

The effect of combined use of oxybutynin and fulguration in children with PUV: experience in a tertiary center in Bangladesh

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ABSTRACT

Aims: Posterior urethral valve (PUV) is a common congenital urethral obstruction leading to significant morbidity. Despite successful fulguration of PUV, the bladder dysfunction persists in most of the cases. Oxybutynin, an anticholinergic drug is commonly used to manage this bladder dysfunction. This study aimed to assess the impact of oxybutynin on bladder and urinary tract function in children with valve fulguration.

Methods: A retrospective observational study was conducted on 41 children who underwent PUV fulguration at a tertiary care center in Bangladesh between 2020 and 2023. All subjects received oxybutynin for at least 6 months post-fulguration. Bladder wall morphology, hydronephrosis, vesicoureteral reflux (VUR), and post void residues (PVR) were assessed. Side effects of oxybutynin were also documented.

Results: All patients had bilateral hydroureteronephrosis (HUN), except one, who was with unilateral HUN during primary diagnosis. Complete resolution of bilateral HUN was seen in renal USG 14 patients at 6 months post fulguration. Correction of VUR documented in 13 units out of 32 units. Mean serum creatinine decreased to 0.52 ± 0.22 from 0.73 ± 0.52 within 6 months of fulguration. Four patients exhibited significant PVR, leading to clean intermittent catheterization (CIC) initiation.

Conclusion: Combined with PUV fulguration and oxybutynin therapy appears to be effective in improving bladder function. Further prospective studies incorporating urodynamic evaluations are warranted to validate these findings.

Keywords: Posterior urethral valve, oxybutynin, fulguration

INTRODUCTION

Posterior urethral valve (PUV) stands as a prevalent form of congenital urethral obstruction, with an incidence of 1 in 2500 to 1 in 5000 male births.¹ This condition is recognized as a primary surgical cause of chronic kidney disease in children necessitating renal replacement therapy.¹ During the development of a normal fetal bladder, bladder cycling generates a stretch force on the bladder that causes a decrease in collagen content in the bladder wall and also a decrease in smooth muscle tension. In patients with PUVs, this normal bladder cycling hampers. It causes structural and functional alteration in the bladder and thus produces bladder dysfunction. Due to the loss of strength and elasticity of the bladder wall, there is a gradual loss of bladder compliance, reduction in capacity, and development of high storage pressures.^{2,3} The presence of PUV typically gives rise to bladder hypertrophy and hydroureteronephrosis (HUN), evident on ultrasound

scans. While ultrasound serves as an effective diagnostic tool, the gold standard investigation for comprehensive evaluation remains the micturating cystourethrogram (MCU). The MCU offers a detailed portrayal of the condition, showcasing not only the dilated posterior urethra but also providing insights into bladder dimensions, trabeculation, and the presence of vesicoureteral reflux (VUR).⁴ Early valve fulguration is proven to be superior to diversion procedures (vesicostomy/ureterostomy) and is considered the optimal management modality following initial stabilization of deranged renal function, metabolic parameters, and coexisting urinary tract infection (UTI).^{5,6}

Despite timely interventions such as valve ablation, bladder dysfunction manifested by frequency, dribbling, and daytime and nighttime incontinence, persists in a substantial proportion of patients, often becoming a crucial determinant



of long-term outcomes.^{5,7} This dysfunction results from the remaining pathological changes in the bladder that is hypertonic, hyperreflexic, small capacity, and noncompliant bladder. The type of bladder dysfunction after valve fulguration is unpredictable. The clinical challenges are to identify those individuals who are at risk of bladder dysfunction.

Oxybutynin, an anticholinergic drug, emerged as the preferred therapeutic choice for managing post-fulguration bladder dysfunction. Oxybutynin, by inhibiting muscarinic action, exerts an antispasmodic effect on the bladder's smooth muscles.⁶ Several studies mentioned that oxybutynin improves this dysfunction.^{2,8} It improves the bladder compliance, increases bladder capacity, and decreases the storage pressure.⁸ Because of this property, it becomes the drug of choice in treating bladder dysfunction in children with PUVs.⁸

This study sought to evaluate the effectiveness of oxybutynin in the management of children following PUV fulguration.

