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CASE REPORT

Teapot ureterocystoplasty in posterior urethral valve and chronic kidney disease: a case report

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Background: *Bladder augmentation is frequently required to manage poorly compliant, low-capacity bladders resulting from posterior urethral valves (PUV). While traditional enterocystoplasty techniques are limited by complications associated with bowel tissue use, ureterocystoplasty presents a favorable alternative in patients with concurrent megaureter.*
Methods: *We describe a novel teapot ureterocystoplasty technique that enhances ureteral vascular preservation by maintaining a 3 cm distal ureteral segment in its detubularized configuration. Postoperative outcomes demonstrated significant improvement, with cystographic bladder capacity increasing from 50 to 180 mL. Renal function stabilized following a transient creatinine elevation to 250 μmol/L.*
Result and Conclusion: *At a 4.5-year follow-up, the patient continues to do well and has successfully avoided renal transplantation—an outcome commonly required for such pediatric cases.*

Key Words: teapot ureterocystoplasty, posterior urethral valve, bladder augmentation, case report

Introduction

Bladder augmentation is a surgical technique to address poorly compliant and low-capacity bladders as a result of posterior urethral valve (PUV), neurogenic bladder, and bladder exstrophy, among other causes. Traditional techniques utilize bowel but are plagued by excess mucus production, urolithiasis, urinary tract infection (UTI), and metabolic abnormalities. Ureterocystoplasty is an alternative technique that makes use of a dilated ureter as the source of augmenting tissue, eliminating the disadvantages of using bowel.[1]

Unfortunately, the indications for ureterocystoplasty are limited as it relies on the presence of a pathologically dilated ureter and often requires a non-functioning or poor-functioning kidney to make full use of the ipsilateral tortuous ureter and renal pelvis for augmentation.[1] With limited tissue, maximizing ureteral blood supply to prevent ischemic contraction of the ureter is paramount. The Teapot ureterocystoplasty was developed to address this issue by protecting the ureteral blood supply.[2]

Herein, we present a case of a boy with small bladder capacity secondary to PUV, for whom we performed a Teapot ureterocystoplasty and followed for 4.5 years.

Case Report

We present the case of a male infant born prematurely at 25 weeks gestation with posterior urethral valves (PUV) who was initially managed with a vesicoamniotic shunt *in utero* followed by vesicostomy shortly after birth, which was later reversed along with PUV ablation. MAG-3 renal scintigraphy demonstrated a nonfunctioning right kidney and diagnostic workup confirmed Stage IV chronic kidney disease (CKD) with baseline serum creatinine

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levels of 130–140 µmol/L. The patient showed gradual renal function deterioration until age 5 when he was hospitalized for a febrile urinary tract infection complicated by acute-on-chronic kidney injury with creatinine peaking at 250 µmol/L. Attempted urodynamic studies (UDS) were unsuccessful due to patient noncooperation, prompting comprehensive noninvasive urodynamic evaluation including detailed voiding diaries, voiding cystourethrogram (VCUG), uroflowmetry with postvoid residual measurements, and renal ultrasonography. For bladder capacity assessment in children >1 year of age, we applied the Koff formula.[3]

$$\text{Capacity (mL)} = (2 + \text{age (years)}) \times 30$$

For our 5-year-old patient, the expected bladder capacity was 210 mL. VCUG showed a bladder capacity of 50 mL and severe (grade V) right-sided vesicoureteric reflux (VUR) (Figure 1A). His ultrasound indicated bilateral hydroureteronephrosis with parenchymal thinning. Due to low bladder capacity and VUR noted on diagnostic testing, right nephrectomy, ureterocystoplasty, and Mitrofanoff procedure were performed.

A midline lower abdominal wall laparotomy was performed to allow simultaneous right nephrectomy and augmentation through a single incision. The renal pelvis was carefully dissected for use as additional augmenting tissue. During ureteral mobilization, we meticulously preserved the periureteral adventitial tissue while separating the ureter from the retroperitoneum, ensuring optimal vascular preservation. The right ureter was then incised longitudinally from the renal pelvis distally, with the lateral approach carefully maintained to was protect the medial blood supply. The ureteral opening was extended to within 3 cm of the ureteral orifice, preserving this distal segment as a vascular pedicle to minimize ischemic risk. The detubularized ureteral segment was reconfigured in an M-shaped pattern using a running absorbable suture (Figure 2). Following a horizontal cystotomy (Figure 3A), we performed a Mitrofanoff procedure by creating a midline submucosal bladder tunnel maintaining the recommended 3:1 detrusor length-to-ureteral diameter ratio. Final anastomosis of the detubularized segment created the characteristic teapot configuration (Figure 3B). The patient recovered well postoperatively and was discharged home on day 6 without complications.

