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Which Reimplantation Technique is Better in Open Surgical Management of Paraureteral Diverticulum: A Retrospective Comparative Study

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Abstract

Objective

To compare the perioperative and long-term outcomes of open Cohen and modified Politano-Leadbetter ureteroneocystostomy performed with diverticulectomy in children with paraureteral bladder diverticula.

Methods

Consecutive patients younger than 18 years who underwent open diverticulectomy with simultaneous ureteral reimplantation for congenital paraureteral bladder diverticulum at a tertiary referral center between 2015 and 2025 were retrospectively reviewed. Demographic characteristics, diverticular features, vesicoureteral reflux, operative variables, postoperative complications, hydronephrosis, and long-term outcomes were compared between the Cohen and modified Politano-Leadbetter groups.

Results

Sixteen patients with a median age of 8 years were included. Vesicoureteral reflux was present in 11 patients (69%). Eight patients underwent Cohen reimplantation and 8 underwent modified Politano-Leadbetter reimplantation. Both techniques achieved complete resolution of reflux, improvement in hydronephrosis, and freedom from diverticular recurrence during a median follow-up of 86 months. Overall complication rates, length of hospitalization, postoperative lower urinary tract symptoms, and stenosis rates were comparable. Median operative time was shorter with the modified Politano-Leadbetter technique [95 (80–170) vs 150 (115–210) minutes; p = 0.015], whereas prolonged postoperative hematuria was more frequent after Cohen reimplantation (50% vs 13%; p = 0.037).

Conclusion

Open diverticulectomy combined with ureteral reimplantation provides durable outcomes in children with paraureteral diverticula. Both techniques were similarly effective, although the modified Politano-Leadbetter approach was associated with a shorter operative time and less prolonged postoperative hematuria. Larger prospective multicenter studies are needed to confirm these findings.

Introduction

Bladder diverticulum is an uncommon condition in childhood and occurs predominantly in boys. Congenital bladder diverticula represent mucosal herniation through a focal weakness of the detrusor muscle and differ from acquired diverticula, which usually develop secondary to bladder outlet obstruction.[1,2]

Approximately 90% of primary congenital diverticula are located near the ureteral orifice. Weakness at the ureterovesical junction may permit herniation at Waldeyer's sheath and lead to paraureteral diverticulum formation.[3,4]

According to their relationship with the ureteral orifice, diverticula may be classified as paraureteral, periureteral, or posterolateral. Paraureteral diverticula, also known as Hutch diverticula, may distort the ureterovesical junction and are frequently associated with vesicoureteral reflux (VUR) and hydronephrosis.[5,6]

Clinical manifestations include recurrent urinary tract infection, hematuria, voiding dysfunction, urinary retention, and bladder outlet obstruction, although some diverticula are detected incidentally.[7,8]

Observation is appropriate for selected asymptomatic patients, whereas surgery is generally considered for recurrent infection, significant reflux, obstruction, calculi, voiding dysfunction, or a large symptomatic diverticulum. Open, laparoscopic, and robot-assisted approaches have been described.[2,9,10]

Because paraureteral diverticula are rare, comparative evidence regarding ureteral reimplantation techniques remains limited. This study compared perioperative and long-term outcomes of open Cohen and modified Politano-Leadbetter ureteroneocystostomy performed with diverticulectomy in children with paraureteral bladder diverticula.

Materials and Methods

This retrospective study included consecutive patients younger than 18 years who underwent surgery for congenital paraureteral bladder diverticulum at a single tertiary referral center between 2015 and 2025. Patients with secondary diverticula, isolated posterolateral diverticula, or incomplete clinical data were excluded. The study was approved by the institutional ethics committee (date: June 3, 2025; approval no. 3017).

All patients underwent a standardized preoperative assessment that included physical examination, serum biochemistry, urinalysis and urine culture, urinary tract ultrasonography, voiding cystourethrography (VCUG), and technetium-99m dimercaptosuccinic acid renal scintigraphy. Cross-sectional imaging was obtained when clinically indicated.

Diverticulectomy was performed together with open ureteroneocystostomy using either the Cohen or modified Politano-Leadbetter technique. A surgical drain, urethral catheter, and pediatric double-J stent were routinely placed. The drain was generally removed on postoperative days 3–4, the urethral catheter

on days 7–10 according to urine appearance, and the double-J stent on days 30–40. Ultrasonography was performed 4 and 12 weeks after stent removal, and VCUG was routinely obtained at approximately 6 months.

