Follow-up of 50 children after posterior urethral valve management in Al-Azhar University Hospitals

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Objective **This study was performed to assess the various clinical presentations, complications, and surgical management, as well as follow-up, of patients with posterior urethral valve (PUV).**

Patients and methods **This is a prospective descriptive analysis of the data of 50 patients with PUVs of different age reviewed. Serum creatinine levels, clinical examination, abdominopelvic ultrasound, and magnetic resonance urography were performed, and the diagnosis was confirmed by voiding cystourethrography. The patients were divided into two categories: primary intervention and surgical intervention.**

Results **A total of 50 boys with a mean age at diagnosis of 100 ± 15 days were included in this work. The most common presentation in patients managed by valve ablation was difficult micturition (60%), whereas in patients managed by initial vesicostomy the most common presentation was febrile urinary tract infection (67%). Vesicoureteral reflux presented in 61.2% and hydronephrosis in 82.6%, whereas complications occurred in three (6%) children. Mortality occurred in five (10%) patients. Postoperative improvement of hydronephrosis grade in both categories is not appreciably different.**

Conclusion **Urinary drainage using small catheters or nasogastric tube in the early days of infancy followed by valve ablation is the best treatment modality in PUV. *Ann Pediatr Surg* 14:116–120 © 2018 Annals of Pediatric Surgery.**

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Keywords: children, outcome, posterior urethral valve, urinary drainage, valve ablation, vesicostomy

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Introduction

Posterior urethral valves (PUVs) are the most common form of congenital urethral obstruction (ranging from 1/3000 to 1/8000 male births) and the most congenital abnormalities giving rise to bilateral renal obstruction [1]. PUV carries out the most causes of renal failure in 25–30% of these children [2,3]. According to the North American Pediatric Renal Transplant Cooperative Group, end-stage renal disease secondary to PUV accounts for 16.8% [4].

PUV(S) are classified into three types: valves representing folds extending inferiorly from the verumontanum to the membranous urethra (type 1); valves as leaflets that glow from the verumontanum, proximal to the bladder neck (type 2); and valves forming diaphragms within the prostatic urethra, either above or below the verumontanum (type 3). Type 1 is the most common [5].

Voiding cystourethrography (VCUG) evaluations are needed for the diagnosis. PUV evaluated whether the valve leaflets are present, bladder trabeculation, dilated or elongated posterior urethra, and bladder neck hypertrophy. VCUG is the gold-standard imaging procedure for documenting PUVs [6].

The procedure of choice for PUV management is performed according to the degree of renal function. After birth, a urethral catheter is placed; further management is dictated by the level of renal function. If normal or satisfactory renal function is present, transurethral valve ablation is performed. An elective vesicostomy is proper and safe in situations in which the newborn urethra seems too small to accommodate the available endoscope. The major area of continuing controversy involves the most right approach for management of the infant who has significant renal insufficiency that persists after a satisfactory period of transurethral drainage. The options for managing this group of children include endoscopy fulguration of the urethral valves only, elective vesicostomy, or high-loop ureterostomy [7].

The aim of this work is to decide which method achieves the current PUV management goals of preserving renal function, as well as the lower urinary tract function integrity. It also aimed to evaluate and record the various clinical presentations and management maneuvers, complications, and surgical management and long-term outcome (for 1 year) of PUV.

Patients and methods

This is a prospective descriptive analysis of the data of 50 patients admitted at the Urology Department of our University Hospital (from October 2011 to July 2015) in whom PUVs were reviewed after local and ethical committee approval, and an informed written consent was obtained from the patient's relative. The patients were classified according to surgical management into two different categories. Complete blood count, urinalysis, blood urea, creatinine, and serum electrolytes were analyzed. Ultrasonography, VCUG, and cystoscopy was performed in all children. In all neonates with urinary retention, the bladder was drained with a small-caliber catheter or feeding tube in the urethra within the early neonatal period. After that they were treated with fulguration/ablation of the PUVs by pediatric resecto-

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scope under general anesthesia; valve ablation was accomplished using cutting current and incisions at the 5 o' clock, 7 o' clock, and 12 o' clock positions. Vesicostomy was performed in 15 newborns and infants with urinary sepsis or poor general condition in spite of urethral catheter drainage and corrective medical treatment. Another indication for temporary vesicostomy in 10 cases was a small-caliber urethra, which precluded primary transurethral valve ablation. Vesicoureteral reflux (VUR) and hydronephrosis were assessed after 3, 6, and 12 months by ultrasonography; VCUG and isotope scan were performed using DTPA and DMSA for all cases.

