Utility of Retrograde Ureteroceleogram in Management of Complex Ureterocele

Arevalo MK, Prieto JC, Bush NC, Cost N, Nuss G, Brown B and Baker LA
Department of Urology, University of Texas Southwestern and Children's Health Dallas

UT Southwestern Medical Center

INTRODUCTION

Congenital ureterocele, a rare anomaly affecting as many as 1 in 500 individuals, is the cystic ballooning of the intravesicular ureter [1]. While typically associated with the upper pole of a duplex kidney, ureterocele anatomy manifests diversely in patients, making evidence-based treatment of this anomaly impractical [2]. Optimal management of ureterocele must generally be individualized, based on the results of a comprehensive preoperative evaluation and the clinical status of the patient. As such, the ability to accurately visualize ureterocele in complicated, precarious cases is of obvious value. Retrograde ureteroceleogram (RUC) is a simple, underutilized radiologic technique that can be performed during cystoscopy. We sought to determine whether RUC changes surgical management by more accurately depicting the complex ureteral and ureterocele anatomy compared to renal ultrasound (US) and voiding cystourethrography (VCUG).

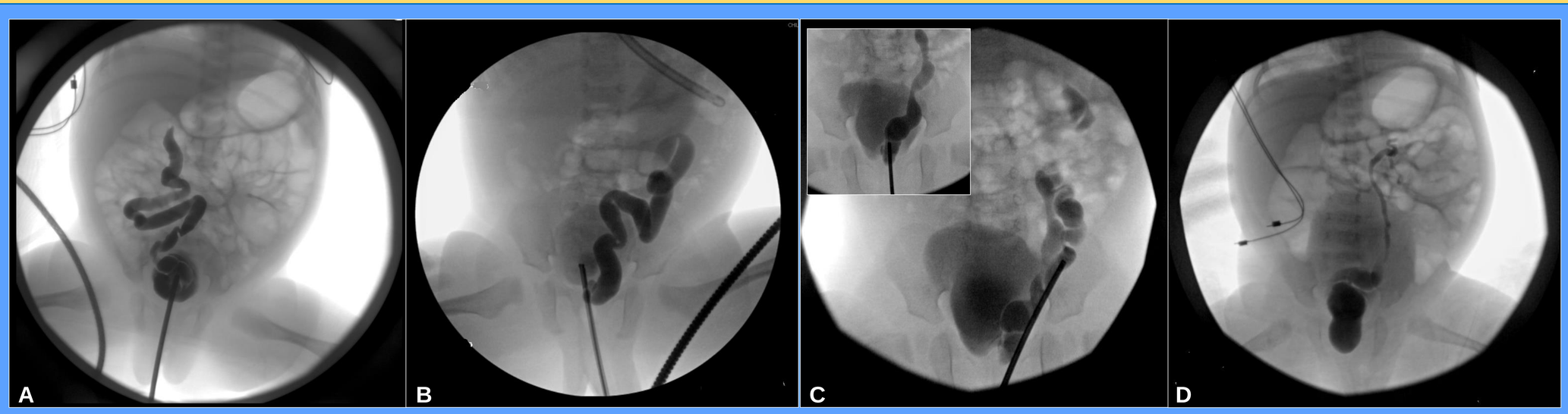

Figure 1. Examples of novel anatomy revealed by retrograde ureteroceleogram: (A) In a neonate with bilateral hydroureteronephrosis and a large, midline ureterocele the RUC reveals right-sided origin (B) RUC shows previously-diagnosed ureterocele to be an ectopic ureter falsely elevating the bladder, or "pseudoureterocele" (C) RUC performed in conjunction with cystogram demonstrates an unsuspected duplex system (D) RUC reveals ureterocele disproportion and the extravesicular extent of the ureterocele, which is ectopic into the bladder neck.

METHODS

Patients who underwent surgical management of ureterocele between 2003-2015 were identified; those who received concomitant fluoroscopic RUC were selected for the case series. Data collected included demographics, preoperative evaluation, surgical interventions, and outcomes. The preoperative evaluation and preoperative anatomical diagnosis were recorded on all patients and RUC images were retrospectively individually examined.

RUC was performed by cystoscopically inserting a needle into the ureterocele and injecting contrast retrograde. If indicated, simultaneous cystogram was performed to visualize the bladder and any refluxing ureters.

RESULTS

Of 43 patients that underwent surgery for suspected ureterocele, 28 underwent cystoscopy + RUC (10M: 18F) at a median age of 4.6 months and median follow-up of 37.0 months. Significant observations from RUC prompted change to the preoperative surgical plan in 9 of 28 children. Additional results are presented in Figures 1 & 2.