Recorded variables included age, sex, presenting symptoms, diverticular diameter and laterality, VUR grade and side, differential renal function, renal pelvic anteroposterior diameter, cortical thickness, hydronephrosis grade according to the Society for Fetal Urology system, distal ureteral diameter, operative technique and duration, length of hospitalization, postoperative complications, follow-up imaging findings, and duration of follow-up.

Data distribution was assessed using the Shapiro-Wilk test and visual inspection of histograms. Because continuous variables were non-normally distributed, comparisons were performed using the Mann-Whitney U test. Categorical variables were compared using the chi-square test or Fisher exact test, as appropriate. A two-sided p value < 0.05 was considered statistically significant. The study was reported in accordance with the STROBE statement.

Results

Eighteen patients were initially identified. After exclusion of 2 patients with isolated posterolateral diverticula without VUR, 16 patients (15 boys and 1 girl) with a median age of 8 years (range, 2–14 years) were included.

Eight patients (50%) had left-sided diverticula, 4 (25%) had right-sided diverticula, and 4 (25%) had bilateral diverticula, yielding 20 operated diverticula. The median diverticular diameter was 36 mm (range, 20–60 mm), and 9 patients (56%) had a diverticulum larger than 3 cm. Ipsilateral VUR was present in 11 patients (69%), including 2 with bilateral grade 2–3 reflux; no reflux was detected in the remaining 5 patients. Lower urinary tract symptoms were present in 9 patients (56%), and 10 (63%) had a history of symptomatic urinary tract infection. Median differential function of the affected renal unit was 40% (range, 9%-52%).

Eight patients underwent diverticulectomy with Cohen ureteral reimplantation and 8 underwent diverticulectomy with modified Politano-Leadbetter reimplantation. The median length of hospitalization was 7 days (range, 4–13 days), and no patient required postoperative intensive care. Prolonged hematuria occurred in 5 patients. Double-J stent migration occurred in 2 patients in the modified Politano-Leadbetter group; one stent was successfully replaced, whereas failed replacement in the other patient was followed by ureterovesical junction obstruction requiring redo ureteroneocystostomy in the first postoperative month.

The median follow-up was 86 months (range, 36–120 months). No patient had persistent or recurrent VUR on follow-up VCUG, and no diverticular recurrence was detected. Hydronephrosis improved in 7 of 8 patients (88%) in the modified Politano-Leadbetter group and 6 of 8 (75%) in the Cohen group.

The groups did not differ significantly in age, laterality, diverticular size, overall complication rate, length of hospitalization, transient lower urinary tract symptoms, stenosis, improvement in hydronephrosis, or VUR resolution. Median operative time was significantly shorter in the modified Politano-Leadbetter group [95 (80–170) vs 150 (115–210) minutes; p = 0.015]. Prolonged hematuria lasting more than 3 days was significantly more frequent after Cohen reimplantation (50% vs 13%; p = 0.037).

Discussion

Pediatric bladder diverticula are uncommon and may remain asymptomatic when small. Larger diverticula can cause urinary stasis, recurrent urinary tract infection, lower urinary tract symptoms, hematuria, urinary retention, VUR, and upper urinary tract dilatation.[7,11,14]

The marked male predominance described in pediatric series was also observed in our cohort, which included 15 boys and 1 girl. Lower urinary tract symptoms were present in 9 patients, 10 had a history of symptomatic urinary tract infection, and 4 had both conditions.

Congenital diverticula are classified according to their anatomical relationship with the ureteral orifice. Paraureteral diverticula involve or incorporate the ureteral orifice, whereas posterolateral diverticula are not directly associated with the ureterovesical junction.[5,6,14]

Because paraureteral diverticula may distort the ureterovesical junction, they are frequently associated with VUR and hydronephrosis. In the present series, 2 patients with isolated posterolateral diverticula without reflux were excluded, leaving 16 patients with paraureteral diverticula for comparative analysis.