Pelvic ultrasound was used to evaluate the urinary bladder size, the urinary bladder wall thickness, the presence of diverticula, posterior urethral dilatation, and postvoiding residual urine. VCUG was performed to confirm the diagnosis and to assess the urinary bladder for associated findings such as VUR, its degree, diverticula, and residual urine. Urodynamic study was performed for persistent bladder dysfunction and videourodynamics was performed to assess bladder capacity in cases associated with VUR.

Statistical analysis

The data were analyzed using statistical package for the social sciences (SPSS version 20.0) for Windows (SPSS Inc., Chicago, Illinois, USA). The results were expressed as mean ± SE with 95% confidence interval by using medians for quantitative variables, and using the frequencies and percentages for qualitative ones; a *P*-value of less than 0.05 is statistically significant.

Results

A total of 50 boys with a mean age at diagnosis of 100 ± 15 days (1 day to 4 years) were included in this work. The most common presentation in cases treated with primary valve ablation was difficult micturition in 15 (60%) patients, urinary frequency in 13 (52%) patients, febrile urinary tract infection (UTI) in 10 (40%) patients, and urge incontinence in five (20%) patients. At 1 year of follow-up, 12 out of 25 (48%) patients were free of complaints. The remaining patients were complaining of urinary frequency in 10 (40%) patients, febrile UTI in seven (28%) patients, urge incontinence in seven (28%) patients, and difficult micturation in five (20%) patients (Table 1).

In cases treated by initial vesicostomy, the most common presentation was a febrile UTI in 17 (68%) patients, difficult micturition in eight (32%) patients, chronic retention with overflow incontinence in seven (28%) patients, suprapubic swelling in seven (28%) patients, and upper abdominal swelling in four out of 25 (16%) patients. PUV was diagnosed during an antenatal period in two out of 25 (8%) patients.

Table 1 Correlation between preoperative and postoperative variables in the primary posterior urethral valve ablation cases

Variables	Preoperative [*n* (%)]	Postoperative [*n* (%)]
Difficult micturition	15 (60)	5 (20)
Urinary frequency	13 (52)	10 (40)
Febrile urinary tract infection	10 (40)	7 (28)
Urge incontinence	5 (20)	7 (28)
Chronic retention with overflow incontinence	7 (28)	0 (0)
Upper abdominal swelling	1 (4)	0 (0)
Bilateral loin pain	1 (4)	0 (0)
P-value	< 0.03*	

*Statistically significant.

Table 2 Correlation between preoperative and postoperative variables in the initial vesicostomy cases

Variables	Preoperative [*n* (%)]	Postoperative [*n* (%)]
Febrile urinary tract infection	17 (68)	5 (20)
Difficult micturition	8 (32)	5 (20)
Chronic retention with overflow incontinence	7 (28)	0 (0)
Suprapubic swelling	4 (16)	0 (0)
Upper abdominal swelling	4 (16)	1 (4)
Antenatal diagnosis	2 (8)	0 (0)
Urge incontinence	0 (0)	10 (40)
Urinary frequency	0 (0)	12 (48)
P-value	< 0.0001*	

*Statistically significant.

At 1 year of follow-up, six (40%) cases were free of complaints. The postoperative presentations in the remaining patients were urinary frequency in seven (47%) patients, urge incontinence in six (40%) patients, and difficult micturition in three (20%) patients (Table 2).

Serum creatinine

The mean preoperative serum creatinine after stabilization with urethral catheter drainage in primary urethral valve ablation patients was 1.16 ± 0.32, which is significantly improved with a mean value of 0.55 ± 0.22 when measured 1 year after valve ablation ($P < 0.001$). One patient had renal insufficiency with serum creatinine level of 1.2 mg/dl. The mean serum creatinine after stabilization with a urethral catheter in vesicostomy patients was 1.529 ± 0.522. When serum creatinine was measured at 1 year of follow-up, the mean value was significantly improved for 0.8 ± 0.39 ($P < 0.01$). Three patients had renal insufficiency with serum creatinine level of 1.4, 1.5, and 1.6 mg/dl. Comparison of postoperative serum creatinine in both categories showed that postoperative serum creatinine is significantly lower in primary valve ablation cases.

