

ORIGINAL RESEARCH

Role of urethral lumen narrowing in predicting the outcome of optical internal urethrotomy

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ABSTRACT

Background: Male urethral stricture is a common and challenging urological disease. Optical urethrotomy is a promising treatment option for short-segment bulbar strictures. The present study aimed to predict the outcome of optical internal urethrotomy for short-segment bulbar urethral strictures by measuring the percentage of lumen narrowing at the stricture site using retrograde urethrogram (RGU). **Methods:** This prospective observational study was conducted at King George Hospital/Andhra Medical College, Visakhapatnam, from January 2019 to December 2020. The study involved analysis of radiological films of patients with short bulbar urethral stricture who underwent optical internal urethrotomy. A high-quality RGU measured the site of the maximal lumen narrowing and patients were followed for symptom recurrence. **Results:** The study included 40 patients with a mean age of 46.61 years. Most patients fell into the age groups of >30-≤40 and >40-≤50 years (30% each). Idiopathic strictures were the predominant etiology in 45.0% of patients. Overall, 16 patients achieved successful treatment, while 24 experienced treatment failure. The lumen narrowing of ≤70% within both RGU (68.18% vs 31.82%) and outcome (93.75% vs 29.16%) was significantly higher among patients with treatment success than those with treatment failure (P<0.0001). Conversely, the lumen narrowing of >70% within both RGU (94.5% vs 5.5%) and outcome (70.83% vs 6.25%) was significantly higher among patients with treatment failure than those with treatment success (P<0.0001). **Conclusion:** The percentage narrowing of the urethral lumen at the stricture site serves as a valuable predictor of the outcome of optical internal urethrotomy.

Keywords: bulbar stricture, percentage narrowing, retrograde urethrogram, treatment outcome, urethral lumen

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INTRODUCTION

Male urethral stricture remains a common and challenging urological condition,¹ involving urethral lumen narrowing from the meatus to the bladder neck.² Urethral strictures can seriously affect patients, leading to a range of complications, including acute urinary retention, bladder obstructive uropathy, urinary tract infections, ejaculation disorders, stenosis recurrence, and renal failure.³ The majority of urethral strictures are found in the bulbar urethra.⁴

The American Urological Association guidelines recommend urethral dilation, direct visual internal urethrotomy, or urethroplasty for the initial treatment of a short (<2 cm) bulbar urethral stricture.⁵ The success of optical urethrotomy in the treatment of initial and short urethral strictures is promising.¹ Additionally, optical urethrotomy confers various benefits, including its suitability for day-care procedures, facilitating early mobilization, and reducing the duration of indwelling catheter usage. However, optical urethrotomy is only a curative

option for short-segment bulbar urethral strictures that do not involve spongiofibrosis.¹

Accurate diagnosis and adequate staging play a crucial role in achieving successful surgical outcomes, especially in the management of ureteral strictures. Various imaging methods, along with patient history and physical examination, aid in selecting the optimal reconstructive procedure for restoring normal urinary function. However, selecting an appropriate imaging technique for preoperative assessment in these patients is essential for making reconstructive procedure decisions, resulting in improved patient outcomes. The retrograde urethrogram (RGU), recognized as the current gold standard, enables accurate diagnosis, staging, and mapping of urethral strictures. It continues to play a pivotal role in the comprehensive management of urethral stricture disease.⁶

The chances of treatment failure in terms of disease recurrence is influenced by several factors including penile and membranous strictures, long (>2cm) and multiple strictures, a previous internal urethrotomy, untreated perioperative urinary infection and extensive periurethral spongiofibrosis.⁷ Notably, among these factors, the caliber or percentage of narrowing has been the least studied. Establishing a correlation between the percentage of lumen narrowing on RGU and the postoperative success rates of optical internal urethrotomy can ultimately contribute to more informed clinical decisions and enhanced patient outcomes in the management of urethral stricture.

Therefore, the present study aimed to predict the outcome of optical internal urethrotomy for short segment bulbar urethral strictures by measuring the percentage of lumen narrowing at the stricture site using RGU.

METHODS

This prospective observational study was conducted at the Department of Urology, King George Hospital/Andhra Medical College, Visakhapatnam, from January 2019 to December 2020. The study involved clinical evaluation and analysis of radiological films of the patients admitted to the hospital. The study protocol was approved by the Institutional Ethics Committee, Andhra Medical College, Visakhapatnam. A written informed consent was obtained from each participant prior to the commencement of the study.

