Imaging and clinical findings in late presenting posterior urethral valves in a resource-constrained economy

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Abstract

Posterior Urethral Valve (PUV) is the commonest cause of lower urinary tract obstruction in male children. Late presentation with delayed diagnosis is common in our setting. This study aims to review the clinical, biochemical, imaging findings and parental factors in late-presenting posterior urethral valves. A retrospective analysis of patients with PUVs seen at UNTH from 2011-2019 was done. Patients who presented at or later than six months of age were considered late presenters and were studied. Patients' sociodemographic characteristics, antenatal diagnosis, clinical features, and imaging findings at presentation were retrieved. Data analysis was done using SPSS version 22. Statistical significance was set at a p-value<0.05. Twenty-four cases of PUV with complete clinical data were studied. Mean age 3.3 (SD±2.1) years had a positive association with maternal educational level (p≤0.001). Nineteen (72.9%) had antenatal care, 4 (16.7%) had prenatal Ultrasonography (USS), and were part of those who had antenatal care. None had a prenatal diagnosis. Prenatal USS was associated with higher paternal education (p=0.03). The most common clinical symptom and finding respectively were straining to pass urine 23 (95.8%) and palpable bladder 23 (95.8%). The common electrolyte derangements included hyperkalemia (50%), raised serum urea (70.8%) while postnatal hydronephrosis 23 (95.8%) was the main ultrasound and MCUG findings. Late presentation is common with urinary dysfunction and azotemia. Improved antenatal care including late trimester ultrasound and parental health education will enhance prenatal diagnosis and early presentation.

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Introduction

Posterior Urethral Valves (PUV) constitute the commonest cause of lower urinary tract obstruction in male children.[1,2] Classic abdominopelvic ultrasound findings in PUV include bilateral hydroureteronephrosis, distended bladder with thickened bladder wall, and dilated posterior urethra.[3,4] The diagnosis is made prenatally or at birth, when male newborns are evaluated for prenatal hydroureteronephrosis, or in early childhood, but rarely during adolescence or adulthood.[5] Prenatal ultrasound has increased the early diagnosis of PUV[6] and this allows for serial monitoring of urinary tract dilatation, fetal serum electrolytes, and amniotic fluid for early intervention in well-selected patients.[7] It also allows beginning the process of parental education on the need for long-term renal status assessment.[8]

In Low and Middle-Income Countries (LMIC) diagnosis is often made in the postnatal period based on clinical features and imaging findings.[7,9,10] In late presentation prolonged and unrelieved lower urinary tract obstruction leads to back pressure effects on the upper urinary tracts resulting in obstructive uropathy with renal impairment.[11] The proper drainage of the upper urinary tract is hampered by a combination of poor bladder sensation, high bladder volumes, and poor compliance producing high storage pressures. Delayed presentation of PUV has a worse prognosis compared to early presentation as prolonged renal damage results in poor long-term outcomes,[10] with long-term morbidity and further operative procedures.[12] It has also been observed that presentation at extremes of life was associated with poorer outcomes.[4]

In our setting, late presentation is common and patients may present with bladder dysfunction and urosepsis. Radiological

investigations are used for diagnosis and include abdominopelvic USS, Micturating Cystourethrography (MCUG), and Intravenous Urography (IVU). MCUG may show a trabeculated bladder, elevated bladder neck, and dilated posterior urethra.[3,4] We rely on these findings together with the clinical features of dysfunctional voiding for the diagnosis of PUV in these patients.

This study is a review of the clinical, biochemical, and imaging findings in late presenting PUVs and an evaluation of the impact of parental education.

Materials and Methods

This was a retrospective analysis of all patients with posterior urethral valves managed at the University of Nigeria Teaching Hospital (UNTH) Enugu from January 2010 to December 2019. Presentation at or after six months of age was considered a late presentation.[13] Patients who were aged 6 months and above at presentation were included in the study. Those aged less than six months at presentation or who died without completing biochemical and radiologic investigations were excluded.

