete ureteral duplication. J Urol 2001;165(2):552–4.
[14] González R, Piaggio L. Initial experience with laparoscopic ipsilateral ureteroureterostomy in infants and children for duplication anomalies of the urinary tract. J Urol 2007;177(6):2315–8.
[15] Yassegoungbe M, Bensaid R, Montalva L, Lecompte J, Glatz G, Gerstner G. Results of uretero-ureteral anastomosis in pathological duplex kidney. J Pediatr Urol 2024;12. S1477-5131(24)00012-3.
[16] Passerotti C, Diamond D, Borer J, Eisner J, Barrisford G, Nguyen H. Robot-assisted laparoscopic ureteroureterostomy: description of technique. J Endourol 2008;22(4):581–4.
[17] Lee N, Corbett S, Cobb K, Bailey G, Burns A, Peters C. Bi-institutional comparison of robot-assisted laparoscopic versus open ureteroureterostomy in the pediatric population. J Endourol 2015;11(29):1237–41.
[18] Neheman A, Kord E, VanderBrink E, Minevich E, Noh P. Outpatient robotic surgery in pediatric urology: assessment of feasibility and short-term safety. J Urol 2022;207(4):894–900.
[19] Sahadev R, Rodriguez MV, Kawal T, Barashi N, Srinivasan A. Upper or lower tract approach for duplex anomalies? A bi-institutional comparative analysis of robot-assisted approaches. J Robot Surg 2022;16(6):1321–8.
[20] Gran C, Kropp B, Cheng E, Kropp K. Primary lower urinary tract reconstruction for nonfunctioning renal moieties associated with obstructing ureteroceles. J Urol 2005;173(1):198–201.
[21] Levy A, Vandersteen D, Morgenstern B, Husmann D. Hypertension after surgical management of renal duplication associated with an upper Pole ureterocele. J Urol 1997;(158):1241–4.
[22] Husmann D. Renal dysplasia: the risks and consequences of leaving dysplastic tissue in situ. Urology 1998;52(4):533–6.
[23] Keene D, Subramaniam R. Duplex systems: top-down or bottom-up approach? J Pediatr Urol 2020;16(3):387.e1–8.
[24] Sheth K, White J, Janzen N, Koh C, Austin P, Roth D. Evaluating outcomes of differential surgical management of nonfunctioning upper Pole renal moieties in duplex collecting systems. Urology 2019;123:198–203.

Please cite this article as: Rodriguez MV et al., Open distal ureteroureterostomy for non-refluxing duplicated collecting system in children: Multicentric study and mid-term outcomes, Journal of Pediatric Urology, https://doi.org/10.1016/j.jpurol.2024.08.005