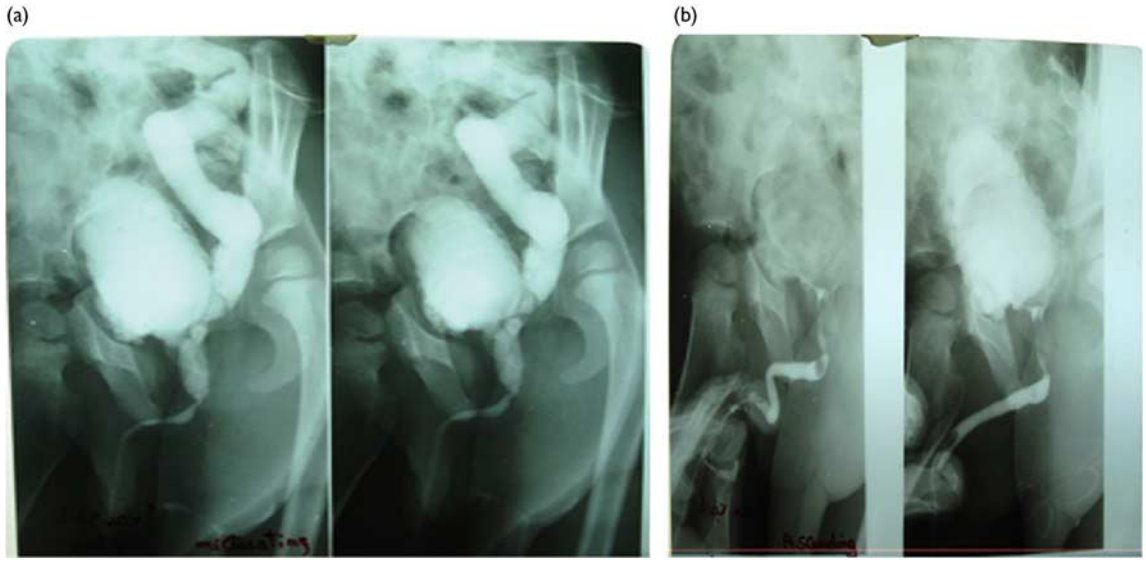
Radiological hydronephrosis

Radiological hydronephrosis shows a comparison between the preoperative and postoperative state of the renal units as regards backpressure changes in cases of primary valve ablation patients. Out of 50 renal units affected by hydronephrosis, 35 (70%) renal units demonstrated postoperative improvement in hydronephrosis grade. A comparison was made between the preoperative and postoperative state of the renal units as regards backpressure changes in initial vesicostomy patients after 3, 6, and 12 months. Out of 50 renal units affected by hydronephrosis, 32 (64%) renal units showed postoperative improvement in hydronephrosis grade. Postoperative hydronephrosis grade improvement in both groups was not significantly different.

Vesicoureteric reflux

Comparison between the preoperative and postoperative state of the renal units as regards vesicoureteric reflux in

Fig. 1



(a, b). Preoperative and postoperative voiding cystourethrography for a posterior urethral valve, after 1 year of treatment with initial valve ablation.

patients of primary valve ablation patients. Out of 35 affected renal units with vesicoureteric reflux, 27 (77.1%) renal units showed postoperative improvement in vesicoureteric reflux grade (Fig. 1). Out of 32 affected renal units with vesicoureteric reflux in initial vesicostomy patients, 21 (65.6%) renal units showed postoperative improvement in vesicoureteric reflux grade (Fig. 2).

The ultrasonographic bladder volume for these patients after 6 months, with an age range of 1–4 years, was found to be 100–240 ml.

Bladder score

The mean preoperative bladder score was 4.26 ± 1.38, which is significantly improved during follow-up with a mean value of 2.13 ± 1.45 ($P < 0.001$) in both categories.

Discussion

PUV is considered as a common cause of infravesical obstruction in pediatrics. PUV severity varies from mild to fatal prognosis, according to the degree of upper urinary tract obstruction [8]. Complications may develop, after valve ablation, on long-term follow-up. PUV management needs adequate care for neonates and infants with a Nephrology consultant to support and treat a UTI and prevent or correct metabolic acidosis and electrolyte imbalance [9,10]. The role of early urinary diversion in the management of boys with PUV is limited. In spite of its potential to improve renal function in the short-term (which is very important in male patients with precarious renal function) and to defer renal replacement to a later stage, there is no convincing evidence to support its role as a way of improving long-term renal function. Its effect on long-term bladder function remains unsatisfactory. Primary valve ablation appears to result in better long-term outcomes, and thus remains the treatment of choice. Nonetheless, urinary diversion must be considered in selected cases with clear goals and endpoints in mind. Given the frequency of chronic and progressive renal impairment, the importance of long-term evaluation of all patients with PUV cannot be overemphasized. Serial measurements of renal function, periodic urinalysis, blood pressure checks, and growth monitor should be performed for such patients [11].

