

Outcome of Endoscopic Fulguration in Patient with Posterior Urethral Valve

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Abstract

Background: In developing countries like Bangladesh, posterior urethral valves (PUV) are typically diagnosed postnatally, whereas in developed countries, they are often identified prenatally. Early diagnosis, complete fulguration, and regular follow-up are crucial to prevent renal impairment in PUV patients. **Objective:** This study aimed to evaluate the outcomes of endoscopic fulguration in PUV patients in a Bangladeshi medical setting. **Method:** Conducted at the Department of Urology, Dhaka Medical College & Hospital, this observational study spanned from July 2018 to June 2019. Thirty-five patients meeting inclusion and exclusion criteria were initially included, with five dropping out during follow-up. Endoscopic valve ablation was performed on all patients, followed by catheterization for 14 days. Post-procedure, patients were discharged within 48-72 hours with oral antibiotics and behavioral therapy advice. Follow-up visits over six months included assessments of height, weight, urine analysis, serum creatinine, kidney ultrasonography, and eGFR. Voiding cystourethrograms were performed at one- and six-months post-fulguration. **Result:** Most patients presented at ages 11-20 months (36.7%) and 21-30 months (26.67%). Poor urine stream and dribbling were the most common symptoms, seen in 83.33% and 76.67% of patients, respectively. Repeated fever was noted in 63.33% of patients, while 43.33% exhibited failure to thrive. VUR was present in 46.7% of patients; 42.86% had unilateral VUR and 57.14% had bilateral VUR. Following six months of fulguration, complete resolution of reflux occurred in 40% of right-side and 50% of left-side renal units. Decreased reflux grade was noted in 20% of right-side and 16.67% of left-side units, while persistence was seen in 40% and 33.33% respectively. Significant improvements in eGFR and serum creatinine levels were observed ($p < 0.001$). Hydroureteronephrosis decreased from 22 to 8 cases, though this was not statistically significant ($p = 0.06$). **Conclusion:** Endoscopic fulguration significantly improves renal function in PUV patients. About half of VUR cases resolved completely within six months post-procedure.

Keywords: Posterior urethral valves, Endoscopic fulguration, Renal function, Hydroureteronephrosis.

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INTRODUCTION

Posterior urethral valves (PUV) are the most common cause of congenital urethral obstruction, significantly impacting the pediatric population [1]. PUV were first described by, and until the 1960s, the prognosis for affected infants was extremely poor. Advances in medical understanding and treatment have since transformed PUV from a fatal diagnosis to a condition that is now considered highly treatable [2].

Vesicoureteral reflux (VUR), a condition characterized by the backward flow of urine from the bladder into the ureters and kidneys, is frequently observed in patients with PUV. The reported incidence of VUR in these patients ranges from 48% to 66% [3]. Primary fulguration, a procedure to ablate the obstructing valves, without upper tract diversion, is the preferred treatment modality for PUV [4]. Despite the effectiveness of this treatment, the management of VUR in PUV patients remains a topic of considerable debate.

The prognosis for patients with PUV has improved significantly in recent years, with most pediatric urologists now considering it an easily correctable urogenital anomaly [5]. However, the presence of VUR complicates the clinical picture. There is ongoing debate regarding the prognosis and management of reflux in patients with obstructive uropathy. While reflux is often assumed to be secondary to infravesical obstruction, it does not always resolve following valve ablation alone. The role of VUR in the long-term outcomes of these patients is controversial, with some experts suggesting that reflux contributes to the progressive deterioration of the upper tracts. Others propose that in cases where VUR is unilateral and associated with renal dysplasia (VURD syndrome), it may actually protect the kidneys from high infravesical pressure generated by a valve bladder [6].

Given the complexity and variability in outcomes for these patients, there is no consensus on the optimal management of VUR associated with PUV. Current treatment strategies for VUR include conservative antibiotic prophylaxis, open surgical treatment, minimally invasive endoscopic treatment, and observation or intermittent therapy with management of bladder/bowel dysfunction (BBD), alongside treatment of urinary tract infections (UTIs) as they occur [7]. Previously, early ureterovesical reconstruction was recommended for cases with significant upper urinary tract dilation. However, a more conservative approach following the release of distal obstruction is now more commonly adopted [8].

