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Case Report

Prospective Evaluation of the Endoscopic Treatment of Posterior Urethral Valves in a Pediatric Hospital in Dakar

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Abstract

Introduction : Endoscopic incision is generally considered the definitive treatment for Posterior Urethral Valves (PUV). This study aims to describe our technique for endoscopic resection of PUV and the long-term outcomes of bladder function.

Patients and methods : We conducted a prospective study in the Pediatric Surgery Department at Albert Royer Children's Hospital, Dakar, from January 1, 2020, to June 20, 2023. Thirty-two children with PUV underwent endoscopic treatment and were followed for at least six months. We assessed pre- and postoperative urinary diversion, age at PUV incision, bladder capacity, urinary incontinence, voiding disorders, bladder dysfunction, and renal failure.

Results : The mean age at treatment was 27.3 months (range: 1 day to 10 years); 65.6% were infants. Preoperative urinary diversion was performed in 62.5% of patients. Post-incision, transurethral catheterization averaged 49.9 hours. At a mean follow-up of 4.8 years, no patients reported dysuria; 90.5% experienced urinary incontinence, and 76.2% had urgency and frequent urination. Among those over 5 years old, 80% were suspected of bladder dysfunction. Three months post-resection, 90.6% had normal renal function. After an average of 16.7 months, 75% had elevated age-specific creatinine levels. Ultrasound showed improvement in 46.8%, stability in 28.1%, and worsening in 9.3%. Renal scintigraphy revealed pyelonephritic scarring in two patients; one had normal results.

Conclusion : Despite endoscopic incision, renal and bladder function outcomes in children with PUV remain unpredictable, especially with comorbid factors like delayed treatment, urinary diversions, and infections.

Keywords: Posterior urethral valves; Endoscopy; Urethrotome; Bladder dysfunction associated with PUV; Renal failure

Abbreviations : PUV: Posterior Urethral Valves; E.Coli: Escherechia Coli; VUR: Bilateral Vesicoureteral Reflux; UHN: Ureterohydronephrosis; MBC: Maximum Bladder Capacity; EBC: Expected Bladder Capacity; FBC: Functional Bladder Capacity.

INTRODUCTION

Posterior Urethral Valves (PUVs) are the leading cause of lower urinary tract obstruction in male children, representing the primary etiology of bilateral urinary tract obstruction and dysuria in this population [1]. The incidence of PUVs is estimated between 1 in 4,000 and 1 in 8,000 male births [2]. This anomaly develops early during fetal life, hindering normal kidney development and often resulting in renal dysplasia detectable prenatally, which contributes to the onset of renal insufficiency [3]. Prenatal diagnosis of PUVs can significantly influence prognosis; earlier detection is associated with more severe outcomes [3]. The consequences of this obstruction persist postnatally, necessitating prompt diagnosis and removal of the obstruction to prevent progression to renal failure [4]. In our practice, PUVs are frequently diagnosed postnatally, often presenting with complications such as urinary tract infections. The prognosis of this malformation is closely linked to the timeliness of diagnosis and intervention [3]. Management has improved considerably in recent years; however, access to pediatric endoscopic treatment remains limited in our region. Despite early diagnosis and treatment, the progression of PUVs can be unpredictable, likely due to bladder dysfunction, underscoring the importance of long-term evaluation for all patients treated for this congenital anomaly.

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PATIENTS AND METHODS

We conducted a prospective descriptive study over a period of 3 years and 6 months, from January 1, 2020, to June 20, 2023. The study included male children diagnosed with Posterior Urethral Valves (PUV) who underwent endoscopic incision and had a follow-up of at least 6 months, including clinical and paraclinical evaluations, in the Department of Pediatric Surgery at Albert Royer Children's Hospital in Dakar. Patients whose PUV diagnosis was not confirmed by cystoscopy and those with less than 6 months of follow-up after endoscopic resection were excluded. Out of 35 PUV cases, 32 met our selection criteria. Among them, prenatal diagnosis was made in 6 patients (20%), all during the second trimester of pregnancy. Postnatally, fever was present in 28 patients (93.3%), dysuria in 11 patients (36.7%), and involuntary urine loss in 2 patients (6.6%).