A one-month postoperative cystogram demonstrated excellent surgical outcomes with no evidence of leakage and a bladder capacity of 180 mL (Figure 1B). The patient's serum creatinine decreased to 141 µmol/L postoperatively, with ultrasound revealing a marked improvement in hydroureteronephrosis. We initiated clean intermittent catheterization (CIC) every 4 h during daytime hours with continuous overnight drainage, complemented by anticholinergic therapy. Over the subsequent 4.5 years, the patient maintained stable renal function with creatinine levels plateauing

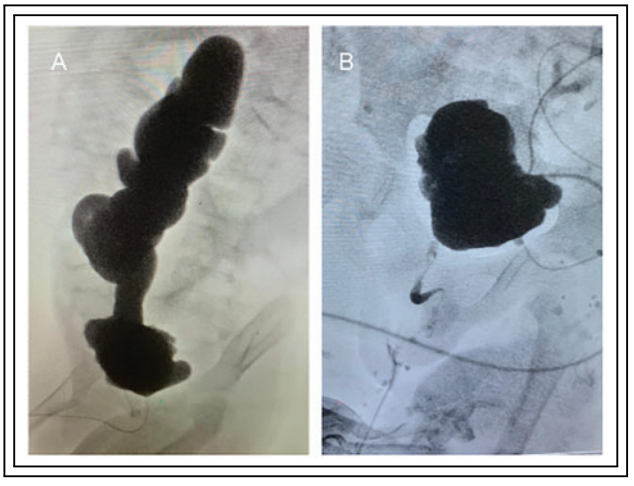

FIGURE 1. A) preoperative cystogram showing small bladder and refluxing ureter that is severely dilated and tortuous. B) postoperative cystogram showing improved capacity and no reflux

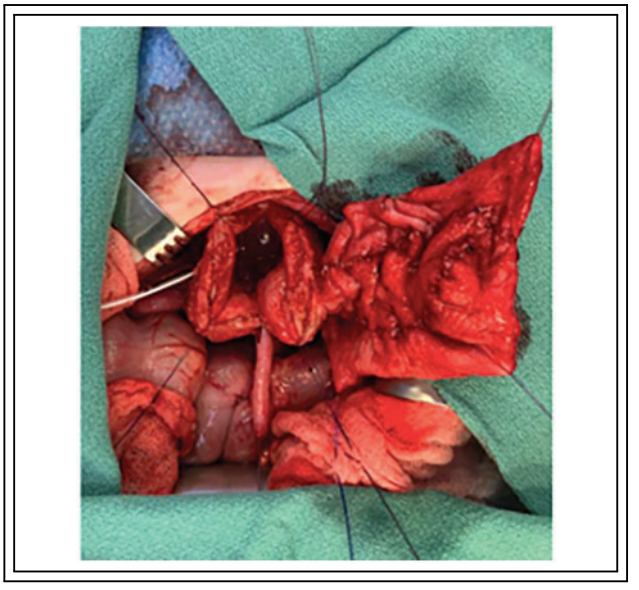

FIGURE 2. Anastomosis of the M shaped ureteral flap to the bladder

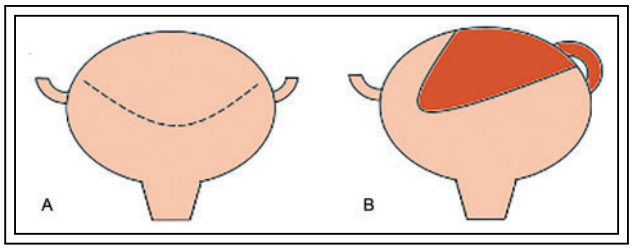

FIGURE 3. A) horizontal cystotomy incision, B) Ureteral flap is sewn to the bladder with the distal ureter remaining tubularized and undisturbed. This forms a teapot appearance

at 191 μmol/L, though recent evaluation shows a gradual increase to approximately 260 μmol/L over the past six months. Current voiding cystourethrogram (VCUG) reveals a bladder capacity of 370 mL, consistent with the expected capacity of 330 mL for a 9-year-old child as calculated by the Koff formula. Urodynamic studies performed at the 3-year follow-up demonstrated satisfactory bladder compliance (11.4 mL/cmH_2O) without vesicoureteral reflux. Notably, this surgical intervention has successfully delayed the need for renal transplantation in this patient to date.

