



# Comparison of transvesicoscopic Cohen and transvesicoscopic Politano-Leadbetter ureteral reimplantation in the treatment of ureterovesical junction obstruction (UVJO) in children: a single-center long-term follow-up study

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## Abstract

**Purpose** To compare the outcomes of transvesicoscopic Cohen ureteral reimplantation (Cohen technique, Cohen group) and transvesicoscopic Politano-Leadbetter ureteral reimplantation (Politano-Leadbetter technique, Politano-Leadbetter group) in the treatment of ureterovesical junction obstruction (UVJO) in children.

**Methods** From March 2008 to January 2024, 105 patients underwent Cohen technique and 87 underwent Politano-Leadbetter technique. The demographic data, perioperative parameters, surgical outcomes, and postoperative complications of the two groups were analyzed and compared.

**Results** The operation time in the Cohen group was shorter than that in the Politano-Leadbetter group ( $128.2 \pm 30.7$  vs.  $143.1 \pm 31.5$  min,  $p < 0.05$ ), but the improvement in hydronephrosis 6 months after surgery in the Politano-Leadbetter group was better than that in the Cohen group ( $1.48 \pm 0.73$  vs.  $1.63 \pm 0.57$  cm,  $p < 0.05$ ). The success rates in the two groups were similar (97.1% vs. 96.6%,  $p = 0.855$ ). There was no statistical difference in postoperative hematuria time, catheter retention time, hospital stay, and improvement in ureteral dilation between the two groups.

**Conclusions** Two minimally invasive surgical methods via the bladder approach for UVJO have a similar results. Compared to Cohen technique, Politano-Leadbetter technique without change the direction of the ureter, but the surgical time is longer.

**Keywords** Vesicoureteral junction obstruction · Transvesicoscopic · Ureteral reimplantation · Children

## Abbreviation

UVJO Ureterovesical junction obstruction

## Introduction

Ureterovesical junction obstruction (UVJO) represents an obstructive condition that occurs as the ureter enters the bladder, impeding the normal flow of urine and potentially leading to dilation of the upper urinary tract and a decline in

renal function [1]. In children with overt symptoms such as urinary tract infections or diminished renal function attributable to UVJO, surgical intervention is warranted [1].

A multitude of surgical approaches exist for the management of UVJO [1]. In tandem with the advancements in urological technology, minimally invasive procedures offer the benefits of minimal trauma and reduced pain, with success rates approximating or equaling those of open surgical techniques [1]. Transvesicoscopic Cohen ureteral reimplantation has long been regarded as a standard surgical method for UVJO; however, it alters the natural course of the ureter, posing challenges for subsequent examinations and treatments of the upper urinary tract [2–5]. In recent years, some scholars have posited that the transvesicoscopic Politano-Leadbetter ureteral reimplantation can ameliorate the deficiencies of Cohen's technique and preclude changes in ureteral direction [6, 7].

There are currently few studies on the treatment of UVJO with transvesicoscopic Politano-Leadbetter technique. The

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objective of this study is to conduct a comprehensive comparison of the long-term efficacy and safety profiles of transvesicoscopic Cohen and Politano-Leadbetter ureteral reimplantations in the management of UVJO.

## Materials and methods

This is a retrospective study. Retrospective collection of all pediatric patients with UVJO who underwent surgical at our institution from March 2008 to January 2024. The information collected encompassed demographic details, clinical manifestations, imaging parameters, surgery-related variables, postoperative outcomes, and follow-up data. The surgical indications for UVJO is one of the following: (1) symptomatic children, such as abdominal pain, urinary tract infections, and other related symptoms; (2) hydroureteronephrosis had progressed and the split renal function had declined to less than 40%.

The inclusion criteria for our study as following: (1) all procedures were performed by the same surgeon (the corresponding author); (2) patients underwent either transvesicoscopic Cohen ureteral reimplantation (Cohen technique) or transvesicoscopic Politano-Leadbetter ureteral reimplantation (Politano-Leadbetter technique); (3) the patient's clinical data were comprehensive and complete; (4) postoperative follow-up exceeded six months. Patients with vesicoureteral reflux (VUR) or a history of bladder surgery were excluded from the study.

Based on the different surgical procedures employed, the patients with UVJO were categorized into two groups for correction: the Cohen group (consisting of 105 cases) and the Politano-Leadbetter group (comprising 87 cases). The choice of surgical procedure was determined by the surgeon's experience. Compare various parameters between the Cohen and Politano-Leadbetter groups, including imaging indicators, operative time, postoperative complications, and follow-up results. The operative time is defined as the time from the start of cystoscopy to the closure of the skin.