Observation with periodic ultrasonography and urinalysis is generally appropriate for incidentally detected, asymptomatic diverticula. Surgical treatment is considered in patients with recurrent urinary tract infection, voiding dysfunction, urinary retention, calculi, VUR, upper urinary tract deterioration, or a large symptomatic diverticulum.[2,7,14]

The goals of surgery are complete excision, preservation of bladder function, correction of reflux when present, and reconstruction of a tension-free, non-obstructive ureterovesical junction.

Isolated diverticulectomy may be insufficient when the diverticulum incorporates the ureteral orifice or distorts the ureterovesical junction. In these circumstances, simultaneous ureteral reimplantation restores an anti-reflux mechanism and permits definitive reconstruction.[7,14]

Barrett et al. reported VUR in all 78 children with paraureteral diverticula in their series.[13]

In our cohort, ipsilateral VUR was identified in 11 of 16 patients (69%), whereas no reflux was detected in 5 patients. Reimplantation was nevertheless required in these patients because the diverticulum was closely related to the ureteral orifice and its excision necessitated ureterovesical reconstruction.

Open surgery remains a reliable option for large diverticula, distorted periureteral anatomy, or simultaneous ureteral reconstruction. Although minimally invasive approaches have increasingly been reported, open surgery permits direct assessment of the diverticular neck, distal ureter, bladder wall, and trigone.[9,10,14,16]

The operative approach should be individualized according to diverticular anatomy, the relationship with the ureteral orifice, the presence of reflux, and surgeon experience.

The intravesical approach provides direct visualization of the diverticular neck, ureteral orifice, trigone, and bladder mucosa. In our Cohen group, the bladder was mobilized and opened through a midline cystotomy. The diverticulum was delivered into the bladder and excised after identification of the ureteral orifice, followed by cross-trigonal ureteroneocystostomy and double-J stent placement.

In the modified Politano-Leadbetter procedure, the distal ureter was identified externally and divided, the diverticulum was excised, and a new hiatus and submucosal tunnel were created before ureterovesical anastomosis. This approach may reduce intravesical manipulation but requires careful assessment of the relationship between the diverticulum and distal ureter.[17]

Both procedures are accepted reconstructive options, and neither is universally preferable for all anatomical configurations.

Aydoğdu et al. evaluated 51 children with VUR associated with paraureteral diverticula who underwent extravesical repair, intravesical repair, or endoscopic injection. At a mean follow-up of 22.1 months, success rates were 80%, 91%, and 79%, respectively, with significantly better outcomes after intravesical repair.[15]

In the present study, 8 patients underwent Cohen reimplantation and 8 underwent modified Politano-Leadbetter reimplantation. Both techniques resulted in complete VUR resolution, and no diverticular recurrence was observed during a median follow-up of 86 months. Hydronephrosis improved in 88% of patients in the modified Politano-Leadbetter group and 75% in the Cohen group, without a statistically significant difference.

Overall complication rates and length of hospitalization were comparable. Ureterovesical junction obstruction occurred in 1 patient after modified Politano-Leadbetter reimplantation and was treated with redo ureteroneocystostomy. Double-J stent migration occurred in 2 patients in the same group. No additional obstruction, persistent VUR, or diverticular recurrence was detected during long-term follow-up.

The principal differences between the techniques were operative duration and postoperative hematuria. Median operative time was significantly shorter with the modified Politano-Leadbetter technique [95 (80–170) vs 150 (115–210) minutes; $p = 0.015$]. Prolonged hematuria was more frequent after Cohen reimplantation (50% vs 13%; $p = 0.037$), plausibly reflecting cystotomy and greater intravesical mucosal manipulation. These findings suggest a potential perioperative advantage of the modified Politano-Leadbetter procedure, whereas both techniques provide comparable functional and radiological outcomes.

This study is limited by its retrospective, single-center design, small sample size, and nonrandomized selection of the reimplantation technique. The choice of procedure may have been influenced by anatomy and surgeon preference. Nevertheless, the long follow-up period provides clinically relevant information regarding the durability of both procedures in a rare pediatric condition.

Conclusion

Open diverticulectomy combined with ureteral reimplantation provides effective and durable treatment for pediatric paraureteral bladder diverticula. Both Cohen and modified Politano-Leadbetter ureteroneocystostomy achieved complete resolution of VUR and prevented diverticular recurrence. The modified Politano-Leadbetter technique was associated with a shorter operative time, whereas prolonged postoperative hematuria was more frequent after Cohen reimplantation. Larger prospective multicenter studies are required to determine whether anatomical or clinical factors should guide selection of the reimplantation technique.

