Research Article

Follow up in posterior urethral valve after primary valve fulguration or diversion with fulguration with special references to urodynamic studies

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Abstract

Background: Follow up of posterior urethral valve patients is very crucial as it is commonest congenital obstruction of the lower urinary tract.

Objective: To evaluate outcome after surgery with special reference to urodynamic studies.

Materials and Methods: Study has been carried out retrospectively. Fifty cases of PUV of age ≥3 years were included in the study between the time period of July 2010 to June 2012. Long term outcome had been evaluated by renal profile, MCU, and UDS regarding bladder dysfunction. In most of the cases the initial presentation data were collected retrospectively at the time of follow up. At that time UDS was performed if there was no contraindication. 50 cases were divided into 2 groups. Group 1 included 18 patients which were managed only by primary valve fulguration while group 2 included 32 patients which required urinary diversion procedure.

Result: The mean value of serum creatinine in group 1 was 1.486±0.7646 mg/dl at the time of initial presentation and 0.8511±0.22721 mg/dl at the time of follow up while for group 2 it was 1.737±0.9734 mg/dl and 1.0913±0.41396 mg/dl, respectively. The mean value of PdetMax was 79.20±33.842 cm H_2O in group1 and it was 51.14±28.141 cm H_2O in group 2. Mean value of bladder compliance was 15.86±17.902 mL/cm H_2O in group 1 and 6.26±3.605 mL/cm H_2O in group 2. PdetMax and bladder compliance showed significantly better results in group 1 as $p<0.05$.

Conclusion: At follow up the patients treated with primary valve fulguration had significantly better outcome.

KEY WORDS: Bladder, posterior urethral valve, urodynamic studies

Introduction

Posterior urethral valves (PUV) are the commonest congenital obstruction of the lower urinary tract.[1] It has an incidence of up to 1 in 4000.[2,3] Initial management of all patients with posterior urethral valves requires the immediate establishment of urinary catheter drainage from the bladder. After successful initial bladder drainage and when the patient's medical condition has stabilized, the next step is to permanently destroy the valves. Other methods useful are vesicostomy and pyelostomy.

Follow up of patients is very crucial to recognize the risk factors and complications to improve the quality of life, it can be done with the help of somatic growth, renal function test, and various imaging investigations, most important is urodynamic studies (UDS).

In the present study, the long term follow up in patients of posterior urethral valve coming to the department with special reference to urodynamic studies to evaluate the outcome of treatment was evaluated.

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Materials and Methods

The present study has been carried out retrospectively and was approved by the ethical committee of the institute. Fifty cases of PUV of age 3 years or above, attending the outpatient department between the period of July 2010 and June 2012 were included in the study. A detailed history and relevant investigations were done. Long term outcome in patients of PUV had been evaluated by renal profile, micturatingcystourethrogram (MCU) and urodynamic study regarding bladder dysfunction.

The initial presentation data were collected retrospectively when patients of PUV >3 years of age came in the outpatient department using discharge sheet issued at time of discharge after the operation. At that time UDS was performed if there was no contraindication with the help of urodynamic measuring system UROCOMP 2000E after giving 1 dose of injectable antibiotic under strict aseptic conditions. Various urodynamic parameters like detrusor contractility, detrusor pressure, sensation, compliance, residual urine, flow velocity, urethral resistance etc., were recorded. Fifty cases were divided into 2 groups based on the basis of initial surgical procedure done. Group 1 included 18 patients which were managed only by primary valve fulguration while group 2 included majority of the cases (32 patients) which required urinary diversion procedure. Diversion procedure was needed due to grade 5 vesicoureteric reflux and no improvement in renal function after catheterization and treatment with the antibiotics. Among both the groups common urodynamic parameters were compared. The statistical analysis was done using statistical software SPSS for windows (version 16). Chi-square test was used for non-parametric variables. Student's *t* test was used for comparing two groups. *p*-value <0.05 was stated as statistically significant.

Result

Unilateral reflux was present in 50% cases, bilateral reflux in 38% cases and reflux was absent in 12% of the cases at the time of initial presentation. Unilateral reflux reduced to 36%, bilateral reflux reduced to 22% in the follow up and no reflux increased to 42% in the follow up.

