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Posterior Urethral Valves Ablation in Nigerian Patients: A 10 Year Experience

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Abstract **Original Research Article**

Background: Posterior urethral valves are the most common cause of obstructive uropathy in male paediatric patients. ***Objective:*** To evaluate the clinical presentation, treatment and outcome of 21 PUV patients managed over a 10-year period in University of Uyo Teaching Hospital and KSH Hospital. ***Methodology:*** A retrospective review of charts of 21 PUV patients managed between Jan.2012 and Dec. 2022, was done. Data retrieved included age at presentation, clinical features, laboratory and radiological findings, methods of drainage, initial and definitive treatment, complications and outcome. The patients were treated with Mohan's valvotomy, endoscopic ablation, catheter balloon avulsion and open resection. ***Results:*** The age range was 2 weeks to 15years (mean = 4.3 +/-4.4 SD years). All patients had lower urinary tract symptoms and abdominal distension. Seven patients presented with vomiting (33.3%), two had fever (9.5%) and two had visible haematuria (9.5%) in association with voiding symptoms. Electrolytes, urea and creatinine were deranged in 15 patients (71%). Micturating cystourethrogram demonstrated diagnostic features of PUV and Intravenous Urogram were abnormal in all patients. Fifteen patients (71%) had back-pressure effects with vesicoureteral reflux (VUR) and hydroureteronephrosis. Mohan's valvotomy was used to treat 10 patients (47.6%); endoscopic valve ablation was done in 7 patients (33.3%); catheter balloon avulsion was done in 2 patients (9.5%); and open valve resection was performed in 1 patient (4.7%). ***Conclusion:*** Preliminary vesical drainage by urethral catheterization or suprapubic cystostomy improved renal function prior to definitive treatment. The provision of endoscopic facilities for direct vision valve ablation is strongly advocated.

Keywords: Posterior urethral valves, Mohan's valvotomy Endoscopic ablation, Obstructive Uropathy.

INTRODUCTION

Posterior Urethral valves (PUV) are the commonest cause of congenital lower urinary tract obstruction in male infants with an estimated incidence between 1: 8,000 and 1:25,000 live births and 1:5000 male infants [1]. Incidence is dropping in some populations because of prenatal diagnosis and subsequent termination of severely affected foetus. A few cases have been reported in adults [2,3]. PUV are folds of mucous membrane in the posterior urethra. Young and associates first provided clinical diagnosis and classification of PUV into types I, II, III based on their anatomical location [2,3]. In type I, two obstructing urethral mucosal folds, each arising from the lower pole of the verumontanum and radiating downwards and laterally, fuse with each other in the anterior wall of the urethra distally. In type II, the valves radiate upwards from the verumontanum to the bladder neck. Type III represents a hole in a diaphragm, or 'iris eye'. Type I is the commonest variety while recent reports fail to confirm the existence of type II [2,3].

Children with posterior urethral valves present with storage and voiding lower urinary tract symptoms, with associated morbidities including chronic urinary retention, recurrent urinary tract infections, urinary incontinence, chronic renal failure and even death. As a result of prenatal ultrasound diagnosis of children with hydronephrosis and maternal oligohydramnios, improvements in resuscitation and respiratory support at birth and management of end-stage renal disease, mortality rate in PUV patients has reduced in developed countries. Preliminary catheter drainage, with early definitive valve ablation to relieve obstruction and metabolic derangement would improve outcome.

Endoscopic valve ablation is the treatment of choice, but other methods of valve destruction, including Mohan's valvotomy are useful where paediatric endoscopic facilities are limited.

Patients and Methods

Twenty-one (21) patients treated between January 2012 and December 2022 treated at University of Uyo Teaching Hospital and KSH Specialist Hospital were included in this retrospective study. Patients' data obtained included age at diagnosis, clinical features, hemogram, serum chemistry, urine studies and radiological investigations; method of valve destruction and outcome. Type of urinary drainage procedure, urethrocystoscopic findings, postoperative voiding habits and complications and mortality were also noted.

Results

Twenty-one (21) patients were treated over a 10-year period. Age range was between two (2) weeks and fifteen (15) years. This report shows that we were seeing about two or three cases of posterior urethral valves per year. The age varied from neonates to infants, toddlers and school age boys (Table 1). Children below the age of one year (33.3%) presented with uraemic symptoms or chronic renal failure, while those above one year of age had storage and voiding lower urinary tract symptoms. The symptoms at presentation are seen in (Table 2).