Information regarding age at presentation, parents' occupation and level of education, antenatal care, clinical presentation, and imaging findings at presentation were extracted from the patient's case notes from the hospital medical records.

Data analysis

Data entry and analysis were done using SPSS 22. Fisher's exact test was used to determine the association between age at presentation, prenatal USS, and parental level of education and occupation, and a p-value less than 0.05 was deemed significant. Ethical clearance for this study was obtained from the Health Research and Ethics Committee of the University of Nigeria Teaching Hospital, Ituku-Ozalla (HREC/05/01/2008B/-FWA00002458-1RB00002323).

Table 1. Sociodemographic data and medical evaluation profile.

Variables Age in years		Highest level of education Maternal/Paternal		Number (%)	Maternal/Paternal occupation		Number (%)
Mean (SD)	8.9 (4.3)	Primary and below	Mothers Fathers	4 (16.7) 5 (20.5)	Public servant	Mothers Fiathers	2 (8.3) 3 (12.5)
Range	1-22	Secondary	Mothers Fathers	8 (33.3) 5 (20.5%)	Traders	Mothers Fathers	8 (33.3) 3 (12.5)
Age at presentation (years)		Tertiary	Mothers Fathers	4 (16.7) 6 (25.0)	Skilled crafts	Mothers Fathers	2 (8.3) 6 (25.0)
Mean (SD)	3.3 (2.9)	Not recorded	Mothers Fathers	8 (33.3) 8 (33.3)	Farmers	Mothers Fathers	5 (20.6) 6 (25.0)
Antenatal care (ANC)		Total	Mothers and Fathers	24 (100)	Housewife Unskilled crafts	Mothers Fathers	2 (8.3) 2 (8.3)
Yes (%)	19 (79.2)				Unrecorded	Mothers Fathers	5 (50.6) 4(16.7)
None/not recorded	5 (20.8)						
Prenatal USS							
Yes (%)	4 (16.7)						
No /not recorded	20 (83.4)						
USS done by							
Radiologist (%)	2 (8.3)						
Radiographer (%)	2 (8.3)						
Total	4 (16.7)						

Table 2. Association of parental level of education and age at presentation and prenatal diagnosis.

Variable	Mothers Educational level Primary & below (n=6); (%)	Secondary (n=8); (%)	Tertiary (n=4); (%)	X^2	P-value
Age at presentation. (years)					
0.5-1	0 (0)	3 (37.50)	2 (50.00)		
1-2	2 (33.33)	0 (0.00)	0 (0.00)	0.004	0.000
2-3	0 (0.00)	3 (37.5)	1 (25.00)		
3-4	1 (16.67)	2 (25.00)	0 (0.00)		
4-5	0 (0.00)	0 (0.00)	1 (25.00)		
>5	3 (50.0)	0 (0.00)	0 (0.00)		
Prenatal USS	**Primary and below n=6 (%)**	**Fathers' level of education Secondary n=5 (%)**	**Tertiary n=5 (%)**		
Yes	0 (0.00)	1 (20.00)	3 (60.00)	0.03	0.03
No.	6 (100.00)	2 (40.00)	3 (60.00)		

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Results

A total of 87 cases of posterior urethral valves were seen within the period of study. The finding of 87 cases of posterior urethral valves in our center over ten years shows a prevalence of 8.7cases per year. Forty-four (50.6%) of them presented late, but only 24 (54.5%) case notes were retrieved and analyzed owing to incomplete or missing data of the study participants. At presentation, the mean age was 3.3 years (SD 2.1), range 0.5-11 years. Most of the fathers (70.8%) were traders (12.5%), farmers (25.0%) and artisans (33.3%). Only 4 (16.7%) of the mothers and 6 (25.0%) of the fathers had tertiary education. Nineteen (72.9%) of them had antenatal care but only 4 (16.7%) had prenatal Ultrasonography (USS) and prenatal diagnosis was made in none (Table 1).