Declarations

Author Contribution

M.Ö.Ö. conceived and designed the study, participated in data collection and interpretation, and drafted the manuscript. B.B. contributed to data collection, data analysis, and interpretation of the results. İ.H.B. contributed to data collection, clinical evaluation, and manuscript preparation. G.K. contributed to data collection, analysis, and preparation of the figures and tables. Y.E.G. contributed to data collection and analysis and critically reviewed the manuscript. K.H. contributed to the study design, interpretation of the results, and critical revision of the manuscript. A.Ö. contributed to the study conception and design, supervised the study, interpreted the results, and critically revised the manuscript. All authors reviewed and approved the final version of the manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Tables

Table 1. Preoperative characteristics of the entire cohort (n = 16)

Case	Gender	Age (yr)	Side of diverticula	Size of diverticula (mm)	Preoperative VUR grade in VCUG	Presentation	Preoperative AP diameter in US (mm)	Preoperative cortical thickness in US (mm)	Preoperative hydronephrosis grade in US	Preoperative distal ureteral diameter in US(mm)
Case 1	Male	5	Left	25	L: 5	UTI+ LUTS	L: 20	L: 4	L: 4	L: 2
					R: 0		R: 14	R: 7	R: 2	R: 7
Case 2	Male	12	Left	37	L: 0	UTI	L: 16	L: 8	L: 2	L: 3
					R: 0		R: 4	R: 10	R: 0	R: 3
Case 3	Male	4	Right	40	L: 0	UTI+LUTS	L: 5	L: 10	L: 0	L: 3
					R: 3		R: 13	R: 10	R: 1	R: 5
Case 4	Male	10	Bilateral	45	L: 0	LUTS	L: 4	L: 9	L: 0	L: 3
					R: 0		R: 4	R: 10	R: 0	R: 3
Case 5	Male	12	Left	20	L: 3	UTI	L: 18	L: 10	L: 2	L: 6
					R: 0		R: 4	R: 13	R: 0	R: 3
Case 6	Female	13	Right	20	L: 3	UTI	L: 13	L: 10	L: 1	L: 5
					R: 2		R: 4	R: 11	R: 0	R: 3
Case 7	Male	11	Bilateral	40	L: 0	LUTS	L: 23	L: 10	L: 3	L: 20
					R: 0		R: 5	R: 11	R: 0	R: 7
Case 8	Male	12	Left	20	L: 0	LUTS	L: 10	L: 8	L: 2	L: 10
					R: 0		R: 7	R: 18	R: 1	R: 7
Case 9	Male	3	Left	20	L: 3	UTI	L: 10	L: 6	L: 2	L: 4
					R: 0		R: 4	R: 11	R: 0	R: 3
Case 10	Male	6	Right	22	L: 0	Flank pain	L: 4	L: 10	L: 0	L: 3
					R: 4		R: 10	R: 11	R: 2	R: 5
Case 11	Male	8	Bilateral	46	L: 1	UTI+LUTS	L: 18	L: 10	L: 3	L: 7
					R: 0		R: 10	R: 10	R: 2	R: 5
Case 12	Male	8	Left	45	L: 4	UTI	L: 15	L: 5	L: 2	L: 8
					R: 0		R: 4	R: 14	R: 0	R: 3
Case 13	Male	2	Left	35	L: 4	UTI+LUTS	L: 21	L: 5	L: 3	L: 5
					R: 0		R: 4	R: 19	R: 0	R: 3
Case 14	Male	14	Left	38	L: 3	UTI	L: 20	L: 5	L: 3	L: 5
					R: 0		R: 4	R: 10	R: 0	R: 3
Case 15	Male	7	Bilateral	60	L: 0	LUTS	L: 4	L: 12	L: 0	L: 2
					R: 0		R: 4	R: 12	R: 0	R: 24
Case 16	Male	3	Right	21	L: 2	LUTS	L: 5	L: 11	L: 0	L: 3
					R: 3		R: 7	R: 18	R: 2	R: 3

Table 2. Perioperative and postoperative characteristics of the entire cohort (n = 16)