Table 1: Age Distribution

Age	Number	Percentage
0-1 years	7	33.3%
1-2 years	4	19.1%
2-3 years	5	23.8%
3-5 years	2	9.5%
5-10 years	2	9.5%
10-15 years	1	4.8%
Total	21	100%

Table 2: Symptoms at Presentation

Symptom	Number	Percentage (%)
Urinary retention	21	100%
Straining at micturition	15	71.4%
Abdominal distension	18	85.7%
Poor urinary stream	13	61.9%
Haematuria	2	9.5%
Frequency	5	23.8%
Vomiting	7	33.3%
Recurrent fever	2	9.5%
Failure to thrive	3	14.3%
Maternal oligohydramnios	2	9.5%
Respiratory distress	7	33.3%

All twenty-one patients had urinary retention with abdominal distension in 85. 7%, associated with straining at micturition in 15 patients (71.4%), poor urinary stream in 13 (61.9%), and frequency/dribbling of urine in 23.8%. Other symptoms included vomiting, recurrent fever, respiratory distress, failure to thrive. The bladder was distended in all patients and the kidneys were bimanually palpable in 85.5% as a result of hydronephrosis. Anaemia (47.6%), dehydration (42.9%), hypertension in 19%, penoscrotal swelling in 9.5% were other significant physical examination findings (Table 3).

Table 3: Physical signs

Physical Sign	Number	Percentage (%)
Distended bladder	21	100%
Hydronephrosis	18	85.7%
Penoscrotal swelling	2	9.5%
Hypertension	4	19%
Small for age	3	14.3%
Urinary ascites	2	9.5%
Anaemia	10	47.6%
Dehydration	9	42.9%

Deranged renal function tests with serum creatinine > 170 micromol/l in (14, 66.7%), urea > 7 mmol/l in (11, 52.4%), bicarbonate < 19 mmol/l in (19, 90. 7%) and hyperkalaemia > 5 mmol/l in (10, 47.6%) were documented (Table 4).

Table 4a: Preoperative Electrolytes, urea and creatinine

Electrolyte	Number	Percentage (%)
Creatinine > 170umol/L	14	66.7%
Blood urea > 7mmol/L	11	52.4%
Bicarbonate < 22mmol/L	19	90.7%
Potassium > 5mmol/L	10	47.6%

Urinary tract infection occurred in most patients with Escherichia coli, klebsiella, proteus and pseudomonas being the common organisms cultured.

Table 4b: Urine Microscopy/Culture Results

Organisms	Number	Percentage (%)
Escherichia coli	7	33.3 %
Klebsiella species	5	23.8%
Pseudomonas aeruginosa	4	19.0%
Proteus mirabilis	5	23.8 %

Micturating cystourethrogram (MCUG) was diagnostic in most patients (Table 5), showing dilatation of the posterior urethra in 21 (100%) of patients, bladder neck hypertrophy in 16 (76%), radiolucent valve cusps in 12 (57%), bladder trabeculation in 13 (62%) bladder dilation in 6 (28%) and vesicoureteral reflux in 4 patients (19%).