Figure 2. Changes to the surgical plan due to novel RUC findings; patient demographics including ureterocele type

	Preoperative Diagnosis	Preoperative Surgical Plan	Interoperative Novel RUC Observation(s)	Change in surgical plan
1	Left duplication with obstructing left upper pole ureterocele and severe hydroureteronephrosis (HUN)	TUIU	Large pseudoureterocele elevating the bladder floor and exiting the prostatic urethra	TUIU is not attempted; ureteroureterostomy (UU) performed instead at later date
2	Bilateral duplications with nonfunctional left upper pole, left ureterocele, and increasing right HUN of unknown origin. Bilateral ureteroceles suspected.	Bilateral ureterocele excision + left upper pole partial nephrectomy (UPPN)	No right ureterocele in duplex system. A large left ureterocele opens into the proximal urethra.	TUIU + left UPPN performed with no open bladder surgery.
3	Large intravesicular ureterocele, side unknown, in a febrile newborn with bilateral HUN.	TUIU	Massively tortuous ureter opening into mid to distal urethra.	Cutaneous ureterostomy performed to relieve HUN with lower tract reconstruction planned at age 6 months.
4	Left HUN with severe left VUR s/p albation of what was thought to be posterior urethral valves; left kidney nonfunctioning	Left nephrectomy	Duplicated left system revealed with two massive hydroureters and an ectopic upper pole ureter with prostatic insertion.	Simple nephrectomy converted to nephroureterectomy of a duplex kidney made complex by the presence of two massive hydroureters.
5	Massive left ureterocele and left lower pole HUN but no lower pole VUR to account for it; single system suspected	Ureteral reimplant + ureterocele excision	False negative VCUG since left lower pole VUR identified; confirmed duplex system	Reimplant + ureterocele exicison changed to left UU + single reimplant and ureterocele excision
6	Single system ureterocele with nonfunctioning moiety	TUIU	Massive pseudoureterocele served by a tortuous, ectopic (prostatic) hydroureter 5+ cm wide	TUIU performed and OR rebooked for more complex nephrectomy
7	Right duplicated system with non-function of upper pole; no ureterocele seen on imaging; bladder floor irregularity noted	Cystoscopy only	RUC diagnosed right upper pole ureterocele with clear ureterocele disproportion + occult left VUR	TUIU not performed; plan was made for open ureterocele excision + bilateral reimplantation
8	"Single" system obstructing right ureterocele with HUN and nonfunctional moiety	Right nephrectomy	Duplex right system revealed with two massively dilated ureters	Simple nephrectomy converted to nephroureterectomy of a duplex kidney made complex by the presence of two massive hydroureters.
9	Neonate with left grade V VUR and 12.6% left kidney function, US shows large obstructing ureterocele	TUIU + possible later nephroureterectomy	RUC reveals upper pole, duplex system ectopic ureterocele with ureterocele disproportion	Plan changed to TUIU + planned left heminephrectomy, lower tract reconstruction and ureterocele excision.

Median age (IQR), months	**4.6 (2.5 - 13.6)**
Median follow up (IQR), months	**37.0 (8.7 – 90.3)**
Gender	
Male	**10 (35.7%)**
Female	**18 (64.3%)**
Clinical Presentation	
Febrile UTI	**7 (25.0%)**
Urosepsis	**3 (10.7%)**
Antenatal sonogram	**15 (53.6%)**
Other/Incidental	**3 (10.7%)**
Previous confirmed UTI preop	**18 (64.3%)**
Imaging studies performed	
Renal ultrasound	**28 (100.0%)**
Voiding cystourethrogram	**25 (89.2%)**
DMSA or MAG-3	**20 (71.4%)**
MRI	**1 (2.6%)**
Ureterocele characteristics	
Duplex system	**21 (75.0%)**
Single system	**7 (25.0%)**
Severe (SFU grade 3/4) HUN	**17 (60.7%)**
Severe (3+) VUR	**10 (35.7%)**
Nonfunctional moiety	**13 (46.4%)**
Surgical Approach	
Staged approach or definitive TUIU	**14 (50.0%)**
Lower tract reconstruction	**5 (17.8%)**
Upper tract approach	**4 (14.2%)**
Upper and lower tract approach	**3 (10.7%)**
Deferred/Pending	**2 (7.1%)**

CONCLUSION

While not needed in routine anatomically-clear ureterocele cases, intraoperative RUC further defines ureterocele anatomy in nearly all complex cases, clearly delineating confusing variants like ureterocele ectopy, pseudoureterocele, ureterocele disproportion, and unsuspected duplex systems. RUC can fluoroscopically verify decompression of the ureterocele post incision, document severity of ureteral dilation, and teach trainees the great damage generated by ureterocele variations. The technique has limitations: it cannot be performed in the incised/decompressed ureterocele, and RUC minimally increases both radiation dose and overall cost. The study design is limited by its small size, retrospective approach, selection bias, and availability of RUC images. Nevertheless, RUC is a useful adjunct to standard US and VCUG studies, as it changed the original surgical plan frequently enough to merit greater use in complex patients,

REFERENCES

1. Uson, A.C., J.K. Lattimer, and M.M. Melicow, *Ureteroceles in infants and children: a report based on 44 cases.* Pediatrics, 1961. 27: p. 971-83.
2. Timberlake, M.D. and S.T. Corbett, *Minimally invasive techniques for management of the ureterocele and ectopic ureter: upper tract versus lower tract approach.* Urol Clin North Am, 2015. 42(1): p. 61-76.