Patients with short primary bulbar urethral stricture who underwent optical internal urethrotomy were included in the study. The study excluded patients with a history of prior intervention, a complete block

of the urethral lumen, and a stricture greater than 2 cm.

Detailed patient information regarding the history of onset, duration, and progression of various symptoms was documented. Patient's medical history, family history, occupational history, socioeconomic status, demographic data were collected. Patients underwent a complete physical examination.

A high-quality retrograde urethrogram was obtained, and the site of the maximal narrowing was measured using a foot scale. The diameter of the normal urethral lumen distal to the stricture site was also recorded. The distal urethral lumen was considered normal because this part undergoes maximum distension during the urethrogram, as opposed to the urethra proximal to the stricture. The percentage narrowing was calculated using the formula.⁸

Percentage narrowing = $[(x-y/x) 100]$

All patients underwent optical internal urethrotomy using a standard 20Fr Sachse's urethrotome. The Foley catheter was removed on the fifth postoperative day. The patients were advised to do self-catheterization once daily for the first month and then once three days later. Patients were followed up for recurrence of symptoms. All patients were given standard therapy with no change in treatment.

STATISTICAL ANALYSIS

Data were analyzed using Statistical Package for Social Sciences (SPSS), version 23. Descriptive statistics was used to describe categorical variables (frequency and percentages) and continuous variables (mean and standard deviation [SD]). A comparison between groups was performed using Chi square test for categorical variables. $P < 0.05$ was considered as statistically significant.

DEFINITION

Treatment failure: The recurrence of symptoms, which included the inability to pass the catheter or the need for a repeat optical internal urethrotomy or urethroplasty, was considered as a treatment failure.

RESULTS

A total of 40 patients were included in the study. The mean age of the patients was 46.61 years. Most of the patients belonged to the age group of >30-≤40 and >40-≤50 years, accounting for 30.0% of patients in each group. The etiology of idiopathic strictures was predominant in 45.0% of patients, primarily caused by instrumentation and catheterization. More than half of the patients had a stricture length of 1-2 cm (57.0%). The majority of patients had lumen narrowing within the range of 71-80% (37.0%) and 61-70% (28.0%), respectively (Table 1).

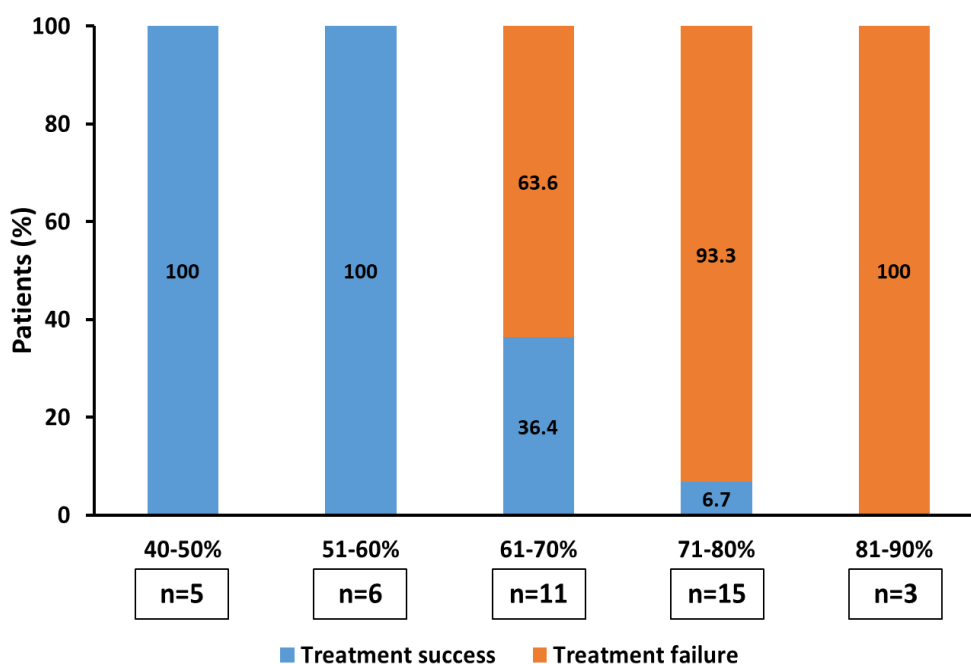
Table 1: Baseline characteristics

Parameters	Number of patients (N=40)
Age (years), mean	46.61
Age group (years) 21-≤30	6 (15.0)

