ORIGINAL ARTICLE

Posterior Urethral Valves in Children: Pattern of Presentation and Outcome of Initial Treatment in Ile-Ife, Nigeria

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ABSTRACT

Background: The management of posterior urethral valves (PUV) and its sequelae is still a challenge to most pediatric surgeons in our environment due to late presentation and inadequate facilities for long-term evaluation and treatment. Despite initial successful treatment about 40% would develop chronic renal failure. The aim is to describe the presentation, management and outcome of the initial treatment in boys with PUV. **Materials and Methods:** It is a retrospective analysis of PUV in boys 8 years and below over a 17 years period. Demographic characteristics, clinical features, investigations, and treatment outcome were reviewed. **Results:** Thirty-seven cases were analyzed. The median age was 5 months (range from birth to 8 years). Three (8.1%) patients had prenatal ultrasound diagnosis. The most common presentation was voiding dysfunction 37 (100%). Part of the preoperative investigation included micturating cystourethrogram (n = 31: 83.8%) and abdomino-pelvic ultrasonography (n = 37:(100%). The mean serum creatinine value of those who presented within the first 30 days of life and those who presented afterwards were 325 (±251) µmol/L and 141 (±100) µmol/L respectively, P = 0.003. Surgical interventions included trans-vesical excision of valves (n = 9: 28.1%), valvotomy (n = 10: 31.3%), balloon avulsion (n = 8: 25.0%), vesicostomy (n = 4: 12.5%) and endoscopic valve avulsion (n = 1: 3.1%). Seventeen (56.7%) patients had serum creatinine >70.4 µmol/L after 1-month of valve excision. Five (13.5%) patients had postrelief complications and 5 (13.5%) died on admission. Ninety percentage (27/30) of patients had poor prognostic indices. **Conclusions:** The initial treatment outcome was good but most had poor prognostic factors.

KEYWORDS: Excision, treatment outcome, urethral valves

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INTRODUCTION

Posterior urethral valves (PUV) are the most common cause of congenital lower urinary tract outflow obstruction in male infants with an incidence of 1:5,000 male infants and 1:25,000 live births.[1-3] The incidence is unknown in our sub-region. Uba *et al.*[1] in Jos, Nigeria reported 3–8 cases per annum. Jaja *et al.*[4] in Port Harcourt observed that it accounted for 1 in 2,447 children seen in their hospital while Odetunde *et al.*[5] noted that 71% were already in renal failure at presentation.

PUV has deleterious effect on the development of the upper urinary tract and on the evolution of bladder function. Persistent and unrelieved obstruction leads to back pressure effect on the urinary bladder and the kidneys resulting in valve bladder and ultimately end stage renal disease (ESRD). The anomaly is associated with considerable morbidity including urosepsis, urinary incontinence (over-flow), chronic renal insufficiency (RI), and even death.[2,6] Odetunde *et al.*[5] In Enugu, Nigeria reported that the bulk of patients seen with PUV in their practice presented late with urosepsis, anemia, uremia, and ESRD.

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Prenatal ultrasound screening of PUV has significantly increased early diagnosis and management of this pathology in most developed societies. In fact, PUV are now commonly diagnosed by the postnatal evaluation of infants who had prenatal hydronephrosis.[3]

Initial continuous catheter drainage and eventual management by valve resection, avulsion or ablation could ameliorate the obstructive uropathy. However, it has been noted that even after surgical treatment of valves; about 70% of older children and adolescent boys continue to have persistent bladder dysfunction with long term morbidity and ESRD.[3,7,8]

Long-term management of PUV constitutes a challenge in pediatric urology practice in our environment due to limited diagnostic facilities to evaluate and monitor these children.[1] Even where facilities are available, most patients fail to turn up for follow-up visit due to an erroneous believe that it has been cured following the initial relief of the obstruction.

In a resource poor economy like ours, public enlightenment, early diagnosis, and prompt institution of management would go a long way in improving initial and long-term outcome of PUV.[1,5]

The aim of this study was to determine the pattern of presentation, trend of surgical management, challenges and outcome of the initial treatment of children with PUV in our center.

Materials and Methods

This was a retrospective analysis of children aged 8 years and below managed for PUV at the pediatric surgical unit of Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Southwest Nigeria between January 1995 and December 2012.

Information on the age at presentation, clinical features, functional status of the kidneys (based on serum creatinine) at presentation, 5–7 days of continuous catheterization and 1-month postvalve resection were obtained from the patient records. Others records retrieved included diagnostic radiology; initial treatment and early outcome.

