Posterior Urethral Valves; Outcome Analysis after Endoscopic Valve Ablation

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ABSTRACT

Introduction: Posterior urethral valves, a major male infra-vesical obstructive uropathy leading to chronic renal failure are most common paediatric urological emergencies with an incidence of 1:5000 -1:8000. Early diagnosis, management and follow up of these patients is challenging in low socio-economic countries like Nepal. This study evaluates the cases with posterior urethral valves and their outcomes after endoscopic valve ablation over a period of five years.

Methods: In this five year retrospective study from January 2016 to December 2020, all the cases with posterior urethral valves undergoing endoscopic valve ablation were reviewed and data were analysed for age, presentation, diagnosis and outcome at follow-up after management.

Results: A total of sixty patients with posterior urethral valves were managed with definitive endoscopic ablation in the five year period. Median age at ablation was 11 months (10 days to 4 years). Commonest presentation was features of bladder outlet obstruction evident by poor stream, straining and dribbling of urine. Only 26.7% cases were managed in neonatal period due to low suspicion of valve in prenatal fetal scan. 83.3% of patients had complete relief from obstruction with normal urinary stream at follow up after ablation of valves with 15% of cases needing re-ablation of the residual valve. Two cases had to undergo anti-reflux surgery two years after valve ablation. Mortality was seen in one case due to cross sepsis. Majority of patients were in regular follow-up which showed its direct relationship to the outcome of the disease after valve ablation.

Conclusion: Early detection, proper relief of obstruction and regular follow-up strategies can avoid life threatening complications of posterior urethral valves. Only treating posterior urethral valves is not the aim of obtaining successful relief of obstruction. Parent's education, developing prenatal ultrasound skills to detect or suspect prenatal PUVs and early referral to tertiary centers where these patients can be managed promptly are equally important.

Keywords: Endoscpic valve ablation Outcome; Posterior urethral valve (PUV).

INTRODUCTION

Posterior urethral valves (PUV) are one of the commonest causes of chronic renal failure (CRF) and end-stage renal disease (ESRD) in male children.[1] It is the most common congenital anomaly of lower urinary tract in boys causing bladder outlet obstruction with an incidence of 1 in 5000 to 8000 live male births. Posterior urethral valve was first described in 1717 by Morgagni and later by Langenbeck in 1802.[2] Though the embryology and etiology of PUV is not clearly known, it is classified in three types: Type I – the most common type, where valves represent folds extending inferiorly from verumontanum to the membranous urethra, Type II – valves are leaflets radiating from the verumontanum proximally to the bladder neck and Type III – valves are concentric diaphragms within the prostatic urethra, either above or below verumontanum.[3]

Majority of the boys with posterior urethral valves present with poor stream, straining during micturition, dribbling of urine after birth.[4] In those cases which are undiagnosed in neonatal period present with various

degree of complications of posterior urethral valve like repeated urinary tract infections and urosepsis, impaired renal function, chronic anemia, failure to thrive, overflow urinary incontinence, chronic kidney diseases (CKD), hypertension, poor quality of life and even death. These complications are consequences of bladder outlet obstruction from persistent and unrelieved pressure on the bladder leading to bladder diverticulum, hydronephrosis, reflux and chronic to end-stage renal disease.[2] All these consequences of posterior urethral valve are preventable if early diagnosis is made and adequate bladder drainage is established either by initial continuous catheter drainage or vesicostomy or eventual management by endoscopic valve ablation.[4]

With the recent advancements in fetal ultrasounds, most of the cases are diagnosed or are suspected of posterior urethral valves prenatally and early postnatal diagnosis is done. Prenatal posterior urethral valves can be suspected in the presence of fetal proximal urethral dilatation, hydronephrosis – usually bilateral and oligohydramnios .[4]However, postnatal micturating cystourethrogram (MCUG) remains the gold-standard for the diagnosis of PUVs. Visualization of the valve leaflets, bladder trabeculation, dilated or elongated posterior urethra, hypertrophied bladder neck, and with or without vesico-ureteric reflux (VUR) is seen on MCUG.[3] Even after the early diagnosis and eventual management of PUVs, the disease process can be severe. Thus long-term follow-up for the children with PUV is needed in terms of blood pressure, growth and weight, creatinine and electrolytes, urinary tract ultrasound, isotope scan, urodynamic-uroflowmetry and micturating cystourethrogram.[3,5]