## Surgical procedure

### Establishing the air bladder

After general anesthesia, elevate the buttocks and abduct both lower limbs. Place a cystoscope and connect dioxide gas to fill the bladder. Under cystoscopy monitoring, a 2–0 suture needle was suture the full bladder layer through abdominal wall for traction, with a distance of approximately 2 cm from the left and right lower sides of this needle, suture the abdominal wall and the full bladder layer again, leaving the traction suture in place. Along the

traction line, leave a 5, 3, and 3 mm trocar in the bladder under cystoscopy monitoring, and then fix it separately with the traction line.

### Politano-Leadbetter techniques

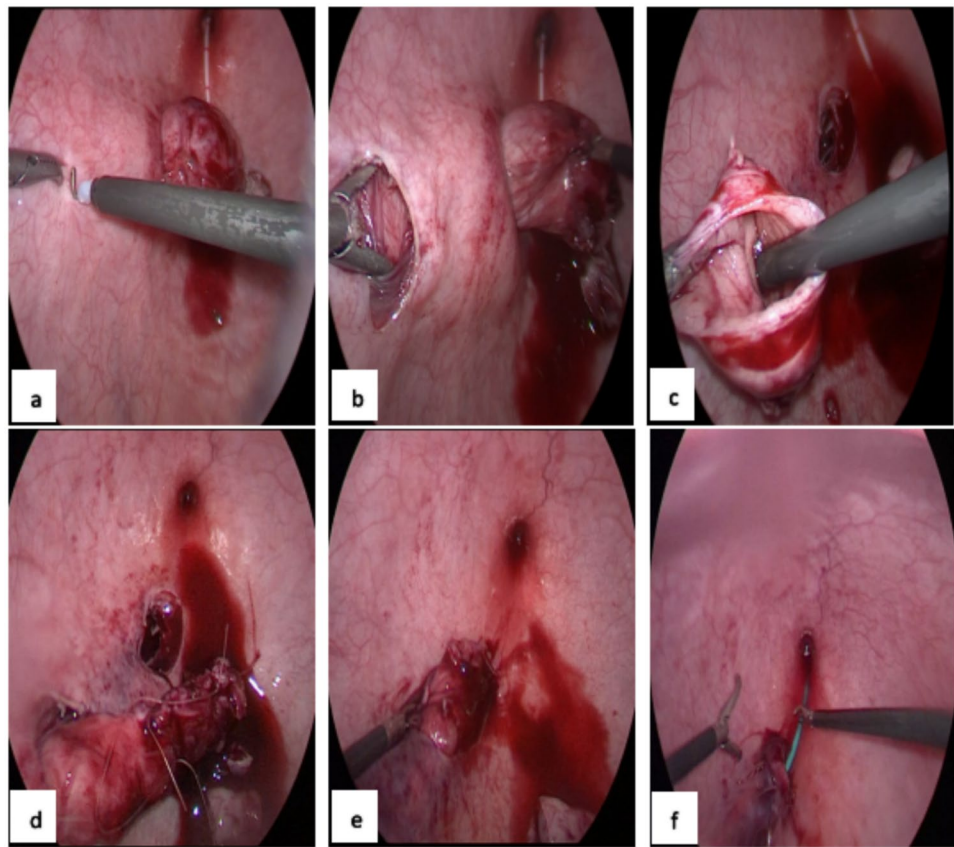
The end of the diseased side ureteral is sutured with a 5–0 suture to traction, release the ureter to an appropriate length outside the bladder wall. Determine the location of the new ureteral hiatus (Fig. 1a) above the original ureteral opening based on a ratio of approximately 1:5 between the diameter of the ureter and the length of the submucosal tunnel. Find the ureter at the new ureteral hiatus, pull the end of the ureter to identify the proximal ureter through the hiatus (Fig. 1b), and then lift the ureter freely from the hiatus to the bladder. If the diameter of the ureter is too large (Fig. 1c), ureteroplasty is necessary (Fig. 1d). Free submucosal tunnel through the new ureteral hiatus to the original ureteral opening, and then pull the ureter again to the original ureteral opening position through this tunnel. 5–0 absorbable suture intermittently sutures the ureteral opening and bladder mucosa to form a new ureteral opening (Fig. 1e). Intermittently suture the ureteral plasma layer and bladder layer at the new ureteral hiatus, and then close the bladder mucosa. Then, place the D–J tube (Fig. 1f) and urinary catheter.