Discussion

Ureterocystoplasty offers a viable alternative to traditional enterocystoplasty by eliminating bowel-related complications, though its primary limitation remains the requirement for a sufficiently dilated ureter to achieve clinically meaningful bladder capacity expansion.[1] The technique was first introduced by Eckstein and Martin in 1973,[4] with subsequent refinement in the 1990s.[5] It was initially exclusively applied in patients with nonfunctioning kidneys where both the renal pelvis and dilated ureter could be utilized.

For patients with bilateral functioning kidneys, some surgeons have employed tapered ureteral reimplantation techniques with residual ureteral tissue.[6] The literature presents conflicting evidence regarding the efficacy of distal ureteral augmentation, with Husmann et al.'s multicenter study reporting a 92% reaugmentation rate[7], while Johal et al. demonstrated successful improvements in both bladder compliance and capacity using distal ureteral segments.[8] Notably, all described techniques necessitate significantly dilated ureters and traditionally involved complete ureteral detubularization including the ureteral orifice, potentially compromising vascular supply.

To address ischemia-related contraction concerns, Adams et al. pioneered an innovative approach in 1998[2] that was later termed "Teapot ureterocystoplasty" in 2010.[8] This technique preserves vascular integrity by: (1) maintaining 3 cm of the distal ureter in a tubular configuration, (2) sparing the ureteral orifice, and (3) avoiding vas deferens disruption—thereby protecting the tripartite blood supply from the internal iliac, and superior vesical, and gonadal arteries.[2,6]

This case report describes a successful case of a patient who underwent Teapot ureterocystoplasty to treat a low-capacity, high-pressure bladder secondary to posterior urethral valves (PUV). The patient's bladder capacity increased from 50 mL preoperatively to 180 mL postoperatively, allowing decompression of the upper urinary tracts and limiting renal damage, to postpone renal transplantation to an older age. Ureterocystoplasty is limited by the requirement of a pathologically dilated ureter. The most common indication for bladder augmentation is neurogenic bladder, where hydroureteronephrosis can be avoided with proper care and patient compliance with treatment protocols.[1] Therefore, most neurogenic bladder patients are not ideal candidates for ureterocystoplasty. This is supported by Husmann et al.'s study where 46 of 64 patients had neurogenic bladder and 47 of 64 patients required re-augmentation.[7] In Johal et al.'s study, where only 2 of 17 patients had neurogenic bladder, 76% of patients did not require re-augmentation. As noted by Johal, patients with PUV tend to have better outcomes following ureterocystoplasty.[8] PUV represents the optimal patient population for ureterocystoplasty because hypertrophic and hyperplastic changes to the detrusor result in a hyper-contractile, low-compliance, small-capacity bladder. This condition is frequently associated with severe hydroureteronephrosis and vesicoureteral reflux (VUR). Obstructive uropathy leads to kidney dysfunction and impaired urine concentration, causing polyuria. The resulting high urine volumes contribute to the deterioration of renal and bladder function even after timely PUV ablation. These patients typically present with a significantly dilated ureter and nonfunctioning kidney, providing abundant tissue for augmentation of the poorly compliant, small bladder.[9]

In this case report, we describe a recent successful application of the Teapot ureterocystoplasty technique. This technique of preserving the distal ureter has been reported previously but remains valuable for maintaining blood supply to the ureteral tissue used for augmentation. While ureterocystoplasty

avoids the complications associated with bowel use in traditional enterocystoplasty, its indications are limited, and PUV patients with small-capacity, high-pressure bladders appear to represent the ideal candidates for this procedure.

Additionally, in this case report, we incorporated the family's perspective, with the parents expressing gratitude for "saving their son's life." They particularly emphasized the importance of multidisciplinary care involving urologists, nephrologists, other physicians, and allied health providers, as well as the extended follow-up over many years, as crucial elements of their child's treatment. This study obtained informed consent from the patient's parent, which is documented and available in the supplementary materials.

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Author Contributions

The authors confirm contribution to the paper as follows: study conception and design: Luis Henrique Braga, Bruno Leslie, Yaqoub Jafar, Geemitha Ratnayake; data collection: Luis Henrique Braga, Yaqoub Jafar; analysis and draft manuscript: Luis Henrique Braga, Geemitha Ratnayake, Yaqoub Jafar. All authors reviewed the results and approved the final version of the manuscript.

Availability of Data and Materials

The authors confirm that data supporting the findings of this study are available within the article and its supplementary materials.

Ethics Approval

This is not applicable. The Hamilton Integrated Research Ethics Board confirmed that specific ethics approval was not needed for this project. Written informed consent was obtained from the patient for the publication of anonymized patient information in this article.

Conflicts of Interest

The authors declare no conflicts of interest to report regarding the present study.

Supplementary Materials

The supplementary material is available online at https://www.techscience.com/doi/10.32604/cju.2025.064122/s1.

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