The endoscopic ablation of PUV is the gold standard treatment for the management of posterior urethral valves which can be achieved by diathermy fulguration, Fogarty balloon dilatation, Bugbee electrode fulguration, Laser ablation and Cold knife incision. Among these, diathermy fulguration is the preferred method in which appropriate pediatric resectoscope of size 8.5F to 11.5F or cystoscope of size 6.5F to 8.5F are used in adjunct with diathermy hook electrode and glycine is used as an irrigating solution during the procedure.[5]

Thus, this study retrospectively evaluates the cases of PUVs and their outcomes after Endoscopic Valve Ablation in our institute over a period of five years.

METHODS

This was a five years (January 2016 to December 2020) retrospective descriptive study conducted in the pediatric surgery, department of Ishan Children and Women's Hospital, Kathmandu, Nepal. All the patients undergoing diathermy fulguration of valves with diagnosis of Posterior Urethral Valves over a five year period were included in the study. Approval of the study was received from the hospital's Institutional Review Board and research committee. Information regarding the patient's age, clinical features, radiological and laboratory findings, management and its outcome were retrieved from hospital records and information systems. A minimum of 6 months (up to 5 years) follow up data were obtained and were analyzed using Microsoft Excel datasheet. The results obtained were presented in the form of means/standard deviations and percentages.

In all the patients' diagnosis was confirmed by Micturating Cystourethrogram (MCUG) after obtaining sterile urine. Valves were fulgurated using 6.5F sized cystoscopy in neonates and infants and 8.5F sized cystoscopy in older children in adjunct with diathermy hook electrodes. After fulguration of the valves, adequate sized urinary catheter was placed in-situ, which was removed on second postoperative day and the patients were discharge on 3rd postoperative day with chemoprophylaxis for the period of 6 months to 2 years depending on the resolution of vesico-ureteric refluxes. All the patients were followed up postoperatively on 2nd week, 1st month, 3rd month, 6th month and then yearly. On follow up, patients were evaluated for growth and weight, creatinine and electrolytes, urine analysis, urinary tract ultrasound in early follow-up and isotope scan, micturating cystourethrogram after 6th months. Cotrimoxazole in low dose was the drug of choice for prophylaxis in all the children.

RESULTS

During this five-year retrospective study, a total of 60 boys with posterior urethral valves were included. They were managed with endoscopic diathermy hook ablation of posterior urethral valves. No patients needed vesicostomy as external urinary drainage. Mean age at presentation was 1.2 years (median age at ablation was 11 months), ranging from 10 days of life to 4 years of age. Type I PUV was most commonly seen in 56 boys and other types in 4 patients (type II and type III in each of 2 boys). About one-fourth of the patients (26.7%) were managed with diathermy hook ablation in neonatal period, all these 16 boys were suspected of PUVs in antenatal fetal ultrasound. Rest 20 (33.3%) presented between 1 month to 1 year age and another 24 (40%) beyond 1 year of age.

Table 1: Presenting Clinical Features in patients with posterior urethral valves

Presenting features	Frequency
Poor stream, straining and dribbling	55 (91.7%)
Urinary tract infection	22 (36.7%)
Palpable bladder	9 (15%)
Features of AKI	4 (6.7%)
Urinary retention	3 (5%)
Features of CKD	2 (3.3%)
Pyuria	2 (3.3%)
Hematuria	2 (3.3%)
Failure to thrive	2 (3.3%)

Almost all the cases (55 of 60) presented with poor stream, straining and dribbling as the feature of bladder outlet obstruction, 16 (26.7%) were prenatally diagnosed or suspected of PUVs, other presentations included urinary tract infection in 22 (36.7%) with Escherichia coli being most common organism, palpable bladder in 9 (15%), urinary retention in 3 (5%), features of acute kidney injury (AKI) in 4 (6.7%), features of chronic kidney disease (CKD), pyuria, hematuria and failure to thrive in each of 2 (3.3%) patients respectively (Table1).