Ultrasound of the urinary tract revealed various anomalies, as shown in table 1. Ureterohydronephrosis was associated with a hypertrophic bladder in 15 cases (33.3%).

Table 1: Postnatal ultrasound findings.

Ultrasound Findings	Number	Percentage (%)
Bilateral ureterohydronephrosis	9	28.1
UHN and hypertrophic bladder	15	46.8
UHN and signs of renal impairment	3	9.3
Normal	3	9.3
Bilateral pyelocaliectasis	2	6.2
Total	32	100

UHN : Ureterohydronephrosis

Urine cultures were performed for all patients; among them, 18 children (60%) had urinary tract infections, with *E. coli* identified in 9 patients (50%). Voiding cystourethrography confirmed the diagnosis of PUV in 30 patients. Twenty-seven children (90%) had normal renal function before the intervention, 3 patients (10%) presented with renal insufficiency, and 5 patients had electrolyte disturbances.

For all patients, we used a flexible 8 Fr cystoscope introduced under video guidance to confirm type I valves in all cases and to assess bladder lesions. An 8 Fr urethrotome was then used to incise the valves at the 12, 5, and 7 o'clock positions, with warm saline as the irrigation fluid. After resection, urinary flow was tested on the table, and a 6 or 8 Fr urinary catheter was left in place.

We evaluated parameters such as the presence or absence of preoperative urinary diversion, age at the time of PUV resection and at evaluation, intraoperative incidents, associated treatments, type and duration of urinary diversion after resection, presence or absence of urinary incontinence, voiding disorders, bladder dysfunction associated with PUV, and renal insufficiency. We also assessed bladder capacity.

RESULTS

The mean age of patients at the time of endoscopic treatment was 27.3 months, with a range from one day to 10 years. Infants accounted for 20 cases, representing 65.6%. Figure 1 illustrates the age distribution of patients during endoscopic treatment of PUV. At the time of the most recent urinary function evaluation, the mean age was 4.8 years, with a range from 7 months to 13 years.

Preoperative urinary diversion was performed in 20 patients (62.5%), including seven vesicostomies, five urethral dilations, five transurethral catheterizations, and three suprapubic cystostomies.

Cystoscopy confirmed the diagnosis of PUV in all patients, including the two children whose voiding cystourethrograms were inconclusive. Figure 2 presents an endoscopic view from one of our patients.

Cold knife resection was utilized for all patients. Figure 3 illustrates an endoscopic resection of posterior urethral valves.

After endoscopic incision of Posterior Urethral Valves (PUVs), transurethral catheterization was systematically performed for an average duration of 49.9 hours, ranging from 24 hours to 10 days. Two intraoperative incidents were noted, both involving urethrorrhagia with difficulties in transurethral catheterization. One of these patients developed acute urinary retention, necessitating suprapubic bladder drainage, while the other subsequently achieved spontaneous micturition.

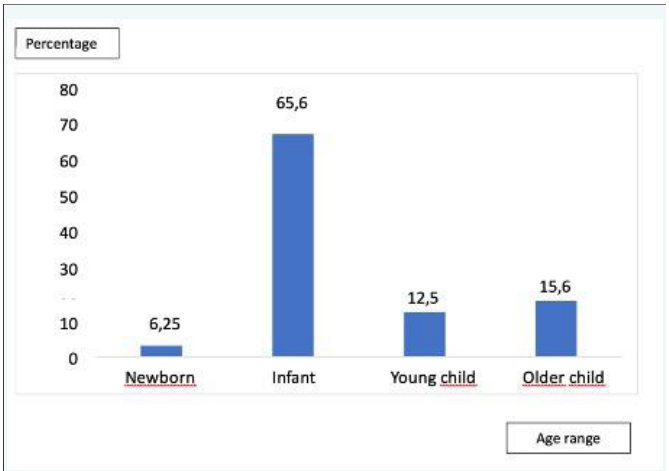

Figure 1: Mean age of patients undergoing endoscopic incision of PUV.