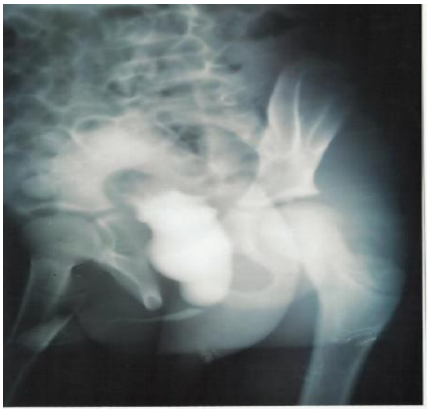

Figure 1: MCUG showing PUV

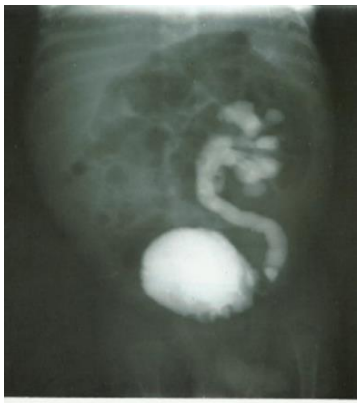

Figure 2: PUV with left VUR

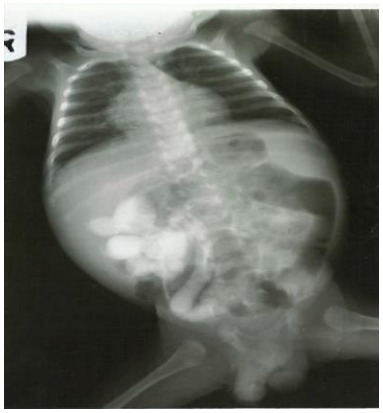

Figure 3: IVU Right Hydronephrosis

Table 5: Micturating cystourethrogram (MCUG) findings

Feature	Number	Percentage (%)
Dilatation of posterior urethra	21	100%
Bladder neck hypertrophy	16	76%
Radiolucent valve cusps	12	57%
Bladder trabeculation	13	62%
Bladder dilatation	6	28%
Vesicoureteral reflux (unilateral or bilateral)	4	19%

The drainage procedure was by urethral catheterization in 16 patients (76%), and suprapubic cystostomy in 5 (24%). Intravenous urography (IVU) done after drainage had improved renal function and serum chemistry to assess the upper urinary tract demonstrated unilateral or bilateral hydroureteronephrosis and non-functioning kidneys in some patients. One child had bladder stone impacted in posterior urethra. The operative procedure was Mohan's valvotomy in 10 patients (47.6%), endoscopic ablation in 7 (33.3%), balloon avulsion in 2 (9.5%) and open valve resection in 1 (4.7%)

Table 6: Operative procedure for valve ablation

Method	Number	Percentage (%)
Mohan's valvotomy	10	47.6%
Endoscopic ablation	7	33.3%
Catheter balloon avulsion	2	9.5%
Open resection	1	4.7%

Following valve ablation or destruction, the patients demonstrated satisfactory voiding on table following bladder expression. Postoperative complications included urethral stricture in 2 patients (9.5%), acute and chronic renal failure in 5 patients (23.8%), urinary tract infections in 6 (28.6%), residual valves in 1 (4.8%) and 2 mortality (9.5%) (Table 7).

Table 7: Postoperative complications

Complications	Number	Percentage (%)
Urethral stricture	2	9.5%
Acute renal failure	2	9.5%
Chronic renal failure	3	14.3%
Anaemia	5	23.8%
Recurrent urinary tract infection	16	76.2%
Residual valves	1	4.8%
Mortality	2	9.5%

The patients who developed urethral strictures and residual valve had urethral dilatation. Five patients who had acute and chronic renal failure had hemodialysis. Metabolic acidosis, uremia, creatinine elevation and anemia were indicative of renal decompensation. Sixteen (16) patients who had preliminary drainage with urethral catheterization or suprapubic cystostomy had urinary tract infection. One 15-year-old child had vesicourethral calculus requiring open vesicolithotomy and valve resection. Voiding pattern and urethrograms at one month were satisfactory in 15 patients (71.4%). Two patients died from renal failure and urosepsis.