METHODS

The study was conducted with the permission of the Ethics Committee of Bangladesh Shishu Hospital and Institute (Date: 07.03.2022, Decision No: 2023712(I)). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. This was a retrospective observational study among the children who underwent fulguration for PUV in Bangladesh Shishu Hospital and Institute, a tertiary care center in Bangladesh between 2020-2023. All children who underwent fulguration from the neonatal period to 5 years of age and on oxybutynin were included in the study. Children with PUV were treated with oxybutynin at 0.2 mg/kg/day in two divided doses for 6-month post fulguration. Exceptions are those who have good bladder morphology as noted during cystoscopy and without complaints of frequency, dribbling, and daytime and nighttime incontinence, those with significant persistent post void residues (PVR) on post fulguration follow-up ultrasound, and those who did not tolerate oxybutynin. Basic demographic details, brief antenatal and neonatal medical history, biochemical parameters, renal ultrasonogram, MCU, DMSA scan reports were assessed in follow up. Bladder wall morphology, the status of HUN, and PVR were compared between preoperative and postoperative ultrasound scans. VUR was assessed in MCUs. The status of renal scarring was determined by DMSA scans. Data regarding the side effects of oxybutynin were collected by asking the parent as well as by going through their medical records.

Statistical Analysis

Data analysis was performed with SPSS Statistics for Windows, Version 20.0. Statistical significance was set at $p < 0.05$.

RESULTS

There was a total of 44 children who underwent fulguration for PUV between January 2020 and December 2023. Of these, 3 children were excluded as they were lost to follow up. Thus, at the time of final follow-up 41 children were available.

The age at presentation ranged from 9 days to 3 years 8 months (Table 1). The relevant clinical features are summarized in

Table 2. The most common clinical presentation was poor urinary stream noted in 30/41 children, UTI in 18/41 children and acute renal failure in 8/41, antenatal diagnosis 10/41.

Table 1. Age of presentation of the patients

Age	n	Frequency
<6 months	21	51%
6months-1year	7	17 %
1year-5year	13	32 %

Table 2. Clinical characteristics of the study population

Clinical presentation	n	Frequency
Poor urinary stream	30	73.17%
Urinary tract infection	18	43.90%
Acute renal failure	8	19.51%
Antenatal diagnosis	10	24.39%

Renal ultrasound revealed bilateral HUN in 40/41 patients and unilateral HUN in 1 patient at presentation (Table 3). In follow up USG at 6 months revealed, 35% (14/40) of those with bilateral HUN had complete resolution. In the remaining 26 patients with bilateral HUN, improvement in HUN was seen in 12 children. There was no change of HUN was observed in 14 patients with bilateral HUN and 1 patient with unilateral HUN (Table 3).

Table 3. Pre and post operative renal ultrasound

		Bilateral HUN	Unilateral HUN
Preoperative USG		40	1
Postoperative USG	Complete resolution	14	0
	Improved	12	0
	Not improved	14	1

HUN: Hydronephrosis

Initial MCU revealed a total of 32 refluxing units (Table 4). In follow up, complete resolution was noted in 8 patients, 13/32 units (41%), and no change in 3 patients. In 7 patients the grade of VUR was improved. However, 2 patients with no VUR had developed new unilateral VUR.

Table 4. Pre and post operative MCU

Preoperative MCU		Bilateral VUR	Unilateral VUR
		13	6
Postoperative MCU	Complete resolution	5	3
	Improved	5	2
	Not improved	3	1

MCU: Micturating cystourethrogram, VUR: Vesicoureteral reflux

Four patients had documented significant PVR in follow-up. This was probably due to the combined effect of oxybutynin with ineffective bladder emptying. All of them were started on clean intermittent catheterization (CIC).

The preoperative mean serum creatinine was 0.73 ± 0.52 and after 6 months of fulguration mean serum creatinine was 0.52 ± 0.22 . There was a significant fall in the mean creatinine ($p = .001$) after fulguration (Table 5).

Most of our patients, 35/41 with oxybutynin for more than 6 months after fulguration, were asymptomatic with a good urinary stream in follow-up. 2 children had daytime



incontinence which was improved with time and 3 children had recurrent UTI which was treated with antibiotics.