Initial management included continuous per urethral catheter drainage of the bladder with size 6 or 8 Foley's catheter or feeding tube under strict aseptic condition. Prophylactic antibiotic therapy was commenced empirically. Investigations done included serial blood urea nitrogen, serum creatinine, urine microscopy, culture and sensitivity. Initial radiological investigations consisted of abdomino-pelvic ultrasound followed by voiding cysto urethrogram and or sometimes intravenous urography (IVU) (with a micturating phase) and occasionally cystoscopy (where appropriate size scope was available) when patients had been clinically stabilized. Micturating cystourethrogram showing dilated and elongated posterior urethral (key-hole sign) was considered diagnostic. After stabilizing the patients by controlling infection, correction of fluid, electrolyte and acid-base balance and with evidence of improved renal function (serum creatinine <132 μmol/L [1.5 mg/L] and blood urea nitrogen <5.8 mg/dl), patients were then scheduled for valve ablation. After valve ablation, a urethral catheter was left *in situ* for 3–5 days to allow the edema to subside and to enable measurement of urinary output. Intravenous fluids were given and adjusted to meet the need of patients while serum electrolytes were monitored. Patients were then subsequently discharged on antibiotic prophylaxis and followed up in an outpatient clinic with voiding history, abdominopelvic ultrasonography and serial serum creatinine estimation. Late presentation was defined in this study as a patient presenting after 30 days of life. The normal range of serum creatinine in our laboratory is 50–132 μmol/L. Thus, in this study, serum creatinine greater than 132 μmol/l (> 1.5mg/dl} was regarded as indicative of RI. Serum creatinine >70.4 μmol/L after 5–7 days of continuous catherization or 30 days postvalve avulsion or ablation was considered as a poor prognostic index. Initial (early) outcome was measured in terms of renal function (serum creatinine < 70.4 μmol/L) and caliber of urinary stream post valve ablation. Good initial outcome was defined as improvement in urinary stream and renal function following intervention. The following bad prognostic factors (loss of corticomedullary differentiation, subcortical cyst (renal dysplasia), increased echogenic kidneys on renal ultrasound and bilateral reflux, serum creatinine >70.4 μmol/L 1-month postavulsion) were used to predict those that may develop unsatisfactory renal function (ESRD) in future.

Statistical analysis

Data collected were analyzed using Statistical Package for Social Scientists software version 17 for windows (SPSS Inc, Illinois, Chicago, USA). The results were presented as tables and frequencies. Continuous variables were compared with *t*-test and categorical variables with Chi-Square or Fischer's exact test. A $P < 0.05$ was accepted as significant.

Ethical considerations: Ethical approval to conduct this study was obtained from Ife Central Local Government Ethical Review Committee.

Results

From the theater, ward and health information records, there were 54 confirmed cases treated within the study period, giving an average of three cases per annum. Of these 37 (71.2%) with sufficient data were analyzed.

Their age at presentation was from 1st day of life to 8 years (median, 5 months). Eleven (29.7%) were neonates, 17 (46.0%) infants and 9 (24.3%) older children [Table 1]. Only 3 (8.1%) patient had prenatal ultrasound diagnosis about 26–37 weeks of gestational life.

The most common clinical features were voiding dysfunction (characterized by dribbling, poor stream and straining) in all 37 (100%) patients, supra-pubic distension from

palpable bladder 36 (97.3%). Others included fever with core temperature >38°C (n = 7: 18.9%), failure to thrive (n = 6: 16.2%), ascites (n = 4: 10.8%), ballotable kidneys (n = 11: 29.7%), of which 7 (7/11; 63.6%) were bilateral. One patient each had hematuria, patent urachus and hiccups. Eleven patients (29.7%) had anemia (hematochrit <30%) at presentation [Table 2].

Common isolates from urine microscopy and culture were Klebsiella specie 19 (51.4%), mixed growth (8; 21.6%), *Escherichia coli* (1; 2.7%), Pseudomonas (1; 2.7%), and *Staphylococcus aureus* (1; 2.7%). Seventeen patients (18.9%) had no growth. All patients had abdomino-pelvic ultrasound with 31 (83.7%) patients having varying degrees of hydronephrosis, hydroureters, and thick wall bladder. Others ultrasound findings included sub cortical renal cysts (n = 9; 24.3%), loss of corticomedullary differentiation (n = 9; 24.3%), and echogenic kidneys (n = 10; 27.0%).