Fisher's exact test showed a strong association between age at presentation with the maternal highest level of education ($p<0.001$) and paternal level of education was significantly associated with prenatal USS ($p=0.003$). None of the patients whose mothers' highest level of education was primary education presented before 1 year of age, majority presented after 3 years of age. None of the patients whose fathers' highest level of education was primary education had prenatal USS, while 60% of those whose fathers had tertiary education had prenatal USS (Table 2).

Clinical presentation was mostly with voiding dysfunction and included straining at urination with a palpable bladder (95.8%), urinary incontinence (83.3%), abdominal swelling (75%), and recurrent urinary tract infection (75.0; Table 3).

Serum potassium was normal in half of the patients, 17 (70.8%) had a raised serum urea and 11 (45.8%) had a raised serum creatinine (Table 4).

Postnatal USS showed hydronephrosis in 23 (95.8%) and pathologic bladder changes in 22 (91.7%). Micturating Cystourethrogram (MCUG) showed Vesicoureteric Reflux (VUR) was seen in 13 (54.2). Other imaging studies were not done or not reported (Table 5).

Discussion

Posterior urethral valve remains one of the causes of chronic kidney disease and progression to end-stage renal disease later in childhood. The higher prevalence of PUV recorded in our center when compared with reports from other facilities suggests a high volume in our center.[7,8] probably because our hospital is a tertiary

Table 3. Clinical presentation of study participants.

Symptoms	Frequency (%)
Straining to pass urine	23 (95.8)
Poor urine stream	21 (87.5)
Incontinence/Dribbling of urine	20 (83.3)
Crying during micturition	19 (79.2)
Abdominal swelling	18 (75.0)
Recurrent fever	18 (75.0)
Urinary frequency	14 (58.3)
Failure to thrive	9 (37.5)
Passage of urine thru the umbilicus (patent urachus)	2 (8.3)
Examination findings	
Palpable bladder	23 (95)
Abdominal distension	14 (58.3)
Pallor	13 (54.2)
Febrile	11 (45.8)
Generalized edema	5 (20.8)
Hypertension	5 (20.8)
Ascites	1 (4.2)
Ballotable kidney	
Left	2 (8.3)
Right	2 (8.3)
Bilateral	8 (33.3)
None	12 (50.0)

Table 4. Renal function tests (serum electrolytes, urea, and creatinine).

Mmol/L	Frequency (no.)	Percentage (%)	Mean (SD)	Range
xx↑↓Sodium	10	41.7	138.1 (9.6)	118.0-164.0
↑Potassium	12	50.0	4.5 (0.7)	3.1-6.0
↓Chloride	4	16.7	104.4 (6.8)	89-125.0
↓Bicarbonate	16	66.7	17.8 (5.7)	6.0-30.0
↑Urea	17	70.8	51.0 (20.5)	4.0-193.0
↑Creatinine	11	45.8	1.5 (0.7)	0.3-3.9

↓: reduced/low; ↑: raised/high.

Table 5. Characteristic findings on ultrasound and mictuirating cystourethrogram MCUG.

Ultrasound findings	Frequency (%)
Hydronephrosis	
Left	2 (8.3)
Right	2 (8.3)
Bilateral	19 (79.2)
None	1 (4.2)
Dilatation of calyces	
Yes	19 (79.2)
No	5 (20.8)
Dilatation of ureter	
Left	2 (8.3)
Right	2 (8.3)
Bilateral	15 (62.5)
None	4 (16.7)
Bladder wall changes	
Yes	20 (83.3)
No	4 (16.7)
MCUG	
Bladder changes	
Yes	22 (91.7)
No	2 (8.3)
Vesicoureteric reflux	
Left	4 (16.7)
Right	3 (12.5)
Bilateral	6 (25.0)
None	11 (45.8)
Dilatation of posterior urethra	
Yes	16 (75.0)
Not recorded	8 (25.0)