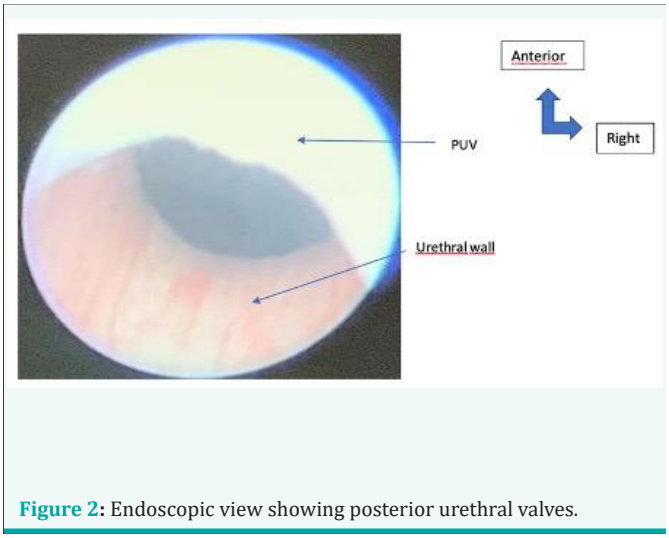

Figure 2: Endoscopic view showing posterior urethral valves.

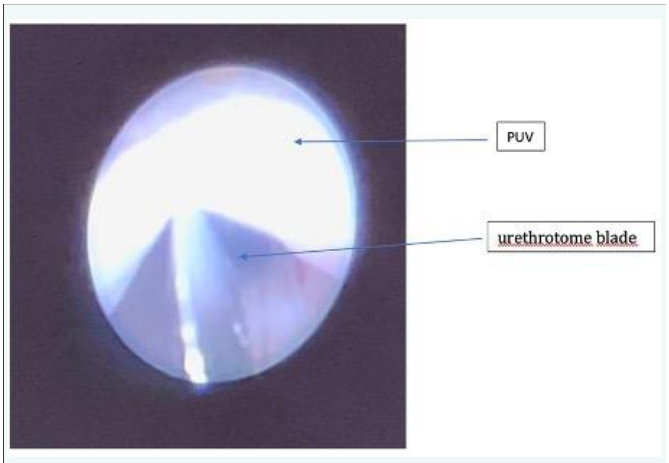

Figure 3: Endoscopic view showing incision of posterior urethral valves

Concomitantly, circumcision was performed in 21 infants, accounting for 65.6% of cases. The nadir creatinine level was 0.75 mg/dL, with a range from 0.1 to 1.8 mg/dL.

During follow-up, patients underwent a final micturition assessment at an average age of 4.8 years. Among them, 21 patients (65.6%), including 10 (47.6%) over 5 years old, achieved continence. The average age for attaining continence was 2.9 years, with a range between 2 and 4 years, and none reported dysuria. Nineteen patients (90.5%) experienced urinary incontinence, diurnal in 5 patients (26.3%) and both diurnal and nocturnal in 14 patients (73.7%). Additionally, 12 patients (76.2%) reported urgency and frequent urination.

Among patients who completed voiding diaries, the mean ratio of Maximum Bladder Capacity (MBC) to Expected Bladder Capacity (EBC) was 1.27, with extremes of 0.75 and 1.88. Ten patients had a Functional Bladder Capacity (FBC) to MBC ratio below 0.8, with a mean ratio of 0.63, ranging from 0.4 to 0.83. In the cohort of 10 patients over 5 years old, valve bladder syndrome was suspected in 8. Micturition assessment results are detailed in table 2.

