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ORIGINAL ARTICLE

Posterior urethral valves: a single center experience over 7 years

Bindu Sudarsanan · AbdulRasheed A. Nasir · Ramakrishnan Puzhankara · Prashant M. Kedari · Gopidas R. Unnithan · Kalyan Ravi Prasad Damisetti

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Abstract
Purpose To evaluate the outcome of management of 65 consecutive children with posterior urethral valves (PUV) using two techniques of valves ablation.
Methods Retrospective review of 65 consecutive children with PUV managed over 7 years. There were two groups based on the methods of valves ablation: either Mohan's urethral valvotome for primary cases or electrocautery fulguration for patient with previous intervention. Serum electrolyte and serial post-void residue (PVR) were monitored in outpatient clinic. Alpha-blockers were started in all cases with high PVR. Management outcome of patient who had valves ablation with Mohan's valvotome were compared with those who had endoscopy fulguration.
Results Sixty-one patients were regular on follow-up with a median age at presentation of 45 days. Nineteen (31%) patients were diagnosed antenatally. There were 32 refluxing ureters in 26 patients; 58 (95%) underwent primary valve ablation (37 with Mohan's urethral valvotome, 21 fulguration). Reflux disappeared in 10 (36%) refluxing ureters. There were five (8.2%) urethral strictures (all five in fulguration group), eight residual valves (four in each group), and three recurrent urinary tract infections. Three patients had nephrectomy and one patient had renal transplantation. There was no death. The mean serum creatinine for all the patients at presentation and at the last follow-up were 1.2 and 0.5 mg/dl, respectively ($P = 0.031$). At follow-up, mean PVR of valvotome group was 2.5 ml and fulguration group was 2 ml ($P = 0.282$). The median follow-up period was 24 months.
Conclusions Early ablation of PUV and detailed attention to bladder management gives a better outcome. With Mohan's valvotome incidence of stricture is less and incidence of residual valves is comparable to endoscopic ablation of PUV.

Keywords Posterior urethral valves · Mohan's valvotome · Stricture · Endoscopic ablation · Bladder management

B. Sudarsanan (✉) · A. A. Nasir · R. Puzhankara · P. M. Kedari · G. R. Unnithan · K. R. P. Damisetti
Department of Pediatric Surgery, Amrita Institute of Medical Sciences and Research Centre, Amrital Lane, Elamakkara P.O., Kochi, India
e-mail: bindus@aims.amrita.edu

Introduction

Posterior urethral valve (PUV) is the commonest cause of bladder outlet obstruction in children leading to end stage renal disease. Recent study suggest an incidence of about 1:2,500–4,000 male births [1]. The morbidity of PUV is related to the congenital obstruction of the urinary tract at a critical time in organogenesis which may have a profound and lifelong effect on kidney, ureter, and bladder function. Its management constitutes an ongoing challenge in pediatric urological practice. Endoscopic valve ablation is the treatment most widely followed, but the dreaded complication accompanying this modality is postoperative urethral stricture [2–4]. Moreover, appropriate neonatal cystoscope that may reduce this morbidity is not currently available everywhere. Initial experience with Mohan's valvotome has been reported [5]. PUV is associated with bladder dysfunction that tends to persist in many patients even after valve ablation leading to progressive deterioration in renal function. Post-ablation bladder management is therefore of paramount importance in improving the outcome of patients with PUV. This is a report of our

management protocol and outcome of management of PUV over a 7-year period.