The mean age in group 1 at the time of initial presentation was 2.294±1.40862 (0.5–6) years and 2.123 ± 2.1830 (0.1–9) years in group 2. In follow up, the mean age in group 1 was 6.361 ± 4.7459 (3–15.5) years and 6.641 ± 4.6146 (3–21.5) years. The mean value of serum creatinine in group 1 was 1.486 ± 0.7646 mg/dl at the time of initial presentation and 0.8511 ± 0.22721 mg/dl at the time of follow up while for group 2 it was 1.737 ± 0.9734 mg/dl and 1.0913 ± 0.41396 mg/dl, respectively.

The detrusor contractility by the slope of Schafer's lines, now known as the bladder contractility index (BCI) was calculated, which was given by the formula: PdetQmax(detrusor pressure in cm H_2O at maximum flow rate) + 5Qmax(maximum flow rate in ml/s). Strong contractility is a BCI greater than 150, normal contractility a BCI of 100 to 150, and weak contractility a BCI of less than 100.[4] Applying statistical analysis, it has been found that detrusor hypocontractility was the most common pattern seen in 74% of patients followed by normal detrusor contractility in 24% and hypercontractility in 2% (Table1).

Table 1: Detrusor contractility

Detrusor contractility (BCI)	No. of patients	Percent
Hypocontractility (<100)	37	74.0
Normal (101–200)	12	24.0
Hypercontractility (>200)	1	2.0
Total	50	100.0

BCI- Bladder contractility index

Table 2: Urethral resistance

AG Number	No. of patients	Percent
Obstructed (<20)	11	22.0
Equivocal (21–40)	25	50.0
Normal (>40)	14	28.0
Total	50	100.0

AG number- Abrams Griffiths number

Table 3: Comparison of infused volume (bladder capacity) between posterior urethral valve cases and normal age matched group

Group	Number of patients	Mean value of bladder capacity (ml)	*p*-value
Cases	50	235.94±117.12	0.036
Normal age group	50	288.90±131.35	

ml- milliliter, *p* value- probability value

Based upon the Abrams-Griffiths nomogram, Abrams and Griffiths[5] and Lim and Abrams[6] introduced the Abrams–Griffiths (AG) number for quantifying the urethral resistance. Each pressure-flow plot can be represented by an AG number that can be easily calculated by the following equation:

$$\text{AG number} = p\text{det.Qmax} - 2 * \text{Qmax}$$

In 1997, the international continence society published a provisional nomogram, which is a modification of the Abrams–Griffiths nomogram and used AG number to classify bladder obstruction into 3 groups. AG number >40 cm H_2O/ml/s were considered normal (in 28% of patients). Residual valve obstruction that is urethral resistance <20 was seen in 22% of patients in follow up (12% after diversion with fulguration while 10% after primary valve fulguration). Fifty percent of patients showed equivocal results (Table 2).

Bladder capacity (BC) in both groups is calculated by infused volume in ml and in normal age matched persons is calculated by, BC (ml) = (Age + 2) x 30. Bladder capacity was found to be significantly low in PUV patients as compared to similar age matched persons with *p* value 0.036 (Table 3).

Table 4: Comparison of common urodynamic parameters in primary valve fulguration and diversion with fulguration groups

Urodynamic parameters	Primary valve fulguration or group 1 (*n* = 18)	Minimum value	Maximum value	Diversion with fulguration or group 2 (*n* = 32)	Minimum value	Maximum value	*p*-value
Detrusor contractility	73.40±57.202	0	219	73.63±35.355	10	135	0.986
AG number	34.27±30.973	0	118	42.49±31.779	3	107	0.403
Bladder capacity (ml)	269.20±108.585	130	450	221.69±119.241	113	645	0.192
PdetMax(cm H_2O)	79.20±33.842	15	128	51.14±28.141	5	145	0.004
Bladder Compliance(mL/cm H_2O)	15.86±17.902	4	54	6.26±3.605	3	18	0.007
Qmax (ml/s)	7.13±9.425	0	39	5.15±2.324	1	10	0.250

AG number- Abrams Griffiths number, PdetQmax- Detrussor pressure in cm H_2O at maximum flow rate, Qmax- Maximum flow rate in ml/sec, *n*- Sample size