Children with PUV are at high risk for renal failure (RF), underscoring the importance of regular follow-up to monitor for complications such as valve fulguration, renal function, hydronephrosis (HDN), VUR, UTIs, and bladder dysfunction [9]. Continuous monitoring and comprehensive management are essential to mitigate the risk of renal impairment and ensure optimal long-term outcomes for these patients.

OBJECTIVES

General

- To see the outcome of endoscopic fulguration in patients with posterior urethral valve.

Specific

- To see the change of symptoms before and after endoscopic fulguration of posterior urethral valve
- To assess the change of vesicoureteral Reflux (VUR) before and after endoscopic fulguration
- To see the status of hydronephrosis before and after fulguration
- To assess the change of renal function before and after fulguration

MATERIAL AND METHODS

Study Design

This study was an observational descriptive design conducted at the Department of Urology, Dhaka Medical College Hospital, from July 2018 to June 2019. The study aimed to evaluate the outcomes of endoscopic fulguration in patients with posterior urethral valves (PUV). Using purposive sampling, 35 patients who met the inclusion criteria were initially selected, with a final sample size of 30 after accounting for postoperative dropouts. Data were collected through medical records and patient assessments during follow-up visits, focusing on the resolution of vesicoureteral reflux (VUR), renal function, hydronephrosis, and urinary tract infections (UTIs).

Inclusion Criteria:

- Patients who had posterior urethral valve and treated with endoscopic fulguration.
- Patients presented below 5 years of age.

Exclusion Criteria:

- Patients with posterior urethral valve who were treated with proximal diversion.
- Patients who did not give consent to include into study.

Data Collection

Data were collected from patient medical records and direct assessments during follow-up visits. Key metrics included height, weight, urine routine microscopic examination, urine culture and sensitivity tests, serum creatinine levels, and ultrasonography of the kidneys, ureters, and bladder. Estimated Glomerular Filtration Rate (eGFR) was also measured. Voiding cystourethrograms were conducted at one month and six months post-fulguration to assess vesicoureteral reflux (VUR) resolution. Data on the incidence and resolution of hydronephrosis (HDN), urinary tract infections (UTIs), and changes in bladder function were also collected. Statistical analysis was performed to determine the significance of changes in these outcomes.

Data Analysis

The collected data were analyzed using SPSS version 26. Descriptive statistics were used to summarize patient demographics and clinical characteristics. Paired t-tests and Wilcoxon signed-rank tests were employed to compare pre- and post-fulguration outcomes, including serum creatinine levels, eGFR, and the presence of hydronephrosis. Chi-square tests were used to evaluate categorical variables such as the resolution of vesicoureteral reflux (VUR) and the occurrence of urinary tract infections (UTIs). A p-value of less than 0.05 was considered statistically significant. The analysis aimed to determine the effectiveness of endoscopic fulguration in improving renal function and resolving VUR.

Ethical Consideration

The study adhered to the ethical standards of the institutional review board at Dhaka Medical College Hospital. Informed consent was obtained from all participants or their guardians. Patient confidentiality and data privacy were strictly maintained throughout the study. Ethical approval ensured that the study's procedures were conducted responsibly and respectfully, prioritizing the welfare and rights of the patients involved in the study.

RESULTS

First 35 cases of PUV patients who were admitted to DMCH were enrolled according to the inclusion and exclusion criteria. During follow up period 5 patients were dropped out. The variables were age at presentation, symptoms, serum creatinine, eGFR, vesicoureteral reflux (VUR), hydroureteronephrosis. The findings derived from data analysis are presented in following few pages:

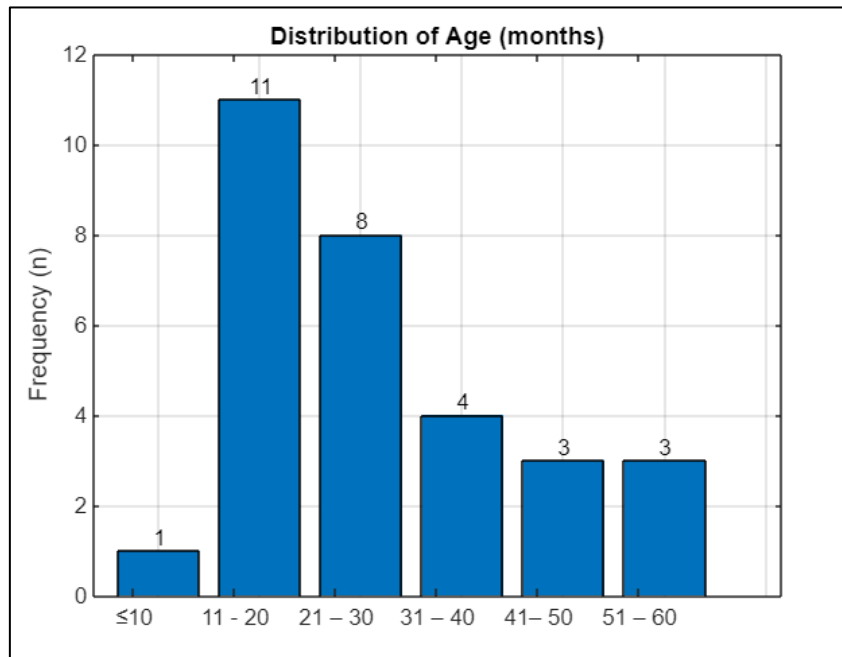


Figure 1: Distribution of Patients According to Age (n=30)

The age distribution of patients shows that the majority of PUV cases were diagnosed between 11-20 months (36.7%) and 21-30 months (26.67%), indicating a trend of diagnosis during infancy and early childhood. Only a small proportion (3.3%) were diagnosed at ≤10

months, suggesting challenges in early detection. The distribution decreases with age, with 13.33% diagnosed between 31-40 months, and 10% each in the 41-50 and 51-60 months brackets, reflecting delayed diagnosis in some cases.

Table 1: Symptoms of Patients at Presentation (n=30)

| Symptoms | Number of patients (n) | Percentage (%) |
|-------------------|------------------------|----------------|
| Poor stream | 25 | 83.33 |
| Dribbling | 23 | 76.67 |
| Repeated Fever | 19 | 63.33 |
| Frequency | 11 | 36.67 |
| Urgency | 6 | 20.00 |
| Failure to thrive | 13 | 43.33 |
| Others | 3 | 10.00 |

The most common presenting symptoms in patients with PUV were poor urine stream (83.33%) and dribbling (76.67%), highlighting significant urinary flow issues. Repeated fever was reported in 63.33% of patients, indicating frequent infections. Failure to thrive was noted in 43.33%, reflecting the impact on overall

health and development. Urinary frequency and urgency were present in 36.67% and 20.00% of patients, respectively, while 10.00% exhibited other symptoms. These findings emphasize the diverse and severe clinical manifestations of PUV, underscoring the need for prompt diagnosis and management.

Table 2: Symptoms of Patients at Postoperative Follow-up Period (n=30)

| Period of Time | Poor stream n (%) | Dribbling n (%) | Frequency n (%) | Fever n (%) | Urinary Incontinence n (%) | Others n (%) |
|----------------|-------------------|-----------------|-----------------|-------------|----------------------------|--------------|
| At 2 weeks | 0 (0.0) | 4 (13.33) | 10 (33.33) | 11 (36.67) | 8 (26.67) | 4 (28.57) |
| At 1 month | 0 (0.0) | 4 (13.33) | 10 (33.33) | 9 (30.0) | 7 (23.33) | 3 (21.43) |
| At 3 months | 1 (3.33) | 6 (20.0) | 6 (20.0) | 9 (30.0) | 5 (16.67) | 3 (21.43) |
| At 6 months | 2 (6.67) | 6 (20.0) | 6 (20.0) | 7 (23.33) | 3 (10.0) | 2 (14.29) |

At two weeks postoperatively, patients exhibited various symptoms: 13.33% experienced dribbling, 33.33% had urinary frequency, 36.67% reported fever, 26.67% had urinary incontinence, and 28.57% had other symptoms, while none reported a poor urine stream. By one month, the symptoms showed slight improvement, with dribbling remaining at 13.33%, urinary frequency and fever reducing to 33.33% and 30.0% respectively, urinary incontinence at 23.33%, and other symptoms at 21.43%. At three months, further improvement was noted: poor stream was reported by

3.33%, dribbling by 20.0%, urinary frequency by 20.0%, fever by 30.0%, urinary incontinence by 16.67%, and other symptoms by 21.43%. By six months, symptoms continued to improve, with poor stream reported by 6.67%, dribbling and urinary frequency each by 20.0%, fever by 23.33%, urinary incontinence by 10.0%, and other symptoms by 14.29%. This gradual reduction in symptoms over time reflects the effectiveness of the postoperative management and the progressive recovery of the patients.