Materials and methods

A review of 65 consecutive children managed for PUV between 2001 and 2007 were carried out. At admission, catheter drainage of the bladder under strict aseptic conditions was achieved by passing a transurethral feeding tube (size 5 or 6 Fr gauge). Blood urea nitrogen, serum creatinine, blood gas analysis and urine cultures were done. Suppressive antibiotics were commenced empirically. Initial imaging included abdominal ultrasonography followed by a voiding cystourethrogram done when patient became clinically stable. Voiding cystourethrogram showing dilated elongated posterior urethra and radiolucent valve cusps was considered diagnostic of PUV. Diagnosis was confirmed at cystoscopy. After stabilizing the baby by correction of fluid, electrolyte and acid base imbalances, and with evidence of improved renal function, patients were taken for cystoscopic primary valve ablation using one of the two methods: Mohan's valvotome in primary cases and electrocautery fulguration with Bugbee electrode through a cystoscope (7.5F, Wolf) in patient with distorted valve due to previous intervention or who had partial valves. Adequacy of ablation was checked by applying suprapubic pressure on the bladder filled with saline to observe the caliber and force of urine stream. This was followed by a check cystoscopy. One patient with persistently elevated serum creatinine, persistent upper tract dilation and urosepsis had bilateral ureterostomies. After valve ablation, urethral catheter was left in situ for 72 h to allow the edema to subside and to enable measuring of urinary output. Intravenous fluids were given equal to urinary output plus insensible loss of the previous hour till diuresis subsided. Electrolytes were monitored. Patients were discharged with antibiotic prophylaxis and followed up in outpatient department for voiding history and serial serum creatinine estimation. Post-void residual urine volume (PVR) was monitored by abdominal ultrasound. Parents were told to measure first void urine volume in the morning to determine bladder capacity. Patients with significant PVR (greater than 10% of expected bladder capacity) were placed on Terazosin 0.04–0.4 mg/kg per day (α1 adrenergic blocker) after obtaining an informed consent. The dose was adjusted to obtain a normal PVR, which was monitored every 2 weeks initially, and then every month. Since hypotension is known to occur with the first dose of the drug, patients were kept under observation in the outpatient department for 2 h after the first dose was given. Voiding cystourethrogram was done 3 months after valve ablation. Follow-up cystoscopy was done after first VCUG if a residual valve was suspected. Renal scan was done 6 months and 1 year after valve ablation. Patients with persistent high grade reflux and deteriorating renal function were considered for reimplantation. Statistical analysis was performed using SPSS. Continuous variables were compared with student's t test and discrete variables were analyzed with Chi-square test and Fisher's exact test where appropriate. A P value of less than 0.05 was considered significant.

Results

There were 61 patients on regular follow-up; the median age at presentation was 45 days, range 1 day–13 years. Nineteen (31%) patients were diagnosed in the antenatal period (Table 1) showed the age distribution at diagnosis. Thirty-nine (64%) patients presented with obstructive symptoms (poor stream, dribbling, palpable bladder), 24 (62%) of them were neonates ($P = 0.014$; Table 2). Twenty-one presented with infective symptoms (recurrent urinary tract infection, urosepsis). One patient had vesicostomy done before presenting to us. One of the neonates presented for evaluation of antenatally diagnosed bilateral hydronephrosis. Twelve patients had deranged renal function at presentation, ten of them were neonates. Nine patients had improved renal function after initial catheter drainage. Mean creatinine at presentation was 1.2 mg/dl (range 0.2–7) and mean serum creatinine following initial catheter drainage was 0.76 mg/dl (range 2–2.5; $P = 0.005$). Twelve patients had bilateral

Table 1 Age at diagnosis

Age group	No. of patients ($n = 61$)	Percentage
Neonate	29	47.6
1 month–1 year	14	23.6
1 year–5 years	15	24.6
>5 years	3	4.9

Table 2 Age group and presenting symptoms

Age group	<1 months[a]	1–12 months	1–5 years	>5 years	Total
Obstructive symptoms	24	7	7	1	39
Infective symptoms	4	7	8	2	21
Total	28	14	15	3	60

$P = 0.014$

[a] One neonate presented for evaluation following antenatal diagnosis of PUV and symptomatology could not be ascertained and not included in this group