Case	UNC Technique	Duration of surgery (min)	Length of hospitalization (days)	Duration of follow-up (months)	Postoperative AP diameter on US (mm)	Postoperative cortical thickness in US (mm)	Postoperative hydronephrosis grade in US	Postoperative distal ureteral diameter in US (mm)	Early complicati
Case 1	UnilateralPolitano-Leadbetter	80	7	60	L: 19 R: 18	L: 5 R: 11	L: 3 R: 2	L: 5 R: 6	None
Case 2	UnilateralPolitano-Leadbetter	95	11	56	L: 8 R: 4	L: 8 R: 10	L: 1 R: 0	L: 3 R: 3	None
Case 3	UnilateralPolitano-Leadbetter	80	7	52	L: 4 R: 7	L: 10 R: 17	L: 0 R: 1	L: 3 R: 3	None
Case 4	Bilateral Cohen	210	8	96	L: 4 R: 4	L: 16 R: 13	L: 0 R: 0	L: 3 R: 3	None
Case 5	Unilateral Cohen	130	4	100	L: 7 R: 4	L: 11 R: 13	L: 1 R: 0	L: 3 R: 3	None
Case 6	Bilateral Cohen	165	7	93	L: 4 R: 4	L: 10 R: 10	L: 0 R: 0	L: 3 R: 3	None
Case 7	Bilateral Cohen	170	5	83	L: 20 R: 4	L: 10 R: 11	L: 3 R: 0	L: 10 R: 4	None
Case 8	UnilateralPolitano-Leadbetter	80	13	84	L: 4 R: 4	L: 7 R: 7	L: 0 R: 0	L: 5 R: 3	DJ migrati (Failed DJ replaceme
Case 9	Unilateral Cohen	135	7	60	L: 25 R: 4	L: 13 R: 15	L: 2 R: 0	L: 5 R: 3	None
Case 10	UnilateralPolitano-Leadbetter	80	4	104	L: 4 R: 10	L: 10 R: 10	L: 0 R: 0	L: 3 R: 3	None
Case 11	Bilateral Politano-Leadbetter	170	5	96	L: 14 R: 4	L: 9 R: 13	L: 2 R: 0	L: 5 R: 3	None
Case 12	UnilateralPolitano-Leadbetter	90	7	88	L: 6 R: 4	L: 6 R: 14	L: 0 R: 0	L: 3 R: 3	None
Case 13	Unilateral Cohen	120	6	87	L: 10 R: 4	L: 9 R: 12	L: 1 R: 0	L: 3 R: 3	None
Case 14	Unilateral Cohen	115	7	120	L: 10 R: 4	L: 8 R: 12	L: 2 R: 0	L: 4 R: 3	None
Case 15	Bilateral Politano-Leadbetter	150	6	36	L: 4 R: 4	L: 12 R: 12	L: 0 R: 0	L: 2 R: 2	DJ migrati (DJ replaceme
Case 16	Bilateral Cohen	180	5	36	L: 3 R: 3	L: 16 R: 11	L: 0 R: 0	L: 3 R: 3	None

Table 3. Comparison of perioperative parameters between surgical techniques

Parameter	Politano-Leadbetter UNC (n=8)	Cohen UNC (n=8)	P value
Age (years)	8 (4-12)	11 (2-14)	0.752
Laterality (bilateral rate)	2 (25%)	2 (25%)	1
Diverticula size (mm)	38.5 (20-60)	28 (20-45)	0.185
Duration of surgery (minutes)	95 (80-170)	150 (115-210)	**0.015**
Complication (n,%)	2 (25%)	0	0.467
Length of hospitalization (days)	7 (4-13)	7 (4-8)	0.481
Prolonged haematuria (>3 days)	1 (13%)	4 (50%)	**0.037**
Transient LUTS (n,%)	2 (25%)	1 (13%)	0.335
VUR resolution (n,%)	8 (100%)	8 (100%)	1
Stenosis (n,%)	1 (13%)	0	0.781
Improvement in hydronephrosis grade (n,%)	7 (88%)	6 (75%)	0.501