Ultrasonography of renal system showed isolated hydro-ureteronephrosis (HDUN) in 19 (31.7%) patients without vesico-ureteric reflux in subsequent voiding cystourethrogram (VCUG), 41 (68.3%) had vesico-ureteric reflux in various grades. Bilateral hydro-ureteronephrosis was seen in 10 (16.7%) boys while 4 (6.7%) had right sided HDUN and 5 (8.3%) had HDUN on left side. All the patients had MCUG done after obtaining sterile urine, showing dilated posterior urethra in all, diverticulum in 10 (16.7%) patients, ureterocele in 1 (1.7%) patient, vesicoureteric reflux in 41 patients, bilateral VUR in 28 (grade III=8, grade IV=10, grade V=10), right sided VUR in 6 (grade III=4, grade IV=2) and left sided VUR in 7 cases (grade III=2, grade IV=4, grade V=1) (Table 2).

Table 2: Radiological findings in patients with posterior urethral valves

Radiological Findings	Frequency
Isolated hydroureteronephrosis on USG	19 (31.7%)
Bilateral HDUN	10 (16.7%)
Left HDUN	5 (8.3%)
Right HDUN	4 (6.7%)
Vesicouretric reflux on VCUG	41 (68.3%)
Bilateral VUR	28 (46.7%)
Left VUR	7 (11.7%)
Right VUR	6 (10%)

Preoperatively, cases with urinary retention, AKI, CKD, urosepsis and those with urinary tract infections were managed with urethral catheterization, intravenous antibiotics till sterile urine was obtained. After confirmation of PUV, endoscopic diathermy fulgurations of valves was done and post-operative catheter was removed on 2nd postoperative day with improvement in urine stream and flow after removal of catheter and patients were discharged on 3rd to 5th postoperative day with low dose chemoprophylaxis. There was no immediate complication in any of the patients. Follow up of patients was done on the 10th day, 1 month, 3 months, 6 months, and then yearly. Follow-up data at 6 months and up to 5 years was obtained to compare outcome and complications of posterior urethral valves after endoscopic valve ablation. There was significant improvement in almost all patients at 3 months follow-up in respect of renal ultrasound, urinalysis, renal function test, except 1 patient who died after 2 months of valve ablation due to overwhelming sepsis and end stage renal disease. At six months from valve ablation, along with urinalysis, renal function and renal ultrasound, voiding cystourethrogram was done to compare with preoperative findings. A total of 50 (83.3%) boys had improvement in all the studies and rest 9 (15%) had persistence of VUR as of pre-operative findings and recurrent urinary tract infections and had features of residual valve on MCUG. All these 9 patients needed redo diathermy fulgurations between 9 to 12 months of previous surgery. Among these 9 boys, 7 had shown significant improvement on subsequent follow-ups but 2 boys had persistence of reflux without evidence of residual valve and deterioration on isotope scan and these two patients needed bilateral ureteric re-implantation after two years of follow-up. Among 50 patients with significant improvement at 6 months post ablation of valve, 5 (8.3%) patients showed solitary hydroureteronephrosis on renal ultrasound in mild to moderate form, 9 (15%) patients had refluxes in lower grades (I - III), five showing grade I VUR, two each with grade II and III, and five patients has 1 to 2 episodes of urinary tract infection. All these 5 were culture proven and were managed by oral antibiotics, mostly with oral ofloxacin. With the commencement of this study almost 50 percent of patients are being followed up for more than 2 years and they are doing well with smooth recovery.

DISCUSSION

Posterior urethral valves remain the most common congenital anomaly that impair renal and bladder function leading to renal failure in children and its diagnosis and management remains a major challenge in developing countries.[3,6] In this retrospective study, on average 6 cases of PUVs were managed per annum, which was

slightly higher than the study from Cameroon by Tambo et al.[2] and in Africa by Talabi et al. [7] where they had managed 2 to 3 cases per annum. But a study from Nigeria by Jeja et al.[8] and Ajao et al.[6] had a higher rate indicating higher incidence in developing countries. These higher cases per anum may be due to unavailability of facilities for endoscopic management of PUVs in peripheral health centers in developing countries like Nepal and our hospital being a tertiary referral center.