hydronephrosis, eight unilateral (five left sided, three right sided). There were two patients with perirenal collection. Twenty-three patients had associated reflux at presentation (five bilateral, eleven left sided and seven right sided), three children developed reflux after valve ablation (one bilateral, one left and one right) given a total of 32 refluxing ureters in 26 patients. Of the 61 patients, 58 (95%) underwent primary valve ablation (37 with Mohan's valvotome, 21 fulguration with Bugbee electrode). Of the 21 patients that had fulguration done, 10 were done in the referring hospital. Two patients had bilateral ureterostomies; one was done in another hospital. Hydroureteronephrosis subsided spontaneously in 16 patients. Upper tract dilatation did not improve in 12 patients (11 bilateral, one right). Reflux disappeared in 10 refluxing ureters, accounting for 36% resolution. Twelve antireflux surgeries were done for 8 children (four bilateral, three right, one left), 11 were Cohen's cross-trigonal ureteroneocystostomy and one extravesical reimplantation, the time of reimplantation ranged between 8 months and 5 years following valves ablation. Comparing post-ablation complications in the two groups, there were five (8.2%) urethral strictures rate; all (24%) in the patients that had valves fulguration and none in valvotome group ($P = 0.001$). Two of the patients with stricture had fulguration done twice on account of residual valve detected at check cystoscopy. There were eight residual valves four in each treatment group. Other complications are shown in Table 3. Three patients had nephrectomy for recurrent urinary tract infection with non-functioning kidneys (two right, one left). One patient from the Mohan's valvotome group with chronic renal failure had renal transplantation from a living related donor (mother). Of the whole series, only one (1.6%) child was in renal failure at the last follow-up. All the patients had good urine stream. There was no death. The mean serum creatinine at the last follow-up was 0.5 mg/dl (range 0.3–1.9) compared to 1.2 mg/dl at presentation $P = 0.031$. There was no statistical difference in the mean creatinine of both groups (0.5 mg/dl for valvotome group; 0.4 mg/dl for fulguration group). Mean PVR before commencing alpha blocker was 15 ml and mean PVR at the last follow-up was 2.5 ml ($P = 0.000$). At follow-up, mean PVR of valvotome group was 2.5 ml and fulguration group was 2 ml ($P = 0.282$). The median follow-up period was 24 months (range 6–75 months).

Table 3 Methods of valves ablation and complications

Complications	Treatment groups		Total	Percentage of total
	Mohan's valvotome group	Fulguration group		
Stricture	0	5	5	8.2
Residual valves	4	4	8	13.1
Recurrent UTI	3	0	3	4.9
Renal failure	1 (resolved after renal transplant)	1	2	3.2
Incontinence	0	1	1	1.6

UTI urinary tract infection

$P = 0.001$

Discussion

With the wide spread use of antenatal ultrasonography and increasing awareness, the vast majority of patients with PUV are being diagnosed in utero. The incidence of antenatally diagnosed PUV is however limited to 10% in developing countries [6]. The 30% antenatally diagnosed cases of PUV in this study are therefore promising. Antenatal diagnosis allows serial monitoring of urinary tract dilatation and amount of amniotic fluid for early intervention in well-selected patients. It also affords opportunity to begin the process of parent education on the potential for normal or near normal lifestyle, need for long-term follow-up and the possibility of long-term renal sequelae [7]. The high incidence of obstructive symptoms in neonate (Table 2) may be due to the fact that the obstructive symptoms are more easily recognized by parents than the infective symptoms. The incidence of obstructive symptoms in this study is similar to other report [8]. Primary transurethral fulguration of PUV has become the most widely acceptable technique of valve ablation worldwide [4, 9]. In developing countries appropriate neonatal urological endoscopes are not widely available, several instruments and approaches have been used for primary valve ablation especially in neonate and small infants [8, 10, 11]. This has also resulted in high diversion rate of 20–71% in some Indian centers [12, 13] (Table 4). Because of the availability of small size valvotome and size 7.5-Wolfe cystoscope, our diversion rate was low, 1.6%. Controversy continues to revolve round the use temporary high diversion for PUV. Even in the most severe cases, many pediatric urologists still do not accept the efficacy of this treatment; they believe that high diversion prevents bladder cycling resulting in non-compliant bladder and does not change the outcome of kidney function in the long run [14–17]. However, temporary high diversion may still have a role in severe cases of PUV, and may possibly improve renal function [18, 19]. We diverted only one patient with deteriorating renal function following an initial improvement in renal function. The child subsequently had right nephrectomy for a dysplastic kidney with the serum creatinine at last follow-up (22 months) of 0.4 mg/dl. Two other children had nephrectomies for non-functioning kidneys, each from the two treatment groups. The most dreaded complication of endoscopic treatment is urethral