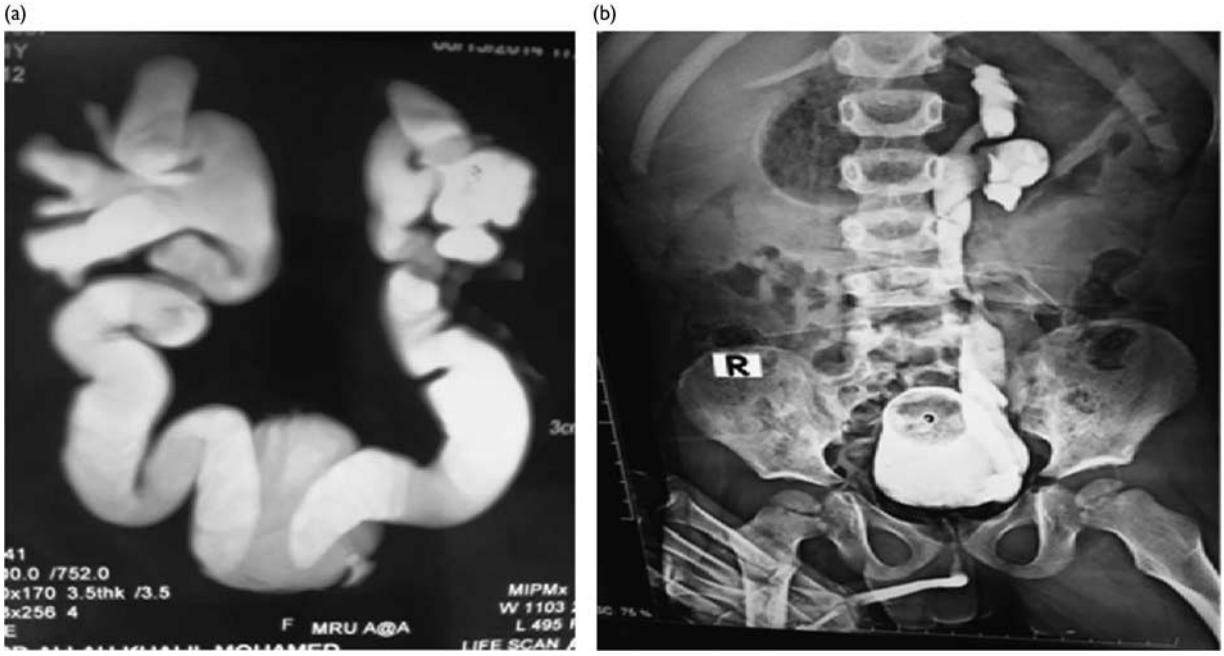
We performed this study to evaluate which method obtains the current PUV management purpose of preserving renal function and functional lower urinary tract integrity.

PUV is increasingly recognized by routine prenatal ultrasound. The diagnostic findings are bilateral hydronephrosis and a distended thick-wall bladder. Occasionally, a dilated posterior urethra is seen. Low amniotic fluid and bright renal parenchyma (suggestive of dysplasia) provide important clues about the severity of renal damage [12]. PUV can present with antenatal hydronephrosis or postnatally with bladder outflow obstruction. Endoscopic valve ablation is the main modality of treatment and diversion is reserved if the former fails or is contraindicated. The prognosis of patients with mild disease and normal renal function is good, and in those with intermediate severity disease postnatal therapy improves the outcome [13].

Out of 50 patients with PUVs in our series, two (8%) patients were diagnosed antenatally. The lower incidence of antenatal diagnosis in our study could be attributed to improper antenatal care in Egypt. Our hospital is a referral university hospital and we receive patients from rural areas with low standard in social and education conditions; therefore, there is less interest in the antenatal care. In addition to the low experience of their physicians to aware of fetal anomalies.

The most common presentation in cases managed by valve ablation was difficult micturition (60%), out of them five only 20% were not improved during the postoperative period ($P < 0.03$). The most common presentation was a febrile UTI (68%) in cases who were managed by initial vesicostomy, with five of them (20%)

Fig. 2



(a) Magnetic resonance urography in a 1-month-old boy who presented with retention of urine. (b) Marked regression of ureterorenal backpressure, after initial vesicostomy, with reduction of serum creatnine from 2.1 to 0.6 mg/dl. However, he is still has detrusor dysfunction after posterior urethral valve ablation.

still complaining in the postoperative follow-up ($P < 0.0001$). The preoperative presentations have significantly improved during the postoperative follow-up. Retention of urine disappeared completely after management in both groups. Although incontinence was not improved, the possible cause is irreversible detrusor dysfunction.