Three months following endoscopic resection, renal function evaluation indicated that 29 patients (90.6%) exhibited normal renal function. However, after an average follow-up of 16.7 months, 24 patients (75%) presented with serum creatinine levels exceeding age-specific norms. Notably, 8 patients (25%) had creatinine levels surpassing 1 mg/dL.

At the three-month post-resection, ultrasonographic evaluations showed improvement in 15 patients (46.8%), stability in 9 patients (28.1%), and deterioration in 3 patients (9.3%). After an average follow-up of 16.7 months, the ultrasonographic findings are detailed in the table 3.

Postoperative Voiding Cystourethrography (VCUG) was performed on ten patients, revealing normal findings in six cases and a reduction in posterior urethral dilation in four cases (40%) (Figure 4).

Follow-up renal scintigraphy was performed in three patients: two at one year and one at six months post-PUV resection. The results indicated renal function asymmetry with pyelonephritic scarring in two cases, while the third patient exhibited normal findings.

Two fatalities occurred in infants aged 45 and 65 days, respectively, both presenting with electrolyte imbalances and acute renal failure.

DISCUSSION

Posterior Urethral Valves (PUVs) are a congenital malformation of the lower urinary tract, affecting approximately 1 in 5,000 to 8,000 male births [5,6]. This anomaly can impact the entire upstream urinary system, posing a significant risk of progression to renal insufficiency, even when initial renal function appears normal [3,7]. Consequently, long-term follow-up is essential for all patients, extending into adulthood, similar to other chronic conditions [8,9]. In Africa, the prevalence of PUVs is challenging to determine and varies across centers, largely due to disparities in diagnostic and therapeutic resources [10,11]. Some neonates or infants may succumb to electrolyte imbalances, septicemia originating from urinary infections, or acute renal failure resulting from undiagnosed PUVs. Centers equipped with endoscopic resection tools and the requisite expertise report higher frequencies of this congenital anomaly. Additionally, antenatal diagnosis rates for PUVs remain low in our regions [4,10,11]. These factors contribute to the delayed timing of endoscopic treatment, with an average age of 27.31 months in our series, which is higher than typically reported [12].

Elsewhere, higher rates of antenatal diagnosis facilitate earlier

Table 2: Micturition assessment in patients over 5 years old.

Patient	Age (Years)	Urinary Incontinence Period	Urgency	Frequency	MBC/EBC	FBC/MBC	Suspected Valve Bladder Syndrome
1	8	Diurnal and nocturnal	Yes	Yes	1.1	0.55	Yes
2	12		No	No	0.75	0.83	No
3	10	Nocturnal	No	No	1.8	0.42	Yes
4	10		No	No	0.8	0.79	No
5	6	Nocturnal	Yes	Yes	1.4	0.4	Yes
6	13	Diurnal and nocturnal	Yes	Yes	1.2	0.71	Yes
7	8	Diurnal and nocturnal	Yes	Yes	1.3	0.65	Yes
8	8	Diurnal and nocturnal	Yes	Yes	1	0.6	Yes
9	8	Diurnal and nocturnal	Yes	Yes	1.6	0.68	Yes
10	5	Diurnal and nocturnal	Yes	Yes	0.9	0.74	Yes

MBC : Maximum Bladder Capacity ; EBC : Expected Bladder Capacity ; FBC : Functional Bladder Capacity

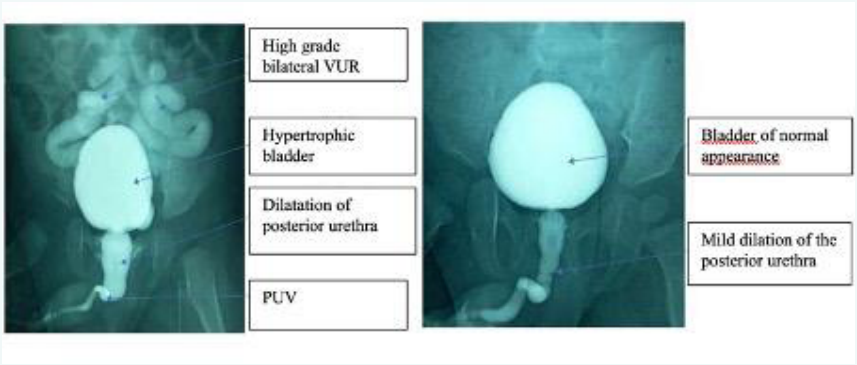

Figure 4: Micturition image showing Posterior Urethral Valves (PUVs) and high-grade bilateral Vesicoureteral Reflux (VUR) in a 3-month-old infant (A), with follow-up 6 months post-resection.