Table 4 Comparison with other studies

Authors	Lal [4]	Basu [22]	Choudhury [12]	Shittu [21]	This report
Number of patients	82	130	90	26	61
Treatment modalities	Fulguration	Fulguration	Fulguration	Mohan's valvotome	Fulguration or valvotome
Stricture rates (%)	3.6	ND	ND	5	8.2
Residual valves (%)	13.4	6.2	ND	ND	13
Diversion rates (%)	46	20	71	0	1.6
Renal failure at follow-up	ND	ND	8.8	20	1.6
Mortality rates (%)	ND	0.8	3.3	ND	0
Follow-up period	1–21 years	ND	ND	18 months–5 years	8–75 months

ND not documented

stricture that may cause more damage than the primary valves. The reported incidence of stricture following endoscopic ablation is between 3.6–25% [2–4]. Incidence of 0% has however been reported with improved fibreoptics and technique [20]. Clinical outcome of patients managed with Mohan's valvotome have been reported [5, 21]. In this study, 8.2% stricture rate was recorded. This is very disturbing especially occurring in 5 (24%) out 21 patients who had valve ablation with fulguration. Four of the patients with stricture had valves ablation by fulguration prior presentation, two presented with stricture which we think may be related to diathermy burns, two had residual valves that necessitate re-fulguration increasing the risk of stricture in them. They all did well with regular urethral dilatation. The risk factors identified in two of the patients was re-fulguration of residual valves; this is consistent with the findings of Lal et al. [4]. Although Shittu [21] in Nigeria reported 5% (one patient) incidence of stricture in long-term follow-up of 26 patients with PUV managed with Mohan's valvotome, none of the 37 patients managed with Mohan's valvotome in this series had urethral stricture (Table 3). Previous fulguration causes distortion of the valves making it difficult to be engaged with Mohan's valvotome, this precluded the use of valvotome in patient who had residual valves after fulguration. Measures that have been advocated for preventing post-fulguration strictures are gentleness in surgical technique, avoidance of oversized instrumentation especially in neonate, minimizing fulguration time, avoiding excessive and deep fulguration, and shortening the duration of preoperative catheterization and use of nonreactive small sized catheters. Residual valve is common with both endoscopic ablation and Mohan's valvotome. This is probably due to insufficient ablation of valves. Other studies have reported residual valves with endoscopic ablation [4, 13, 22] (Table 4). In our study, eight patients 13% (four valvotome group, four fulguration group) had residual valves that were detected at check cystoscopy. This is comparable to 13% reported by Lal [4] (Table 4). Those from valvotome group were fulgurated with no complication, while two of the fulguration group were re-fulgurated and subsequently developed urethral stricture as discussed earlier. The bladder dysfunction tends to be persistent in many PUV patients even after valve ablation leading to progressive deterioration in renal function. In order to reduce the attendant morbidity, careful attention must be given to bladder management. Regular follow-up with detailed of urinary history is essential. Measurement of early morning void urine by parents was used in estimating the bladder capacity; and witnessed void at follow-up clinic was done to ascertained urine stream. Ultrasound was done after witnessed post-void to estimate the residual urine. Patients with significant residual post-void urine were placed on Terazosin (alpha1 adrenergic blocker) after detail explanation of possible side effect to parents and informed consent obtained. Voiding cystourethrogram is done 3 months after ablation to evaluate patients for residual valves, urethral stricture and status of the upper tract. This bladder management protocol has yielded good result with 83% reduction in PVR from mean of 15 ml before alpha blocker to mean 2.5 ml at the last follow-up. We recorded a low diversion rate of 1.6%. The urinary stream improved in all the patients. Renal function improved in 10 (83%) of 12 patients who presented with deranged renal function. Only one (1.6%) patient was in renal failure at the last follow-up, this is a significant improvement compared to 30% of patients in renal failure reported by Sen [13] in Vellore, India, and 28% by Scott [8] in UK. One patient developed hypotension to the alpha blocker which was discontinued. There was no mortality in this study compared to 3.3% in Choudhury [12] series. The mean serum creatinine at the last follow-up was 0.5 mg/l, this is within normal value. Post-ablation bladder management is of utmost importance in the management of PUV. This study suggest that early and proper removal of obstruction by endoscopy or Mohan's valvotone and detailed attention to the bladder management with post-ablation alpha1-adrenergic drug improved the outcome of patients with PUV, reducing

dramatically the use of high urinary diversion. Incidence of stricture is less with Mohan's valvotome and incidence of residual valves are comparable to endoscopic ablation of PUV.

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