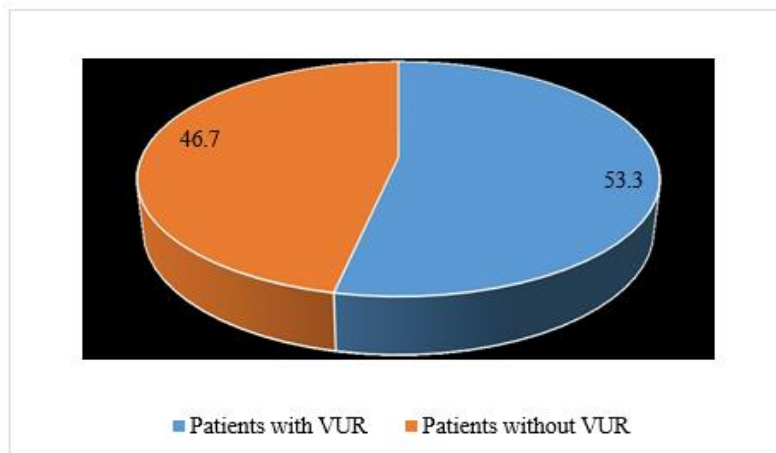


Figure 2: Pie Chart Showing Presence of VUR Among PUV Patients

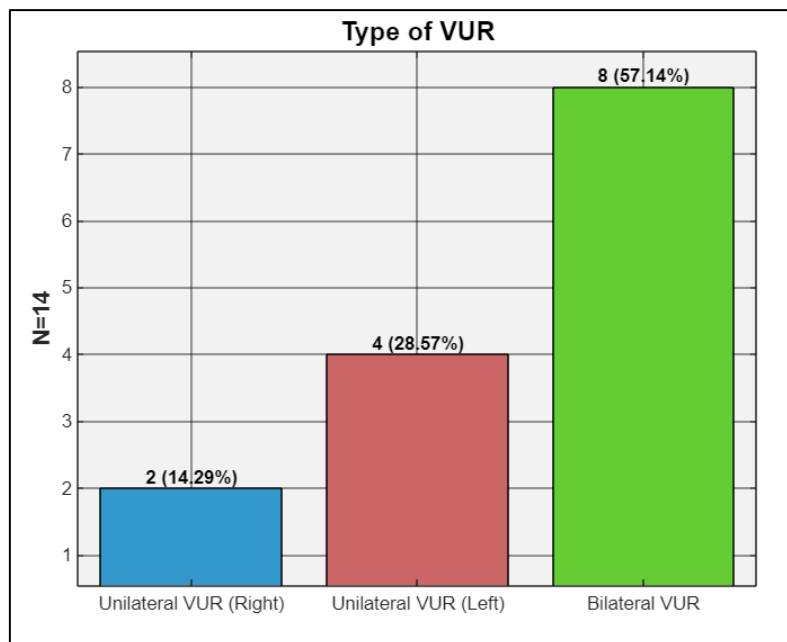


Figure 3: Presentation of VUR Among PUV Patients (n=14)

In this study, vesicoureteral reflux (VUR) was observed in 14 patients with posterior urethral valves (PUV), representing 46.7% of the study population. Of these, unilateral VUR was found in 6 patients (42.86%), with 2 cases (14.29%) on the right side and 4 cases (28.57%) on the left side. Bilateral VUR was present in

8 patients (57.14%). These findings highlight the prevalence and distribution of VUR in PUV patients, emphasizing the need for careful monitoring and targeted management to address both unilateral and bilateral cases effectively.

Table 3: Pre and Post-operative Grade of VUR on the Right Side (n=10)

| Period of Time | Grade 0 n (%) | Grade I n (%) | Grade II n (%) | Grade III n (%) | Grade IV n (%) | Grade V n (%) |
|----------------|------------------|------------------|-------------------|--------------------|-------------------|------------------|
| Pre-operative | 0 (0) | 0 (0) | 1 (10) | 3 (30) | 4 (40) | 2 (20) |
| At 1 month | 0 (0) | 1 (10) | 4 (40) | 0 (0) | 3 (30) | 2 (20) |
| At 6 months | 4 (40) | 1 (10) | 1 (10) | 0 (0) | 2 (20) | 2 (20) |

Preoperatively, reflux was present in 10 renal units on the right side, with high-grade reflux (grades IV & V) in 6 units (60%) and low-grade reflux (grades I to

III) in 4 units (40%). After six months, complete resolution occurred in 4 units (40%), decreased grade in 2 units (20%), and persistence in 4 units (40%).