Voiding cystourethrogram was diagnostic in 31 (83.8%) patients, showing dilated and elongated posterior urethra. There was associated vesico-ureteric reflux in 11 (29.7%) patients; 7 (63.6%) of them had bilateral reflux while 4 (36.4%) had unilateral reflux. IVU with a micturating phase was done in 3 (8.1%) patients. The indications for IVU were suspected renal mass and chronic renal diseases. Cystoscopy was the sole diagnostic investigation in three patients with one benefitting from endoscopic ablation at the same sitting.

Table 1: Age distribution of patients

Age at presentation	*n* (%)
In months	
0-1	11 (29.7)
2-12	17 (45.9)
In years	
1-5	8 (21.6)
6-8	1 (2.7)

Table 2: Clinical features of patients

Clinical features	Frequency (%)
Voiding abnormalities	37 (100)
Distended bladder	36 (97.3)
Anaemia	14 (37.8)
Ballotable kidneys	11 (29.7)
Fever	7 (18.9)
Failure to thrive	6 (16.2)
Ascites	4 (10.8)
Patent urachus	1 (2.7)
Hiccups	1 (2.7)
Hematuria	1 (2.7)

At presentation, 15 (40.5%) patients were in RI while 22 (59.5%) had normal renal function [Table 3]. The mean serum creatinine value of those who presented within the first 30 days of life and those who presented afterwards were 325 (±251) μmol/L and 141 (±100) μmol/L respectively, P = 0.003. After 5–7 days of continuous bladder drainage, 21 (56.8%) had serum creatinine >70.4 μmol/L (0.8 mg/dl), [Table 3]. The mean (± standard deviation) serum creatinine value of children who survived and those who died after continuous bladder drainage for 5–7 days was 109 (±90) μmol/L and 344 (±260) μmol/L, respectively (P = 0.001). One-month postavulsion or vesicostomy, 30 (81.1%) patients returned for follow-up. The percentage of patients (n = 17/30; 56.7%) with serum creatinine >0.8 mg/dl were not different from those at initial 5–7 days of continuous bladder drainage before treatment [Table 3].

Thirty-six (97.3%) patients had initial bladder drainage with Foleys catheter while a 17-day-old who had failed catheterization had supra-pubic cystostomy. Thirty-two (86.5%) patients had further surgical intervention comprising of primary valve ablation (n = 28/32; 87.5%) and vesicostomy (n = 4/32; 12.5%). The primary valve ablations done were trans-vesical valve excision nine, catheter balloon avulsion eight, Mohan's valvotomy 10, and endoscopic valve resection one. The four patients who had vesicostomy subsequently had improved renal function with a resolution of sepsis on admission. There was postavulsion improvement in urinary stream in 27 (96.4%) patients among those who had primary valve ablation. The only patient with poor stream postavulsion had cystoscopy and redo valvotomy. The trend of treatment is shown in Figure 1. Thirty (81.1%) patients were followed up for 1-month postvalve avulsion in our pediatric surgical out-patient clinic. Of these 27 (90%) patients had bad prognostic factors based on the following selected factors: Echogenic kidney (9/30; 30%), loss of corticomedullary differentiation (10/30; 33.3%), subcortical cysts 9/30; 30%), bilateral reflux (7/30; 23.3%), and serum creatinine >70.4 μmol/L 1-month postvalve excision (17/30; 56.7%).

Treatment complications were 3 (8.1%) cases of postobstruction relief diuresis, 2 (5.4%) of hematuria, and 1 (2.7%) each of vesico-cutaneous fistula and incomplete valve avulsion. Five patients died during the period of continuous catheter drainage and thus could not have definitive valve ablation. Of these, three died from renal failure and overwhelming septicemia and two

Table 3: Frequency of patients and serum creatinine estimation pre- and post-intervention

	Normal renal function			RI		Total
Serum creatinine levels (μmol/L)	<70.4*	70.5-88.0	88.1-132	133-211.2	>211.2	
At presentation (%)	3 (8.1)	5 (13.5)	14 (37.8)	7 (18.9)	8 (21.6)	37
5-7 days of continuous catheterization (%)	16 (43.2)	2 (5.4)	9 (24.3)	5 (13.5)	5 (13.5)	37
1-month postvalve avulsion (%)	13 (43.3)	7 (23.3)	8 (26.7)	1 (3.3)	1 (3.3)	30