DISCUSSION

Posterior urethral valves (PUV) are the commonest cause of obstructive uropathy in male neonates and infants. PUV occurs in 1 in 8,000 to 25,000 live births and make up 10% of urinary obstruction in utero [1]. The incidence in our population is unknown. Our hospital incidence of 2 to 3 cases per year is lower than reports from other centers like Osegbe in Lagos (10 cases per year), Talabi in Ille-Ife (3 cases/year) and Uba in Jos (3-10 cases/year) [3,5,6]. Mteta *et al.,* reported an average of 6 cases per year in Tanzania, East Africa [12], while Jaja in Port Harcourt observed PUV hospital incidence of 1 in 2,447 children seen in their hospital [8]. In developed countries, the widespread use of prenatal evaluation has significantly increased its early diagnosis and management. Odetunde *et al.,* from Enugu, Eastern Nigeria noted that poverty, poor utilization of ultrasound scanning, healthcare poor referral systems contribute to low rates of prenatal presentation and late diagnosis [9]. In our series, two groups of patients were apparent i.e., neonates and infants below 1 year of age who had chronic retention, chronic renal failure associated with voiding symptoms, while those above 1 year of age had predominantly voiding and storage symptoms. Seven patients (33.3%) were below 1 year of age while the remaining were toddlers or of school age. The presenting symptoms were chronic urinary retention in 100% of patients, abdominal distension (85.7%), straining at micturition (71.4%), and poor urinary stream in 61.95%, frequency of urination in 23.8%, vomiting in 33.3%, recurrent fever, failure to thrive and maternal oligohydramnios. The bladder was distended in all the patients with palpable kidneys and ureters (hydroureteronephrosis) in 85.5%, as confirmed by abdominopelvic ultrasound scans. The abdominal distension was caused by chronic retention, hydronephrosis and urinary ascites. The syndrome of posterior urethral valves, vesicoureteral reflux and renal dysplasia, congenital bladder diverticula, urinary extravasation and ascites are anatomical variables which may provide protective "pop-off" mechanism to reduce high intravesical pressures and preserve better renal function [17]. Anemia, dehydration and hypertension were other findings. Urinary stasis predisposed to urinary tract infections, urosepsis and recurrent pyrexia. The diagnosis was made by micturating or voiding cystourethrograms (VCUG) which demonstrated vase-like dilatation and elongation of the posterior urethra in 100% of the patients and bladder neck hypertrophy in 76% of patients. Vesicoureteral reflux (VUR) was seen 4 (19%) of patients compared with Talabi et al in Ife who found VUR in 29.7% of patients while Uba *et al.,* in Jos found VUR in 22% [5,6]. Urethrocystoscopy was done in seven patients and enabled visualization of the valve leaflets as delicate fronds and inspection of bladder for compensatory and decompensatory detrusor changes.

Renal failure in PUV patients has two main causes i.e. obstructive uropathy with glomerular and tubular injury due to high pressures which is reversible and renal dysplasia due to increased pressure and

abnormal embryologic development which is not reversible. In addition, there is renal scarring from urinary tract infection. Abnormal renal function tests, including elevated creatinine >170 micromol/l in 66.7%; elevated urea >7 mmol/l in 52.4%; metabolic acidosis with bicarbonate <22 mmol/l in 90.7% and hyperkalemia >5 mmol/l were documented. Deranged renal function tests were also seen by Talabi (40.5%) and Uba (73.2%), Odetunde *et al.,* (71.4%) and Mirshemirani *et al.,* [5,6,9,16]. In the Lagos series by Osegbe, metabolic acidosis (low bicarbonate < 25mmol/l) was found in 60% of patients, even with normal urea and creatinine, which suggested that acid-base balance deficits occurred early in PUV patients [3]. Elevated serum creatinine levels were associated with poor prognosis and may persist with relief of obstruction. Children who presented early in the neonatal period with PUV had more severe obstruction and high creatinine levels than those who presented late with lesser degree of obstruction. About half of the patients (47.6%) had anemia and 42.9% were dehydrated with fluid and electrolyte imbalance. Urinary tract infection was seen in all the patients with Escherichia coli, klebsiella species, proteus mirabilis and pseudomonas aeruginosa being the predominant organisms and was a result urinary retention and prolonged drainage with indwelling urethral and suprapubic catheterization.

The objective of preliminary urinary drainage was to improve renal function, reduce upper tract dilatation and increase ureteric peristalsis [3]. Vesical drainage was achieved by urethral catheter in 16 children (76%) and suprapubic cystostomy in 5 (24%). In the Ife study by Talabi, initial bladder drainage was by Foley's urethral catheter in 97.3% of patients [5]. Post obstructive relief diuresis was seen in all patients. Bladder drainage improved renal function significantly. Nasir *et al.,* [15] found improved renal function in 8/57% of 14 patients with impaired renal function at presentation, while Sudarsanan *et al.,* [21] in a review of 65 patients documented improved renal function in 9(75%) out of 12 patients with renal impairment. The medical management of these patients included urinary drainage, correction of fluid and electrolyte imbalance, correction of acid-base deficits, treatment of urinary tract infections and correction of anemia. Infants with severe urosepsis and chronic renal failure who did not improve on continuous bladder drainage had hemodialysis before valve ablation. Vesicostomy and supravesical urinary drainage through nephrostomy, pyelostomy, or bilateral ureterostomies were not done in our patients. Complications associated with upper tract diversion may include infection, tube fallout, ureteric kinking, retraction or obstruction and prolonged drainage with contracted bladder and increased morbidity [3]. Supravesical drainage should be limited to very ill patients whose renal function do not improve with vesical drainage.