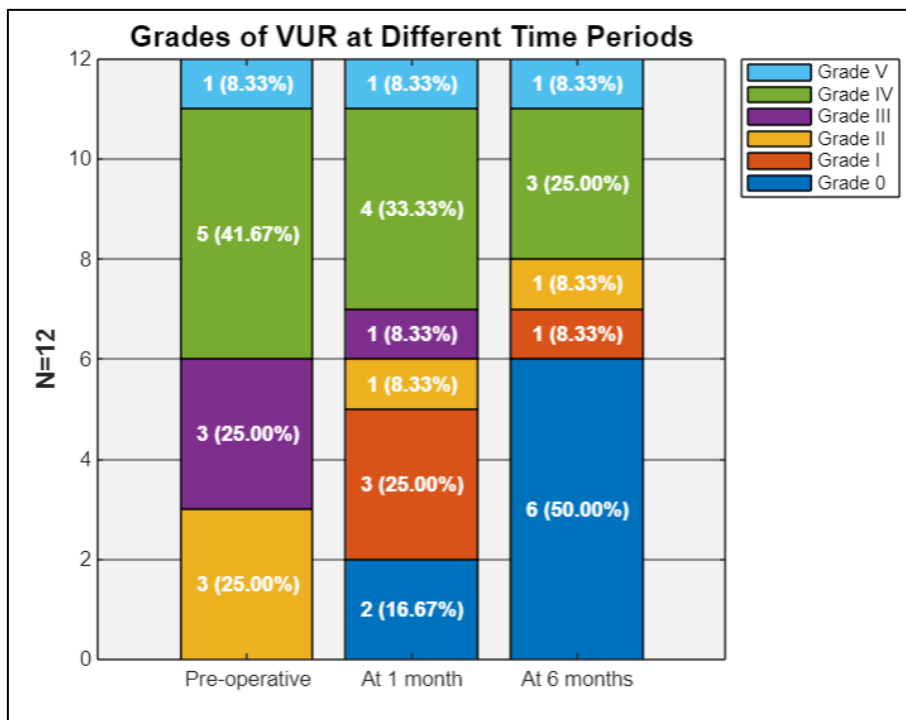


Figure 4: Pre and Post-operative Grade of VUR on the Left Side (n=12)

Preoperatively, reflux was present in 12 renal units on the left side, with high-grade reflux (grades IV & V) in 6 units (50%) and low-grade reflux (grades I to

III) in 6 units. After six months, complete resolution occurred in 6 units (50%), decreased grade in 2 units (16.67%), and persistence in 4 units (33.33%).

Table 4: Pre and Post-operative Serum Creatinine of Patients (n=30)

| Period of Time | Mean ± SD | Min - Max | p-value |
|----------------|-------------|-------------|----------------|
| Pre-operative | 0.71 ± 0.09 | 0.50 - 0.80 | |
| At 2 weeks | 0.51 ± 0.06 | 0.45 - 0.60 | Pre-op vs 2 wk |
| At 1 month | 0.44 ± 0.04 | 0.40 - 0.50 | 2 wk vs 1 mon |
| At 3 months | 0.41 ± 0.03 | 0.37 - 0.45 | 1 mon vs 3 mon |
| At 6 months | 0.37 ± 0.02 | 0.35 - 0.40 | 3 mon vs 6 mon |

A paired t-test measured the significance of changes in serum creatinine levels following fulguration. Pre-fulguration mean serum creatinine was 0.71 ± 0.09

SD mg/dl, decreasing to 0.51 ± 0.06 SD mg/dl at 2 weeks and 0.37 ± 0.02 SD mg/dl at 6 months post-fulguration, indicating significant reductions (p<0.001).