Figures

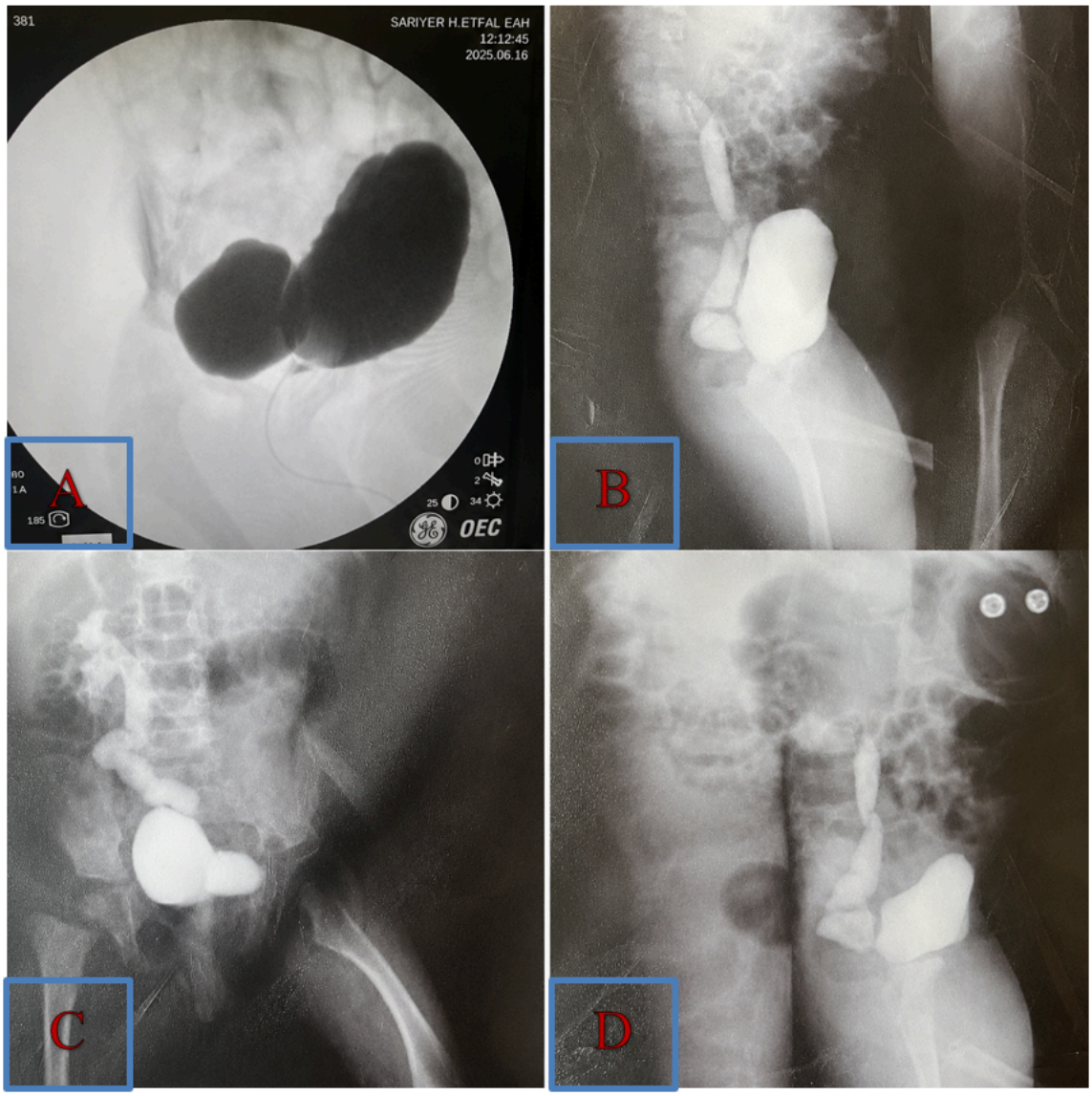


Figure 1

Preoperative radiological evaluation of a right congenital paraureteral (Hutch) diverticulum.

(A) Voiding cystourethrogram (VCUG) demonstrating a **right congenital paraureteral (Hutch) diverticulum** associated with **ipsilateral vesicoureteral reflux (VUR).**

(B–D) Additional VCUG images obtained in different projections, confirming the **right congenital paraureteral (Hutch) diverticulum** and illustrating its anatomical relationship with the distal ureter and urinary bladder.