The gold standard for valve ablation is endoscopic fulguration, but in developing countries with limited resources endoscopic facilities and expertise may not be widely available. Reports from Nigeria included the use of Mohan's urethral valvotome (Shittu in Ibadan [4], Talabi in Ife [5]; Ikuerowo in Lagos [7], Nasir in Ilorin [13,15], Oyinloye in Yola [20]), balloon avulsion and transvesical resection by Uba [6]. Osegbe in Lagos had first reported on Endoscopic ablation of PUV in Nigerian patients with 100% successful fulguration results [3]; while Shittu reported good postoperative outcomes with Mohan's valvotomy [4]. Ten of our patients had Mohan's valvotomy while seven patients had endoscopic valve destruction. Urethrocystoscopy demonstrated the valves and enabled type classification, inspection of the bladder for bladder neck and detrusor hypertrophy, trabeculation and diverticula. The scopes are equipped with high resolution lens, light source, slender sheaths and valve fulguration was done under direct vision using insulated diathermy with deflecting mechanism. The operating time was short (20-30 minutes) and satisfactory voiding was demonstrated by expression of bladder filled with normal saline. Talabi et al., did primary valve ablation in (n=28/32; 87.5%) patients and vesicostomy in (n=4/32; 12.5%) patients. Their operative technique was Mohan's valvotomy in 10 patients, transvesical valve excision in 9, catheter balloon avulsion in 8 and endoscopic resection in 1 patient.

Complications in our series included urethral stricture (9.5%), acute and chronic renal failure (23.8%), urinary tract infection in (28.6%), residual valves (4.8%) and two mortalities (9.5%). Shittu and Asinobi reported long term complications following Mohan's valvotomy including recurrent urinary tract infections in 35%, acute renal failure in 5%, chronic renal failure in 15%, urethral stricture in 5 %, and anemia in 15% of their patients [18]. Voiding dysfunction and urinary incontinence may persist after valve ablation due to detrusor muscle abnormalities including myogenic failure, detrusor hyper-reflexia and hypertonia. Anticholinergic therapy with oxybutynin hydrochloride, imipramine or tolterodine tartrate improves compliance, reduces detrusor instability, improve continence and reduce vesicoureteral reflux in overactive bladder patients [18,24]. The mortality rate in our series of 9.5% contrasted with 13.5% by Talabi in Ife, 4.9% by Uba *et al.,* and 12.9% by Okafor *et al.,* [5,6,10]. The cause of death was uraemia and overwhelming sepsis. The follow-up period was 12 months to 3 years and patients seen in the urology clinic had voiding history, abdominal examination, ultrasound scan if indicated, urinalysis/culture, and electrolytes, urea and creatinine checked. About 20%-50% of PUV patients have significant renal impairment at long term follow up [18,24]. Poor prognostic factors predisposing to end stage renal disease included early neonatal presentation, bilateral reflux, echogenic kidneys with loss of corticomedullary differentiation with cortical cysts

indicative of renal dysplasia, and high serum creatinine levels greater than 70 micromol/l post valve ablation [5]. Nasir *et al.,* have documented that serum creatine at presentation and after initial bladder drainage are reliable reflection of functional kidney mass, while nadir creatine after valve ablation was a significant prognostic indicator for final renal outcome [15].

Prenatal diagnosis and antenatal management were not common in our setting. PUV detection rate by prenatal ultrasound is about 20%-42% in developed countries [21]. In comparison, the antenatal detection rate in Nigeria is less than 10% [5,10,15]. Modalities used for prenatal fetal intervention though controversial include early delivery, vesicoamniotic shunting, open fetal surgery to decompress hydronephrosis, percutaneous fetal cystoscopy, and termination of pregnancy [23].

Conclusion

Our results compare favourably with that of similar studies in Nigeria. Endoscopic visualization and diathermy fulguration using ensures precise destruction of posterior urethral valves, though use of Mohan's valvotome and other modalities are still practiced in developing countries where paediatric endoscopic facilities are limited. Health education of mothers, antenatal care and counselling, prenatal ultrasound scans, early diagnosis, drainage and valve ablation and management by paediatric urologists and nephrologists would improve outcome.

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