Table 5: Pre and post-operative eGFR of Patients with VUR (n=30)

| Period of Time | Mean \pm SD | Min - Max | p-value |
|----------------|-------------------|--------------|----------------|
| Pre-operative | 57.99 \pm 10.69 | 47.7 - 82.5 | |
| At 2 weeks | 77.26 \pm 9.37 | 64.2 - 85.6 | Pre-op vs 2 wk |
| At 1 month | 87.83 \pm 7.35 | 77.0 - 96.3 | 2 wk vs 1 mon |
| At 3 months | 95.16 \pm 6.36 | 85.6 - 104.1 | 1 mon vs 3 mon |
| At 6 months | 105.80 \pm 5.69 | 96.3 - 110.0 | 3 mon vs 6 mon |

The estimated Glomerular Filtration Rate (eGFR) of patients with vesicoureteral reflux (VUR) showed significant improvement following endoscopic fulguration. Pre-operatively, the mean eGFR was 57.99 \pm 10.69 ml/min/1.73 m², with a range of 47.7 to 82.5 ml/min/1.73 m². At two weeks post-operation, the mean eGFR increased to 77.26 \pm 9.37 ml/min/1.73 m² (range 64.2 to 85.6 ml/min/1.73 m²). At one month, the mean eGFR further improved to 87.83 \pm 7.35 ml/min/1.73 m² (range 77.0 to 96.3 ml/min/1.73 m²). Continued

improvements were seen at three months, with a mean eGFR of 95.16 \pm 6.36 ml/min/1.73 m² (range 85.6 to 104.1 ml/min/1.73 m²), and at six months, reaching a mean eGFR of 105.80 \pm 5.69 ml/min/1.73 m² (range 96.3 to 110.0 ml/min/1.73 m²). The p-values for these changes indicate statistically significant improvements at each follow-up interval, underscoring the effectiveness of endoscopic fulguration in enhancing renal function in patients with VUR.

Table 6: Pre and Post-operative Hydronephrosis of Patients (n=22)

| Period of Time | Right Side (n=12) | Left Side (n=10) |
|------------------------|-------------------|------------------|
| Pre-operative | 9 (75.0) | 9 (90.0) |
| At 2 weeks | 8 (66.7) | 8 (80.0) |
| At 1 month | 5 (41.7) | 6 (60.0) |
| At 3 months | 4 (33.3) | 4 (40.0) |
| At 6 months | 4 (33.3) | 4 (40.0) |
| p-value (pre vs 6 mon) | 0.063 | 0.063 |

Hydronephrosis was present in a significant number of renal units preoperatively, affecting 75.0% of right-sided units and 90.0% of left-sided units. Following endoscopic fulguration, there was a notable reduction in the presence of hydronephrosis over time. At two weeks post-operation, the incidence decreased to 66.7% on the right side and 80.0% on the left side. This trend continued, with further reductions observed at one month (41.7% right, 60.0% left), three months (33.3% right, 40.0% left), and six months (33.3% right, 40.0% left) post-operation. The change in hydronephrosis from preoperative to six months post-operative was not statistically significant, with p-values of 0.063 for both right and left sides. This indicates a positive trend towards improvement, although not reaching statistical significance, suggesting the need for longer follow-up or larger sample sizes to fully assess the impact of the treatment.

DISCUSSION

Post-valve ablation management plays a critical role in improving the outcomes for patients with posterior urethral valves (PUV) [10]. PUV is the most common cause of lower urinary tract obstruction in male infants. In the present study, most patients with PUV presented in the age group of 13-18 months (36.7%) and 19-24 months (20.0%). This aligns with findings by in our country, where 44.04% of patients were between 6 months and 3 years old. A study conducted in Maharashtra, India, by, found that the majority of

patients (40%) presented between the ages of 1-5 years, with only 16% identified during antenatal care. In contrast, developed countries often diagnose PUV antenatally.) described antenatal diagnosis of PUV with vesicoureteral reflux (VUR) in 65.7% of cases, and reported that 78% of PUV patients were diagnosed prenatally. Late presentation, common in developing countries, is associated with urosepsis, uremia, anemia, and other complications that increase morbidity. In resource-poor economies, public awareness, early diagnosis, and prompt management are crucial for improving outcomes [11,12].

In this study, the most common preoperative symptoms were poor urine stream and dribbling, reported by 83.33% and 76.67% of patients, respectively. Repeated fever and failure to thrive were noted in 63.33% and 43.33% of patients, respectively. These findings are consistent with, who reported that the most common presenting symptoms were urinary tract infections (UTI) (43.3%) and voiding difficulties (33.33%), such as poor stream, urgency, and incontinence [13]. A high index of suspicion for PUV is essential in any child presenting with these symptoms. PUV presents a broad spectrum of symptoms, and resection of the valve is not a complete cure. As shown in this study, while resection improved symptoms for some patients, others continued to experience a range of issues. At six months post-operation, 50% of patients were symptom-free. However, continued symptoms such as fever, urinary frequency, and dribbling were

noted in 28.57%, 28.57%, and 21.43% of patients, respectively. These patients received conservative post-operative treatment, including long-term prophylactic antibiotics, desmopressin, antimuscarinics, anticholinergics, behavioral therapy (timed-voiding, double voiding, triple-voiding, bed-wetting alarm), and ongoing bladder volume increase with somatic growth.