Acute kidney injury (AKI) is not only of concern to adults, as the pediatric population can also be affected just as in adults, etiologies of pediatric AKI can be classified as prerenal, intrinsic renal and postrenal. Although postrenal causes are not the most common, they are associated with the same complications and have as particularity that surgical intervention is required for remission. PUV is the most common pediatric obstructive uropathy and equally represents an undermined cause of preventable AKI in children [14]. To prevent this outcome in a low-income population like ours, where an antenatal diagnosis is rarely done, physicians should be aware of obstructive signs, UTIs in children less than 2 years, and perform imaging of the urinary tract when it is required [15].

Renal failure presented in 30% of boys with severe PUVs before adolescence. Deterioration of renal function in those children is due to bladder dysfunction, which is irreversible even with adequate valve ablation [16].

In our study, the mean serum creatinine after stabilization with urethral catheter drainage was higher in cases treated with initial vesicostomy than in patients treated with valve ablation 1.529 ± 0.622 mg/dl (range: 0.70–2.22). In both of our studies, the preoperative serum creatinine is significantly improved during follow-up after 1 year of the management. Postoperative serum creatinine is significantly decreased in primary valve ablation than vesicostomy cases. In our study, postoperative hydronephrosis grade improvement in both was not significantly different. In primary valve ablation, backpressure changes improved in 25 of 35 (71.4%) evaluated renal units.

Sudarsanan *et al.* [17] studied 50 patients with PUV; out of them, 44 underwent valve ablation and four patients underwent initial vesicostomy, pyelostomy was performed in two patients and primary valve ablation was encountered in 44 patients, and two cases required secondary vesicostomy. In those patients who underwent valve ablation, 33 renal units were affected by hydronephrosis, and 23 (69.69%) renal units demonstrated postoperative improvement in hydronephrosis degree.

In our series, the VUR incidence was 63.3%. In group 1 managed by valve ablation, reflux improved in 27 of 35 (77.1%) evaluated renal units, whereas in group 2 21 out of 32 were improved (65.6%). However, these results were statistically insignificant ($P > 0.5$).

The most common symptom in the study by Malik *et al.* [18] was associated fever (72%), whereas in our group it was a febrile UTI (68%) and poor stream (60%). In our cases, there was 70% VUR (right 15%, left 20.4% and bilateral 34.6%). UTI was found in 40.8% of our patients, who were treated with antibiotics, whereas in severe or persistent cases they were treated with a diversion. Mirshemirani *et al.* [19] concluded that urinary drainage by small catheter or nasogastric feeding tube in the early days of infancy – 7–15 days – followed by valve ablation is the best treatment modality in PUV, and urinary diversion if indicated improves the outcome. Vesicostomy plays an important role in the initial management of PUV where primary valve avulsion

cannot be readily done owing to lack of appropriate facilities and instruments [20]. In this series, vesicostomy was performed for 15 newborns and infants with urinary sepsis or poor general condition in spite of urethral catheter drainage and corrective medical treatment. Another indication for temporary vesicostomy in 10 cases was a small-caliber urethra, which precluded primary transurethral valve ablation.

VCUG is the most important imaging procedure for diagnosing PUV. Follow-up of our cases using DTPA revealed that there is a persistent upper tract dilatation (mostly unilateral) with mild to moderate functional obstruction in 10 patients, which improved in later follow-up. In this study, 14 of the 25 (56%) patients treated with primary valve ablation had severe bladder scores preoperatively versus 17 of the 25 (68%) treated with primary vesicostomy. Bladder appearance improved in both procedures within 12 months postoperatively.

The ultrasonographic bladder volume for these patients after 6 months of follow-up, age range 1–4 years, was found to be 100–240 ml. These values correlate with expected bladder capacity for age in our patients, which ranged from 115 to 250 ml [20]. Postoperative bladder score improvement is insignificant in both procedure categories.

Conclusion

Urinary drainage using small catheters or nasogastric tube in the early days of infancy followed by valve ablation is the best treatment modality in PUV, whereas there is an indication for initial vesicostomy management in prematurity, small body size, severe UTI or septicemia, and high-grade renal insufficiency.

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Conflicts of interest

There are no conflicts of interest.

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