*Refers to favorable (good) prognostic factor. RI: Renal insufficiency

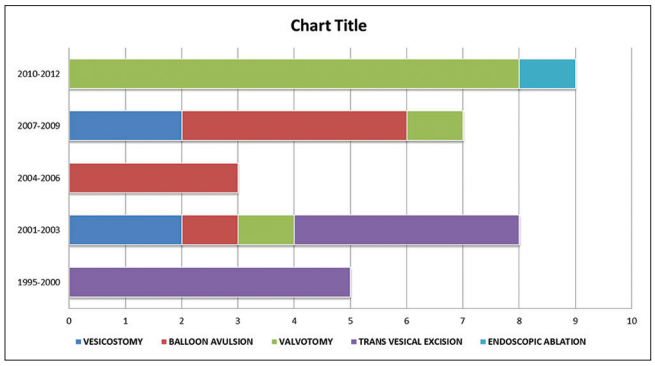

Figure 1: Trend of initial treatment of patients

patients died from septicemia alone. Two patients discharged against medical advice few days after valve avulsion. The median follow-up period was 1-month (range 1–36 months). Only two patients were monitored for 24–36 months with voiding history, clinical examination, abdomino-pelvic ultrasound, blood and urine chemistry with normal renal function and good somatic growth. Their serum creatinine was <70.4 μmol/L (0.8 mg/dl) at 5–7 days of catheterization and 30 days postvalve ablation.

Discussion

PUVs are not uncommon as the paucity of reports on the prevalence in English literature may suggest.[1] An earlier review of childhood obstructive uropathy in Nigeria suggests that the condition is certainly not rare,[4] though it appears as if a lesser number of cases is seen in our center. In the present study, the rate of three children with PUV diagnosed yearly is comparable to 3–8 reported by Uba *et al.*[1] in North Central Nigeria. Perhaps one of the most important reasons for the low prevalence in our environment may not be unconnected to early death in infants with severe obstruction, superimposed infection and acute renal failure, who never get to hospital and were therefore never diagnosed.[1] The use of antenatal ultrasound to diagnose PUV in utero may be lagging behind in most developing countries including Nigeria compared to developed nations because of the low level of antenatal care. Basak[9] reported that the incidence of antenatal diagnosis of PUV is limited to 10% in developing countries. In a study from Nigeria, heavy financial cost of ultrasound scanning, negative perception of patients towards ultrasound scanning, unsatisfactory previous scan experience, long distance to service providers, and long waiting periods have been identified as major obstacles to prenatal diagnosis.[10]

In the present series, 8.1% of cases had prenatal ultrasound diagnosis of PUV and this is consistent with a report by Okafor *et al.* from Southeastern Nigeria.[11] A much higher incidence of 30% was reported by Sudarsanan *et al.*[12] Antenatal diagnosis allows serial monitoring of urinary tract dilatation, fetal serum electrolytes, and amniotic fluid for early intervention in well-selected patients. It also affords the opportunity to begin the process of parental education on the need for long-term renal status assessment.[13] This underscores the importance of public enlightenment about this condition and the need for a high index of suspicion among health workers especially in pregnant women with oligohydramnois in developing countries.

We observed that most patients (11 neonates, 17 infants) were seen during the 1st year of life – while, nine were older children; and this is similar to the findings by Dahab *et al.*[14] and Uba *et al.*[1] As in previous studies,[1,5,15] all patients presented with one form of obstructive symptoms or another. In addition, most of our patients presented late with distended and palpable bladder, ballotable kidneys, and renal impairment. The presence of ballotable kidneys suggests back pressure effect from the infravesical obstruction with attendant hydroureter and hydronephrosis. This predisposes to stasis of urine and colonization by bacteria with attendant sepsis and fever.

The gold standard for diagnosis of PUV is voiding cysto-urethrogram (VCUG).[15,16] In our study, VCUG demonstrated dilated and elongated posterior urethra due to obstructing valves in 83.8% of cases. Cystoscopy was done in three patients with direct visualization of the valves. However, cystoscopy is not yet routinely employed in our center due to lack of appropriate size endoscopes for neonates and younger infants. In a study of 17 African children by Van Den Bulcke and Hennebert,[17] they found no demonstrable reflux and concluded that the ureterovesical junction in Africans may be anatomically different and that the African bladder responds differently to lower urinary tract obstruction. In contradistinction to their findings, VCUG demonstrated vesicoureteric reflux in 29.7% of our patients. This compares favorably with the 22% reported by Uba *et al.* in North Central Nigeria. A much higher figure was reported in India[6] and Iran.[18] Future prospective studies are necessary to elucidate the presence of VUR in African boys with PUV.