Posterior urethral valves can be suspected or diagnosed in utero during prenatal fetal ultrasonography, only 26.7% cases were suspected prenatally in this study and were managed in neonatal period. This number was similar to study from Iran by Mirshemirani et al.[3] and from Nigeria by Agbugui et al.[4] but less in comparison to study from India by Sarma.[1] Lower rate of prenatal ultrasound suspicion of PUVs in developing countries can be related to irregular scan, lack of scan experts in local setup, lack of health services facilities or lack of consciousness in low economy populations. This early suspicion of the disease has a direct impact on outcome after early intervention and in preventing renal damage. In our study 40% cases were managed late, that is after 1 year of age, median age being 11 months, which is quite low in comparison to studies done in Cameroon by Chiabi et al.[9] and Tambo et al.[2] Those cases which missed prenatal ultrasound suspicion of posterior urethral valves had been referred from primary and secondary health centers after post natal presentation which has contributed to a slight earlier management of patients with PUVs in comparison to other developing countries.

Features of bladder outlet obstruction like poor stream, straining and dribbling was seen in almost all cases with 36.7% cases of urinary tract infection, which was similar to other studies from Cameroon by Chiabi et al.[9], in India by Bhaumik et al.[10], in Nigeria by Ajao et al.[6] Other presenting features were fewer in numbers, 15% with palpable bladder, 6.7% with features of acute kidney injury, and 5% with urinary retention. For the confirmation of the valves, renal ultrasonography and voiding cystourethrogram (VCUG) was done in all the patients, vesicoureteric reflux was seen in 68.3% cases with bilateral VUR in 46.7%, right sided VUR in 10% and left side VUR in 11.6% in various grades. Similarly study in Iran by Mirshemirani et al.[3] had 61.2% VUR (right 10.2%, left 20.4% and bilateral 30.6%). All the patients had dilated posterior urethra on VCUG, and only 31.7% patients had no refluxes but showed hydro-ureteronephrosis on renal ultrasound scan.

The endoscopic valve ablation by various techniques has been described. In our setup all the cases underwent valve ablation using diathermy hook . Following ablation of the valve, 83.3% cases had successful relief of obstruction while 15% had persistence of VUR and had residual valve at 6 month VCUG and these patients needed redo ablation of valve for complete drainage. Success rate after valve ablation was comparable to various other studies as seen in Cameroon by Tambo et al.[2] with similar successful relief of drainage, with residual valve needing repeat valve ablation in 16.7%, while 15.3 and 13% respectively in study by Mirshermirani et al. [3] and Sudarsanan et al .[11] In our study there was single mortality (1.7%) following 2 months of valve ablation due to sepsis and end stage renal disease. Higher mortality rate was observed in study from Cameroon 5.6%. [2], Nigeria 4.9%.[12], Iran 5.1%.[3], and Canada 3.8%.[13] respectively. Few complications like urethral stricture were observed in other studies but there was no such complication in any of our patients, but 2 (3.3%) patients needed anti-reflux surgery after 2 years of persistence of VUR.

Patients followed-up regularly after obtaining complete recovery, which may be due to satisfactory urinary stream after relief of obstruction. Very few patients were lost to follow up. Parent counselling and education about the disease progression pathology and the importance of follow-up and renal damage even after complete valve ablation was done for better follow up management of these patients.

CONCLUSION

With early detection, proper relief of obstruction and regular follow-up strategies, life threatening complications of PUVs can be avoided with minimal hazards. Treating posterior urethral valves is not the only aim of obtaining successful relief of obstruction. Parent's education to incorporate regular follow-up along with developing prenatal ultrasound facilities reachable to all primary health centers and developing skills to detect or suspect prenatal PUVs is very important. Early referral to tertiary centers is another important step for proper management.

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