### Cohen techniques

The end of the diseased side ureteral is sutured with a 5–0 suture to traction, release the ureter to an appropriate length outside the bladder wall. The location of the new opening of the diseased ureter above the contralateral ureteral opening is determined in a ratio of approximately 1:5 between the diameter of the ureter and the length of the submucosal tunnel. Incision of the bladder mucosa above the contralateral ureteral opening to form a new ureteral opening. If the diameter of the ureter is excessive, ureteroplasty is performed. Establish a tunnel under the bladder mucosa, with a width approximately twice the diameter of the ureter. Drag the diseased ureter through this tunnel to the new opening above of the contralateral ureter, where the new opening of the ureter is intermittently sutured with the bladder mucosa. Then, the bladder muscle layer at the original ureteral opening is sutured and fixed with the ureteral plasma muscle layer, and the bladder mucosa at the original ureteral opening is intermittently sutured. Then, place the D–J tube and urinary catheter.

Postoperatively, the patient was administered intravenous antibiotics for 3–5 days, followed by oral antibiotic therapy until discharge. The D–J stent was removed 4–6 weeks after surgery.

**Fig. 1** Image showing transvesi-coscopic Politano-Leadbetter ureteral reimplantation. **a** Find and open a new ureteral hiatus; **b** pull the end of the ureter to identify the proximal ureter through the hiatus; **c** the ureter diameter is too large and needs to be trimmed; **d** ureteroplasty; **e** forming a new ureteral orifice; **f** indwelling the double J stent



### Follow-up

The patients were followed up at 3, 6 and 12 months after operation and every one to two years thereafter. Ultrasound of urinary system was reviewed at each follow-up. Surgical success was defined as the improvement of hydroureteronephrosis or the elimination of symptoms.

### Statistical analysis

SPSS version 22.0 software was used for data analysis. Categorical variables were analyzed by chi-square test or Fisher's exact test. Continuous data were analyzed by Student's *t* test. The statistical significance was  $p < 0.05$ .

### Results

In the Cohen group, there were 46 girls and 59 boys in the age range of 11–95 months (median age of 50 months), seven of them were less than 2 years old; 61 cases (58.1%) were left side UVJO, 41 cases (39.0%) were right side UVJO, and 3 cases (2.9%) were bilateral UVJO; 63 cases (60.0%) had lumbar and abdominal pain, 20 cases (19.0%) had urinary tract infections, 5 cases (4.8%) had gastrointestinal symptoms, and 17 cases (16.2%) had no obvious

symptoms; 76 cases (72.3%) had preoperative radioisotopic diethylenetriamine pentaacetic acid (DTPA)  $< 40\%$ .

In the PL group, there were 47 girls and 40 boys in the age range of 12–81 months (median age 47 months), five of them were less than 2 years old; 50 cases (57.5%) were left side UVJO, 34 cases (39.1%) were right side UVJO, and 3 cases (3.4%) were bilateral UVJO; 53 cases (60.9%) had lumbar and abdominal pain, 19 cases (21.8%) had urinary tract infections, 4 cases (4.6%) had gastrointestinal symptoms, and 11 cases (12.6%) had no obvious symptoms; 61 cases (70.1%) had preoperative DTPA  $< 40\%$ .

The demographic and clinical characteristics of the two groups of patients are summarized in Table 1.

In the Cohen group, three children were switched to open procedure due to trocar displacement; two cases were given transabdominal puncture decompression due to intraoperative air leakage to complete the operation; 2 cases developed subcutaneous emphysema in the chest and abdomen after surgery. In the PL group, two children were switched to laparoendoscopic Lich–Gregoir technique due to trocar displacement; peritoneal perforation occurred when looking for the retrovesical ureter through the proximal hiatus in sixteen children, and abdominal puncture decompression was performed to continue the operation in eight children; 1 cases developed subcutaneous emphysema in the chest and abdomen after surgery.