The abnormal renal function was found in 40.5% of the boys which is comparable with 71.4% reported by Odetunde *et al.*[5] and Uba *et al.*[1] in Nigeria, but in conflict with 15.4% reported by Dahab *et al.*[14] Elevated serum creatinine level has been documented to be associated with poor prognosis in PUV patients, and this may not be reversed even with the relief of the obstruction. Hendren[19] and Parkhouse *et al.*[20] noted that early presentation of PUV was viewed as a poor prognostic sign and suggestive of a severe form of obstruction. The late presentation suggested a lesser degree of obstruction with little clinical significance. We noted in our study that children who presented early (in the neonatal period) had significantly worse serum creatinine levels ($P < 0.05$) compared to older children, thus, it is imperative to promptly investigate and rigorously manage children presenting early in life with PUV. Unfortunately, we are unable to relate the initial serum creatinine to long-term renal function in these children due to the loss to follow-up.

Earlier studies have reported various operative techniques.[21-23] The advantages of each of these procedures have equally been documented. In this report, most of the valves were avulsed

or disrupted using Mohan's valvotome, although a sizeable number of our patients had balloon catheter avulsion or trans vesical resection of valves. These techniques produced improvement in urine flow and renal function in our patients. Since the introduction of pediatric endoscopes, most workers have embraced endoscopic resection of valves. Sadly, the nonavailability of this equipment is a barrier militating against their use in our center though one older child benefitted from endoscopic resection in our series. Furthermore, there was no antenatal intervention because of the lack of experience in these techniques in our center. Four patients had vesicostomy in our series due to refractory urinary tract infection and persistent elevation of serum creatinine. We found that vesicostomy is a very useful method of diversion, as functioning vesicostomy provides adequate drainage of the upper urinary tract with improvement in renal function. It allows cycling of the bladder to take place at low pressure. Bilateral ureterostomy has been advocated by some authors[24,25] as a better alternative method of diversion in patients whose serum creatinine level have remained persistently high, and the upper urinary tract dilatation did not improve significantly.

The mortality rate of 13.5% in the present series was consistent with 12.9% reported by Okafor *et al.*,[11] but in contrast to 4.9% by Uba *et al.*[1] Some workers recorded no mortality.[12] Uremia with superimposed infection was the cause of death in three patients while overwhelming sepsis alone was the cause of death in the remaining two patients in this series. This underscores the need to adequately and effectively control infection and uremia as urgently as possible to achieve a good outcome in such children.

Two patients were followed up for 2–3 years with good somatic growth and normal renal function (serum creatinine <70.4 μmol/L). It is important to note that the serum creatinine values of these patients had been consistently <70.4 μmol/L (0.8 mg/dl) since valve fulguration. The rest were lost to follow-up within 6–12 weeks after valve ablation.

Studies[7,8,26-30] have documented different variables that may have predictive value or be responsible for the long term development of ESRD after initial therapy. Prenatal detection of PUV before 24 weeks of gestation, poor compliance and presentation before 1-year of age could predict an unfavorable long-term renal function. Others factors implicated include bilateral reflux, echogenic kidneys, loss of corticomedullary differentiation, sub cortical cysts (indicative of renal dysplasia) and serum creatinine >70.4 μmol/L (0.8 mg/dl) 1-month postvalve avulsion. Serum creatinine levels at 4–5 days of continuous catheterization and glomerular filtration rate at a year old also strongly correlate with final renal function. In the present study, 90% of our patients had one form of selected poor prognostic factors or another though we were unable to follow them up for a longer period. Hence, PUV should be taken as a public health issue in our environment. Health education, adequate parental counseling and routine prenatal ultrasound screening are germane to early diagnosis, long-term monitoring and treatment when necessary.

Conclusions

Early presentation in life seems to be associated with the worse renal function. A larger percentage of our patients had one form of a poor prognostic factor or another. Trans-vesical, Mohan's and balloon valve ablation techniques afford an improvement in the urine stream and some improvement in renal function. Vesicostomy was found useful in those patients with refractory renal impairment and associated sepsis in patients who were already on the urethral catheter. Mortality is often as a result of sepsis and renal dysfunction. The postintervention follow-up is poor.

Limitation

A major limitation is its retrospective nature; hence, a prospective study is recommended to determine the best management method and long-term outcome of patients with PUV.

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Conflicts of interest

There are no conflicts of interest.

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