VUR is observed in 48%-66% of patients with PUV. The gold standard for diagnosing PUV is voiding cystourethrogram (VCUG) (Talabi *et al.*, 2015). In this study, VUR was present in 46.7% of PUV patients, with unilateral VUR in 42.86% and bilateral VUR in 57.14%. Among unilateral VUR cases, 14.29% were on the right side and 28.57% on the left side, consistent with findings by, who reported bilateral VUR in 37% and unilateral VUR in 27% of patients [14]. VUR often resolves after the release of urethral obstruction. Johnston reported VUR resolution in 30 of 65 ureters (46%) in 44 patients at 2 weeks to 13 months follow-up. Other studies showed VUR resolution in 27% to 40% of patients at 1 to 21 years follow-up after valve ablation. In neonates, the resolution rate was even higher (64%) during a mean follow-up of 6.3 years.

In this study, after six months of fulguration, complete resolution of reflux was observed in 40% of right-side renal units and 50% of left-side units. The reflux grade decreased in 20% of right-side units and 16.67% of left-side units, with persistence in 40% of right-side and 33.33% of left-side units. These results are comparable to Johnston's findings. found that VUR resolved significantly sooner in unilateral cases compared to bilateral cases, a finding supported by [15]. Our study also found higher resolution rates for unilateral VUR. However, reported that bilateral reflux tended to resolve more commonly in their series (35% compared to 11% for unilateral reflux), possibly due to lower grades of reflux in their bilateral group.

Low-grade reflux (grades I to III) resolved earlier than high-grade reflux (grades IV and V), consistent with. In our study, the majority of patients were aged 11-20 months (36.7%) and 21-30 months (26.67%), with earlier presentation associated with lower-grade reflux. Noted that early presentation and diagnosis, along with early fulguration, were associated with lower grades of VUR, better resolution, and good outcomes [16]. Conversely, late presentation was linked to higher grades of VUR, higher serum creatinine levels, and renal impairment. During the postoperative follow-up period, serum creatinine levels significantly decreased ($p<0.001$) at each follow-up interval, similar to findings by, who reported a significant improvement in mean serum creatinine from 1.16 ± 0.32 preoperatively to 0.55 ± 0.22 one year after valve ablation ($p<0.001$) [17].

Similarly, in this study, eGFR levels significantly increased ($p<0.001$) at each follow-up

interval. Reported a median baseline eGFR of 27 ml/min/1.73 m² preoperatively, improving to a median best post-intervention eGFR of 42 ml/min/1.73 m², with a median difference of 12 ml/min/1.73 m². Overall, 35% of patients showed eGFR improvement to 60 ml/min/1.73 m² or greater [18]. In this study, the change in hydroureteronephrosis between preoperative and six months postoperative was not statistically significant ($p=0.063$). Found that 70% of renal units showed postoperative improvement in hydronephrosis grade [19]. Observed a statistically significant reduction in hydronephrosis grade over six months ($p<0.05$), with only one child showing complete resolution [20-22].

In study the management of PUV post-valve ablation is crucial for improving patient outcomes. While the procedure effectively alleviates many symptoms and complications, continuous monitoring and appropriate management of residual issues such as VUR, hydronephrosis, and renal function are essential. Early diagnosis and intervention are key to better outcomes, emphasizing the need for public awareness and resource allocation in developing countries to improve the prognosis for children with PUV.

CONCLUSION

Vesicoureteral reflux (VUR) is present in almost half of the early presenting posterior urethral valve (PUV) patients. After 6 months of PUV fulguration about half of the VUR completely resolute, one fifth decrease in grade and one third of VUR persist. There is significant improvement of renal function after PUV fulguration. The change of hydroureteronephrosis between preoperative and 6 months after operation was not statistically significant.

Recommendations

- Treatment of posterior urethral valve (PUV) is a clinical challenge, requiring active management from infancy to adulthood to avoid progressive renal impairment. Effort at improving awareness among the guardians and early diagnosis and referral among the health team should be encouraged.
- Further research work could be done using larger study sample and longer study period to get more precise results.

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