Table 5. Laboratory findings

	Pre intervention		Post intervention		p
	n	Mean (SD)	n	Mean (SD)	
Creatinine	41	0.73±0.52		0.52±0.22	.001

SD: Standard deviation

DISCUSSION

We conducted a retrospective observational study to find out the course of disease in children diagnosed with PUV and on oxybutynin for at least 6 months with fulguration. The most common presenting complaints in our study population were poor urinary stream and recurrent UTI which was similar to the study done by Norris JJ et al.⁹ 55.56% of their patients presented with poor urinary stream and 41.67% with UTI. In our study only 5 (5/41) patients presented at the age of <1 month and 24.39% of our patients had antenatal diagnosis. These findings differed from other studies. Ezel et al.¹⁰ reported a single-center experience of 22 years with 64 children where the median age of diagnosis of PUV was one month (range 1-132 months) and 51.5% were diagnosed antenatally. Another retrospective study over 29 years reported that 42.5% (n=77/181) of the total 181 South African boys with PUV were diagnosed in their first month of life.¹¹ This is probably due to the lack of proper antenatal screening facilities in our country. We have observed that ultrasound during antenatal period paid very little attention to the detection of congenital anomalies.

In our study, we found improvement in lower urinary tract symptoms and having a good urinary stream in patients with the use of oxybutynin for at least 6 months after ablation. A similar finding was mentioned by Norris JJ et al.⁹ There was a decrease in postoperative mean serum creatinine than mean preoperative serum creatinine in our study.

The combined use of oxybutynin and PUV fulguration also caused resolution of the HUN in renal ultrasound scans and the resolution of VUR in MCU in this study. All of these reflect improved bladder function in our PUV patients. These findings were similar to Kim et al.¹² who used anticholinergic medication. Other studies observed that oxybutynin improves bladder compliance, and detrusor overactivity, increases the bladder capacity, and decreases the storage pressure.^{8,13} Wani SA et al.¹⁴ mentioned in their study that early use of oxybutynin immediately after the diagnosis of PUV improves the urodynamic parameters in these patients. In our country, urodynamic study cannot be done before 5 years of age. This makes it difficult to identify the specific bladder dysfunction in our setting. We can only assess the improvement of lower urinary tract symptoms, and USG and MCU parameters during follow-up after 6 months of fulguration.

The main concern in using anticholinergic therapy is a reversible iatrogenic myogenic failure causing the overdistended bladder, worsening reflux, and incontinence.¹⁵ We had 4 patients for whom PVR was significant. MCU of these children showed moderate capacity bladder, presence of PVR, and resolution of reflux in 3 patients but increased the grade of reflux in 1 patient. So it was unlikely for the patients to have myogenic failure. However urodynamic evaluation was necessary to confirm. The treatment for myogenic failure is to stop the anticholinergic therapy and start CIC to facilitate bladder

emptying.^{15,16} So, we treated these 4 patients with CIC and stopped the oxybutynin.

The combined use of oxybutynin and PUV fulguration has resulted in resolution of the HUN in renal ultrasound scans and the resolution of VUR in MCU, thereby reflecting an improvement in bladder function. A comparative study revealed, the observation group where oxybutynin was not given after valve fulguration hydronephrosis was improved in 16/50 (34.8%) renal unit, which was significantly lower than the oxybutynin group.¹⁷ Our study showed improvement of hydronephrosis in 52/81 (64%) renal units.

Oxybutynin has some side effects, these include dry mouth, dry eyes, constipation, and urinary retention.¹⁸ Dryness of the mouth is usually the most common side effect encountered. However, we did not observe these side effects as our patients were mostly below 3 years of age and they could not comprehend the dryness of mouth.

Limitations

Our study has a few limitations. The data were collected retrospectively. It was also not possible to have a control group as management of PUV with oxybutynin and fulguration have become the standard of care. The accuracy of valve fulguration is also predicted by improvement in symptoms and investigations in follow-up. Therefore, it is difficult to mention the outcome of adequate valve fulguration and the use of oxybutynin individually. The other major limitation is the unavailability of urodynamic study in our country So urodynamic correlation could not be possible in our study.

CONCLUSION

Adequate valve fulguration and oxybutynin therapy in children with PUV can improve the function of bladder and helps in preventing structural damage to the upper tracts.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was conducted with the permission of the Ethics Committee of Bangladesh Shishu Hospital and Institute (Date: 07.03.2022, Decision No: 2023712(I)).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.



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