**Table 1** Demographic and clinical characteristics of the two groups

Observations	Cohen techniques	Politano-Leadbetter techniques	P-value
No	105	87	
Median age (months)	50 (range, 11–95)	47 (range, 12–81)	0.284
Sex			0.158
Male	59 (56.2%)	40 (46.0%)	
Female	46 (43.8%)	47 (54.0%)	
Side			0.972
Left	61 (58.1%)	50 (57.5%)	
Right	41 (39.0%)	34 (39.1%)	
Bilateral	3 (2.9%)	3 (3.4%)	
Symptoms			0.767
Abdominal pain	63 (60%)	53 (60.9%)	
Urinary tract infection	20 (19%)	19 (21.8%)	
Other	22 (21%)	15 (17.2%)	
Anterior posterior diameter of renal pelvis before operation (cm)	2.61 ± 1.27	2.69 ± 1.38	0.257
Preoperative maximum diameter of ureter (cm)	1.38 ± 0.33	1.47 ± 0.41	0.188

The operation time of Cohen group was superior to the Politano-Leadbetter group ( $128.2 \pm 30.7$  vs.  $143.1 \pm 31.5$  min,  $p < 0.05$ ), but the hydronephrosis improvement of 6 months after operation in Politano-Leadbetter group was better than that of Cohen group ( $1.48 \pm 0.73$  vs.  $1.63 \pm 0.57$  cm,  $p < 0.05$ ). None of the cases developed postoperative urinary tract infection, pyuria or asymptomatic bacteriuria. There was no statistical difference in postoperative hematuria time, catheter retention time, hospital stay, and improvement in ureteral dilation between the two groups. The outcomes of the two groups are summarized in Table 2.

The median follow-up time was 75 months (range, 38–143 months) in the Cohen group and 47 months (range, 8–79 months) in the Politano-Leadbetter group. In Cohen group, there were 8 cases of urinary tract infection before removing the double-J tube, and the urinary tract infection

was improved with antibiotics. There were 3 cases of urinary tract infection after removing the double-J tube; voiding cystic urethrography (VCUG) was performed after infection control, and 1 case of grade 1 to 2 VUR was treated conservatively. In the Politano-Leadbetter group, urinary tract infection occurred in 8 cases before removing the double-J tube, and the urinary tract infection was improved with antibiotics. Urinary tract infection occurred in 3 cases after removing the double-J tube. VCUG was performed after infection control, and VUR occurred in 2 cases. One case had grade 3–4 reflux with multiple urinary tract infections, and then underwent laparoendoscopic Lich–Gregoir technique, no reflux and urinary tract infection were found in the subsequent review. The other one had grade I to II reflux, which resolved after conservative treatment.

The results of postoperative ultrasound showed that the anterior posterior diameter of renal pelvis and the maximum

**Table 2** Outcomes of the Cohen techniques and Politano-Leadbetter techniques groups

Observations	Cohen techniques	Politano-Leadbetter techniques	p value
No	105	87	
Operation time (minutes)	$128.2 \pm 30.7$	$143.1 \pm 31.5$	$< 0.01$
Postoperative hematuria time (days)	$4.2 \pm 0.5$	$3.8 \pm 0.6$	0.176
Postoperative indwelling catheter time (days)	$5.3 \pm 0.9$	$4.9 \pm 1.0$	0.382
Postoperative hospital stay (days)	$6.3 \pm 1.2$	$5.7 \pm 1.1$	0.493
Anterior posterior diameter of renal pelvis at 6 months after operation (cm)	$1.63 \pm 0.57$	$1.48 \pm 0.73$	0.021
Maximum diameter of ureter at 6 months after operation (cm)	$0.88 \pm 0.28$	$0.96 \pm 0.47$	0.257
Success rate (%)	97.1 (102/105)	96.6 (84/87)	0.855



diameter of ureter in the two groups were superior than those preoperative.

## Discussion

The objective of UVJO treatment is to guarantee unobstructed urine drainage within the ureter, protect renal function, and reconstruct the ureteral anti-reflux mechanism [1]. Our findings indicate that both transvesicoscopic Cohen ureteral reimplantation and transvesicoscopic Politano-Leadbetter ureteral reimplantation are safe and efficacious approaches for treating pediatric UVJO. In contrast to the Cohen technique, the Politano-Leadbetter technique does not alter the orientation of the ureter.

The traditional open vesicoureteral reimplantation has been demonstrated to possess a high success rate in the management of UVJO. However, this approach necessitates opening the bladder, resulting in a relatively large abdominal wall incision and, and there are many postoperative complications [1]. Benefit from the development of minimally invasive technology, the effect of endoscopic vesicoureteral reimplantation is equivalent to that of open vesicoureteral reimplantation, and endoscopic surgery can provide a clearer surgical vision, less trauma, and better cosmetic outcomes [1]. In 2005, Yeung et al. reported the successful implementation of the Cohen ureteral reimplantation using the transvesicoscopic technique [8, 9]. In 2022, Li et al. reported the treatment of 23 children with UVJO via transvesicoscopic ureteral reimplantation, achieving a success rate of 91.3%, with 2 cases requiring conversion to open surgery [1]. In this study, transvesicoscopic Cohen ureteral reimplantation achieved satisfactory results in the treatment of UVJO, with a success rate of 97.1%, and only 3 cases were converted to open surgery. The cases converted to open surgery mainly occurred in the early stage of laparoscopic ureteral reimplantation in our study. With the continuous improvement of surgical skills, Cohen ureteral reimplantation can be well completed under transvesicoscopic technology.