Both the groups were comparable regarding detrusor contractility, bladder outlet obstruction, bladder capacity, and urine maximum flow rate. The mean value of PdetMax was 79.20 ± 33.842 cm H_2O in group 1 and it was 51.14 ± 28.141 cm H_2O in group 2. Similarly, the mean value of bladder compliance was 15.86 ± 17.902 mL/cm H_2O in group 1 and 6.26 ± 3.605 mL/cm H_2O in group 2. Both PdetMax and bladder compliance showed significantly better results in group 1 as compared to group 2 as calculated *p* value for both came $p < 0.05$ (Table 4).

Discussion

PUV is a common cause of obstructive uropathy in male children at the institution. The study was undertaken mainly to evaluate the outcome of its management by thorough clinical and investigative measures with special references to UDS. Bauer et al.[7] established the entity of bladder dysfunction in posterior urethral valves by performing UDS. There have been several reports from the west. However, a thorough literature search revealed only few reports from India.[8–10] Moreover, the circumstances in the western world differ quite a lot from ours as regards modern medical advances and also in the socio-economic aspects. Hence, this study was undertaken to follow up children with PUV by UDS, renal function test, and MCU that will help in better management of this problem.

The mean value of serum creatinine at the time of presentation and in the follow up in group 1 was 1.486 ± 0.7646 mg/dl and 0.8511 ± 0.22721 mg/dl, which is highly significant ($p = 0.001$) while in group 2 was 1.737 ± 0.9734 mg/dl and 1.0913 ± 0.41396 mg/dl and it is also highly significant ($p < 0.001$). Both primary valve fulguration and diversion with fulguration significantly reduced the serum creatinine from initial presentation to that in follow up and mean value of serum creatinine was higher in diversion with fulguration group than in primary valve fulguration group both at the time of initial presentation and in the follow up but the difference was not significant. This shows that patients of primary valve fulguration group showed better renal functional status than the patients of diversion with fulguration group. Sudarsanan et al.[11] also reported mean serum creatinine at presentation and the last follow up were 1.2 and 0.5 mg/dl, respectively (p=0.031). Narasimhan et al.[12] reported preoperative and postoperative mean serum creatinine was 1.6 +/- 1.5 and 0.7 +/- 0.2 mg/dl, for the fulguration group and 1.7 +/- 1.5 and 0.9 +/- 0.7 mg/dl, respectively, for the vesicostomy group. They found that transurethral fulguration and vesicostomy were equally effective for neonatal valves and achieve similar renal function. Nickavar et al.[13] showed that initial serum creatinine value before catheterization were higher in end stage renal disease (ESRD) (4.24±2.83) group than in non-ESRD (1.38 ± 0.99) group ($p = 0.001$). They also studied different prognostic parameters but only serum creatinine had a meaningful correlation to the ESRD. Sarhan et al.[14] also found that serum creatinine before valve ablation correlates significantly with long term renal function. Though in present series, renal prognostic importance has not been studied.

In the present study, both group 1 and group 2 were comparable regarding all the urodynamic parameters except Pdetmax, and compliance for which $p < 0.05$ showing better results in group 1 than in group 2, but no such elaborative urodynamic study has been found in posterior urethral valve in India.

About two third of the patients had evidence of poor compliance of UDS. The reports from literature were variable ranging from 26 to 74.2%. So observation of poor compliance in the present study falls in the mentioned compliance range in the other studies. The reason for the wide range of poor compliance reported in literature is multifactorial. There may be a factor of selection bias because UDS was done by most authors on those patients of PUV who had symptoms. Some authors consider more than 40 cm of water to denote poor compliance,[15] while some others consider that the filling pressure of more than 20 cm of water to define poor compliance.[16,17]

In the present study the detrusor hypercontractility was observed only in 2% of the patients while literature showed it varied from 9.1 to 81%. Ziylan et al.[18] noted detrusor overactivity in 50% of patients before 5 years of age however, it decreased to 20% after age of 10 years. In this series

hypocontractility was the most common pattern seen in 74% patients. In the study done by Gennaro et al.,[15] true hypocontractility was detected in 3 of the 11 boys at the first examination and in 8 at the last pressure flow analysis. This suggests that majority of boys with posterior urethral valves have progressive impairment of detrusor contractility at voiding many years after relief of obstruction near puberty. This probably can be avoided by starting pharmacological treatment at the earlier period based on the initial urodynamic findings.