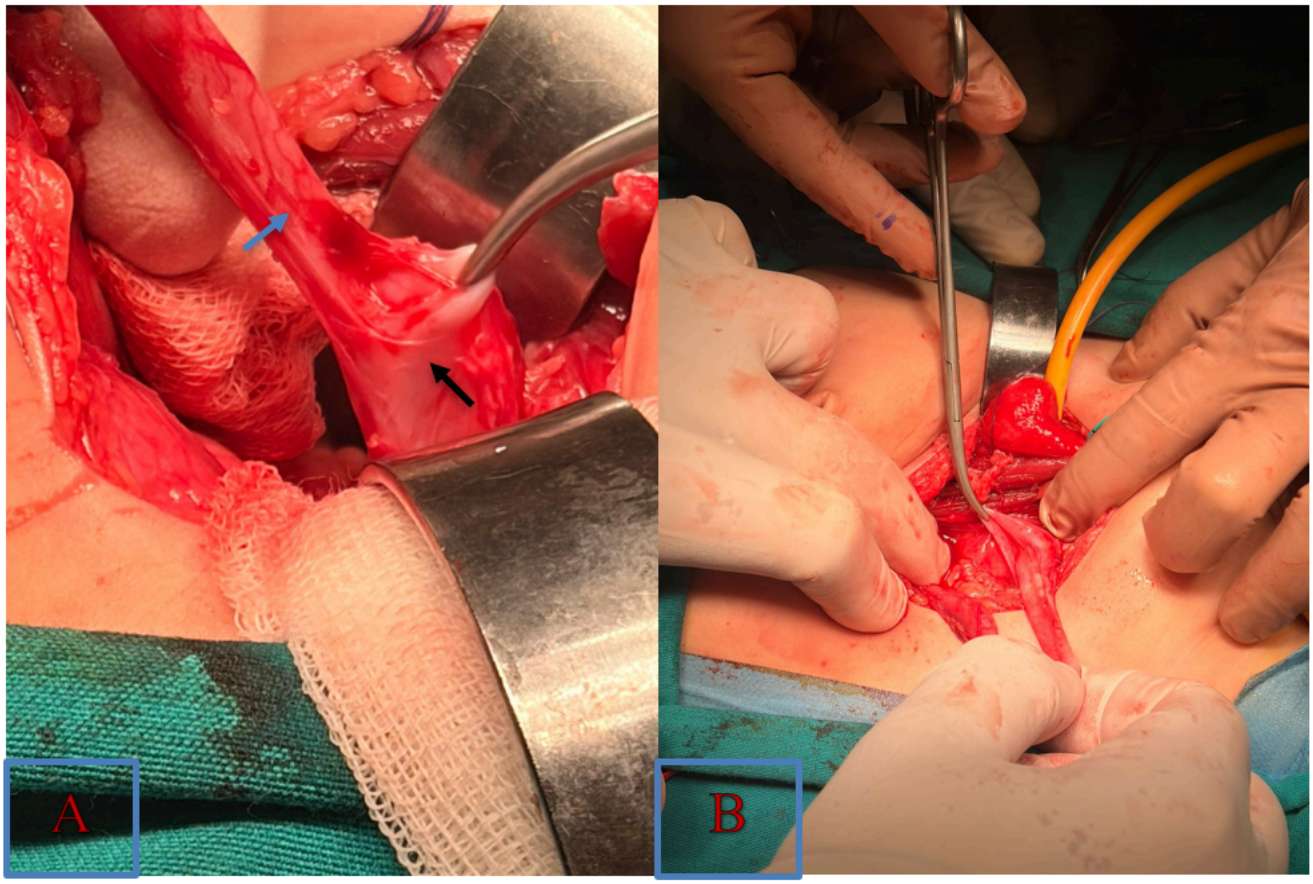


Figure 2

Intraoperative findings and surgical reconstruction in a 1-year-old boy.

(A) Intraoperative view demonstrating the **distal ureter (blue arrow)** and the **right paraureteral (Hutch) diverticulum (black arrow)** after surgical exposure.

(B) Following complete diverticulectomy, the distal ureter was transected and subsequently reimplanted through a newly created hiatus using the **modified Politano–Leadbetter technique**, with construction of a submucosal tunnel to perform ureteroneocystostomy.