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center and several referrals were made. For this study, we defined late presentation as presentation at or later than six months of age and found that more than half of the patients presented late (44, 50.8%). This contrasts with 38% reported by Killian and colleagues.[13] The late presentation in our series could be attributed to several factors including poor parental awareness. Mean age at presentation of about 3 years agrees with a pattern of late presentations and compares with other studies in the region.[9,14,15]

Findings from this study showed that at presentation, a majority had straining while passing urine and recurrent UTI which is in keeping with findings from other researchers.[9,11,1,14,15] Recurrent urinary tract infection is a major mode of presentation in our study as was noted by other workers.[9,11,16] The causes of UTI in these patients are varied and include urinary stasis arising from anatomic or functional obstruction, dysfunctional elimination syndrome, instrumentation of the urinary tract, and VUR.[11]

In more than half of the patients, there was no evidence of impaired renal function. This finding could imply that those who present late have milder forms of obstruction reducing the degree of back pressure on the upper urinary tract and kidney and compares with the findings of Killian *et al.* who noted that none of the patients in their study on late presenters required a renal transplant.[13] It however contrasts with other studies that showed significant renal impairment in late presenting PUVs.[15,17,18]

Upper urinary tract dilatation with pathologic bladder changes were noted in the majority of the patients, more than half had vesicoureteric reflux and the posterior urethra was dilated in all and this compares with the report of many other authors.[9,14,19] Ozen and colleagues in a study of the place of MCUG in late PUV, however, reported positive detection of PUV in only 58.8% of their patients and cautioned that the diagnosis may be missed despite normal MCUG. They recommended that cystoscopic examination should be preferred for the diagnosis of PUV in older boys regardless of VCUG results.[20] However, this investigative tool is not yet available in our center. The conflicting data in numerous studies indicate that postnatal age at diagnosis alone is not a reliable factor in predicting outcomes in patients with PUVs.

The reasons for late presentation of PUV in this study include poverty, parental ignorance, paucity of specialist care, and suboptimal prenatal ultrasound scan utilization and compares with findings of other researchers in the sub-region.[21,22] Our study shows a very low uptake of prenatal USS despite high attendance to antenatal clinics and no prenatal diagnosis. This compares with the study by Ikuerowo and colleagues in Lagos and other workers.[9,14] Only 6 (25%) of the mothers and 7 (29.1%) of the fathers in this study had tertiary education and a strong association with the maternal level of education and age at diagnosis was demonstrated, likewise paternal education and prenatal ultrasound. The majority of those who presented as older children had mothers who did not have tertiary education. We found no similar studies to compare this finding as there is a paucity of published work on the association of age at presentation in PUV with parental education. There is, however, a cultural attitude that places more value on the male child in our environment. Prenatal ultrasound is therefore used by mothers mostly for the determination of the sex of the unborn child rather than for pathological observation and encourage formal education. This might explain the lack of association between maternal level of education with prenatal diagnosis though the association with the paternal level of education was significant. A more qualitative study would be required to ascertain the exact reason for this observation. The low level of detection of PUV by prenatal ultrasound can also be explained by the lack of experts in prenatal imaging hence missed diagnosis.[14] This calls for improvement in the training of relevant personnel. It is also important that antenatal clinics are organized in such a way that prenatal USS is carried out by trained radiologists for prenatal diagnosis. Indeed, 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.[14]

Limitations

The study is limited by its retrospective nature with resultant incomplete data in the case notes.

A prospective study would have made it possible to better categorize the parents according to their social status for the examination of its association with age at presentation.

Conclusions

Late presentation of posterior urethral valves is still common in our setting due to poor parental awareness, poverty, and low-scale prenatal diagnosis. Urinary dysfunction with pathologic bladder changes and recurrent urinary tract infections are the commonest modes of presentation. Common radiological findings include hydroureteronephrosis and vesicoureteric reflux. Improvement in the conduct of antenatal services with an emphasis on prenatal diagnosis and widespread public enlightenment and other measures to alleviate poverty will be necessary for early presentation, diagnosis, and better outcomes.

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