Cohen technique is a method of ureteral reimplantation by creating a cross triangular submucosal tunnel [10, 11]. Its disadvantage is that the direction of the ureter is not natural after surgery, which is not conducive to the future upper urinary tract examination and treatment [12–14]. Based on these concerns, Politano and Leadbetter et al. improved the ureteral reimplantation technique without changing the ureteral path and opening [6, 7]. There are few reports about the treatment of UVJO cases with transvesicoscopic Politano-Leadbetter ureteral reimplantation. In this study, transvesicoscopic Politano-Leadbetter ureteral reimplantation effectively treated children with UVJO, with a success rate of 96.6%. Two cases were converted to laparoscopic technology, which was related to unskilled early operation.

In our study, the effect of Politano-Leadbetter technology and Cohen technology in the treatment of UVJO was similar. The improvement of hydronephrosis in the Politano-Leadbetter group was better than that in the Cohen group 6 months after operation, which may be related to the restoration of normal anatomy of ureter. However, the operation time of Politano-Leadbetter technology is longer than that of Cohen technology. We believe that the learning curve of Politano-Leadbetter technology is longer, and it takes a certain amount of time to seek the proximal ureter intraoperatively, and peritoneal perforation may occur at the same time, which needs to be managed.

The age of operation may be correlated with the success rate of transvesicoscopic ureteral reimplantation and postoperative complications [1, 6, 15]. Kutikov et al. reported that the complication rate of transvesicoscopic ureteral reimplantation surgery in patients under 2 years old is high [15]. It is worth noting that Kutikov et al. proposed that the operation of these children was carried out in the early stage of laparoscopic vesicoureteral reimplantation, which was still in its infancy at that time [15]. Li et al. reported used transvesicoscopic ureteral reimplantation to treat UVJO, and two cases aged less than 12 months (8 and 11 months) were converted to open surgery intraoperatively, because the bladder volume was too small [1]. However, Yagiz et al. reported performed transvesicoscopic ureteral reimplantation in children under 2 years old without complications [6]. In this study, no correlation was found between age and the success rate of transvesicoscopic ureteral reimplantation and postoperative complications. The reasons may be as follows: 1) the surgeon has rich experience in minimally invasive techniques in our study, 2) the age of our group of cases is at least 11 months and there are not many children under the age of 2 years.

Both the Politano-Leadbetter and Cohen minimally surgical methods require stable and precise endoscopic technique. How to successfully establish and maintain an air bladder is the key to ensuring the smooth progress of surgery. Young age or small bladder capacity limit the operating space, ureteroplasty is required for cases with large ureteral diameter, and a professional team and increasing experience in minimally invasive techniques may help overcome these difficulties. Compared to Cohen's technique, although the Politano-Leadbetter technique is more complex, it does not alter the anatomical shape of the ureter. With the accumulation of minimally invasive technology, Politano-Leadbetter technology may have better prospects.

Our study has some shortcomings. First, this is a retrospective study. Second, postoperative follow-up is mainly based on ultrasound examination, VCUG is not routinely used to exclude VUR. However, this is the largest case study comparing transvesicoscopic Politano-Leadbetter ureteral reimplantation with transvesicoscopic Cohen ureteral reimplantation in the treatment of UVJO in children.

## Conclusions

Transvesicoscopic ureteral reimplantation is an effective method for treating pediatric UVJO, and the results of the Politano-Leadbetter technique and Cohen technique are similar. Compared with Cohen technology, the Politano-Leadbetter technology does not change the direction of the ureter, but the surgery is more difficult and takes longer. Surgeons need to choose a reasonable surgical method based on their own experience.

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**Data availability** No datasets were generated or analysed during the current study.

## Declarations

**Conflict of interest** The authors declare no competing interests.

**Ethical approval** Approval was obtained from the ethics committee of Shenzhen children's hospital. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

**Informed consent** Informed consent was obtained from legal guardians. The authors affirm that human research participants provided informed consent for publication of the images in Figure(s) 1a, 1b and 1c.

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