Table 3: Ultrasonographic findings at the final evaluation.

Ultrasonographic Findings	Number of Patients	Percentage (%)
Stable ureterohydronephrosis	4	12.5
Worsened ureterohydronephrosis	2	6.3
Improved ureterohydronephrosis	4	12.5
Normal	21	65.6
Signs of renal distress	1	3.1
Total	**32**	**100**

management of neonates, potentially including prenatal interventions to alleviate pressure on the upper urinary tract [3,13-15].

Preoperative evaluation is crucial, encompassing clinical assessment and paraclinical investigations, particularly renal function tests. Early identification of potential renal dysfunction guides appropriate management strategies. Urinary diversion, are vital in cases of late diagnosis accompanied by acute renal failure or uncontrolled urinary infections [16-18]. In our study, 62.5% of patients underwent such procedures. Urinary catheterization helps maintain a low-pressure urinary system.

Sixty percent of our patients presented with urinary infections upon admission, a common complication and often a revealing sign of PUVs [3]. Urinary stasis and associated vesicoureteral reflux, along with the frequent use of urinary diversions, contribute to these infections [19].

This creates a vicious cycle, complicating procedures like voiding cystourethrography and necessitating prolonged antibiotic treatments, which risk fostering drug resistance and further renal damage. Delayed diagnosis and treatment increase the likelihood of progression to chronic renal insufficiency.

Endoscopic valve ablation is currently considered the standard treatment. In our series, we employed cold knife incision; laser and electrocoagulation methods were not utilized. Nonetheless, cold knife incision has proven to be a safe technique. Postoperatively, routine urinary diversion is not mandatory. Although reflex acute retention is possible, there is no consensus on this practice. When implemented, diversion should be brief, not exceeding 48 hours. In our study, no patients reported dysuria, and the majority exhibited normal renal function immediately post-operation, indicating the effectiveness of endoscopic ablation. However, evidence shows that despite successful ablation, the long-term consequences of congenital obstruction persist, even into adulthood, underscoring the need for ongoing evaluation [19].

Subsequent ultrasound monitoring is essential to observe the gradual regression of pre-existing dilatation. After an average follow-up of 16.7 months post-ablation, ultrasound revealed persistent or even worsening dilatation in some patients. Voiding cystourethrography is not routinely performed but may be indicated if dilatation worsens, to check for incomplete valve ablation [20]. Residual reflux is generally well-tolerated if the bladder empties properly and functions under satisfactory urodynamic conditions. Even after relieving the obstruction, there remains a risk of bladder dysfunction, potentially leading to valve bladder syndrome and chronic kidney disease. This may explain the initial normalcy of renal assessments and imaging post-operation, followed by deterioration over time.

Diagnosing valve bladder syndrome requires comprehensive urodynamic studies, including cystomanometry, which are unavailable in our practice. Nonetheless, certain indicators—such as urinary incontinence, increased frequency, urgency, elevated maximum bladder capacity, and reduced functional bladder capacity—can suggest the diagnosis. These signs were observed in eight patients in our study.

CONCLUSION

Posterior Urethral Valves (PUVs) present a significant challenge in pediatric urology, particularly in sub-Saharan Africa, where various factors contribute to a more rapid progression toward renal insufficiency. Nonetheless, concerted efforts have led to notable improvements, resulting in a low short-term mortality rate. It is imperative to implement urgent measures to enhance the long-term outcomes for children affected by PUVs.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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