In the present series, residual valve obstruction was seen in 22% of patients in follow up (12% after diversion with fulguration while 10% after primary valve fulguration). Oktar et al.[19] reported residual valve or stricture in 9.9% of the patients. The possible presence of residual valve remnants after primary valve ablation should be confirmed by careful clinical, radiological, and endoscopic evaluation. In this study, residual valve obstruction was detected by subsequent cystoscopy and appropriate intervention was taken for residual valve and stricture to relieve urethral resistance while Menon et al.[20] assessed the residual valve obstruction by calculating Prostatic Urethra/ Bulbar Urethra (PU/BU) ratio with the help of MCU which is >3SD (1.92) should alert to an incomplete fulguration or stricture.

In present series, BC (235.94±117.12 ml) is significantly low in posterior urethral valve patients as compared to similar age matched persons and observed normal BC in 34% of cases. Two third of the patients had a small capacity bladder. Other studies have reported small capacity bladder in 30–33% of the patients.[18,21] Anticholinergics are known to increase the bladder capacity apart from improving compliance.[3,22,23] So, the patients in group1 have better outcome than those in group 2 just like in previous study done by Miguel et al.[24]

MCU in the follow up had persistent dilated urethra in 66% cases, unilateral reflux in 36% cases, bilateral reflux in 22% cases, residual posterior urethral valve in 26% cases and urinary bladder diverticulum in only 4% cases. While, Menon et al.[20] assessed the adequacy of fulguration by doing MCU pre- and post-operatively. As mentioned earlier PU/BU ratio >3 SD (1.92) should alert to an incomplete fulguration or stricture. Patients with normal range ratio have faster recovery of slow draining units, reflux and less voiding dysfunction. Gupta et al.[25] have also given a post-fulguration ratio of 2.5–3 as an acceptable result. In a study conducted by Smeulders et al.[26], positive predictive value of a repeat MCU for subsequent resection of valve remnants to be only 56%. In present series on the basis of MCU, UDS and cystoscopic findings at the time of follow up cystoscopic valve fulguration had been done in 26% cases along with unilateral ureteric reimplantation in 10% cases, bilateral ureteric reimplantation in 4% cases, nephroureterectomy in 12% cases and medical treatment in 74% cases. Kim et al.[22] and Cuckow et al.[27] performed a nephrectomy in 17% and 23.07% cases, respectively.

Strength of the present study was that maximum long duration of follow up after surgery was up to 21 years. There are few studies in the literature of long term follow up in posterior urethral valves, so data pertaining to this study will help in better management of this disease.

Though based on the UDS revealing detrusor dysfunction, the medical treatment was started in appropriate cases, its outcome could not be evaluated in this series because of non availability of adequate time period. Hence this assessment needs further follow up by subsequent urodynamic evaluation in near future. Other drawbacks of this study were small sample size, only one follow up with UDS and controls were not taken as UDS is an invasive study.

Conclusion

PUV is one of the most common congenital malformation of the posterior urethra in male having deleterious effects on upper urinary tract in long term follow up. Hence, regular follow up till adolescent is mandatory in all the cases. Amongst the various parameters of follow up both MCU and UDS followed by either cystoscopy for surgical management or medical management for bladder dysfunction are the important modulating factors for achieving better long term outcome in such cases. At follow up the patients treated with primary valve fulguration had significantly better outcome regarding detrusor pressure, bladder compliance, and renal profile than those treated with diversion with fulguration. To conclude primary valve fulguration should be the procedure of choice in PUV whenever possible.

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Abbreviations

PUV - Posterior urethral valve
MCU - Micturatingcystourethrogram
UDS - Urodynamic studies
ESRD - End stage renal disease
AG number - Abrams Griffiths number
BCI - Bladder contractility index
PdetQmax - Detrussor pressure in cm H_2O at maximum flow rate
Qmax - Maximum flow rate in ml/s

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