>30-≤40	12 (30.0)
>40-≤50	12 (30.0)
>50	10 (25.0)
Stricture etiology	
Idiopathic	18 (45.0)
Traumatic	11 (28.0)
Iatrogenic	9 (22.0)
Lichen sclerosus	2 (5.0)
Stricture length (cm)	
<1	17 (43.0)
1-2	23 (57.0)
Lumen narrowing (%)	
40-50	5 (12.0)
51-60	6 (15.0)
61-70	11 (28.0)
71-80	15 (37.0)
81-90	3 (8.0)
Data presented as n (%), unless otherwise specified.	

A total of 16 patients achieved successful treatment who did not experience any recurrence throughout the study duration. The lumen narrowing in the range of 40-50% and 51-60% showed a treatment success rate of 100%. However, a further increase in the lumen narrowing led to an increase in the treatment failure. The lumen narrowing in the range of 61-70%, 71-80%, and 81-90% showed treatment failure of 63.6%, 93.3%, and 100%, respectively (Figure 1).

Figure 1: Treatment outcome according to percentage narrowing on the retrograde urethrogram



Overall, the treatment failed in 24 patients. Most recurrences occurred between 7-12 months in 12 patients, followed by recurrences at >12 months in seven patients and <6 months in five patients. Of the 16 patients with treatment success, 15 patients had lumen narrowing of ≤70% and one patient had lumen narrowing of >70% on the RGU (Table 2).

Table 2: Correlation between percentage urethral narrowing on retrograde urethrogram and treatment outcome

Lumen narrowing on RGU (%)		Treatment outcome		Total	P value
		Success	Failure		
≤70	Count	15	7	22	
	% within RGU	68.18	31.82	100	
	% within outcome	93.75	29.16	55	

>70	Count	1	17	18	<0.0001**
	% within RGU	5.5	94.5	100	
	% within outcome	6.25	70.83	22.92	
Total	Count	16	24	40	
	% within RGU	40	60	100	
	% within outcome	100	100	100	
**Denotes significant at 1% level.					
RGU, retrograde urethrogram.					

The lumen narrowing of $\leq 70\%$ within RGU was significantly higher among patients with treatment success than those with treatment failure (68.18% vs 31.82%; $P < 0.0001$). Similarly, the lumen narrowing of $\leq 70\%$ within outcome was significantly higher in patients with treatment success than those with treatment failure (93.75% vs 29.16%; $P < 0.0001$). On the contrary, the lumen narrowing of $> 70\%$ within both RGU (94.5% vs 5.5%) and outcome (70.83% vs 6.25%) was significantly higher among patients with treatment failure than those with treatment success ($P < 0.0001$).

DISCUSSION

Optical internal urethrotomy is preferred as the first treatment option by many urologists. Internal urethrotomy offers advantages in terms of ease, simplicity, speed, and a shorter convalescence period. However, the success rates can vary.⁹ The present study was conducted in patients with short primary bulbar urethral stricture who underwent optical internal urethrotomy. Literature suggests that urethral stricture primarily affects the anterior urethra,⁴ particularly the bulbar tract.^{4, 10, 11}

In this study, the mean age of patients was 46.61 years, which correlates with other studies reporting the mean age of 45.1 years⁴ and 41.98 years.⁸ The majority of the study population equally belonged to the age groups of $>30\text{--}\leq 40$ years and $>40\text{--}\leq 50$ years. This trend was comparable to the study by Palminteri et al.⁴ where the stricture distribution increased until about 45 years and then decreased. However, studies suggest that in males, a sharp increase in urethral strictures is observed after the age of 55 years.¹² Evidences also support that the disease might be highly prevalent in elderly populations.^{12, 13}

Idiopathic stricture (45%) was the most common etiology in this study. This was supported by Mundy et al.,¹⁴ who reported that for bulbar urethral strictures, about 40% are idiopathic, while Fenton et al.¹¹ reported that the majority (34%) of anterior urethral strictures were idiopathic.

The present study reported a stricture length of 1-2 cm (57%) in the majority of patients. On similar lines, Karrupiah et al.¹⁵ and Ganesan AN,¹⁶ both reported a stricture length of 1-2 cm in 59% of patients. In contrast, Fenton et al.¹¹ reported a mean bulbar stricture length of 3.1 cm, while Mandhani et al.⁸ reported a mean primary bulbar urethral stricture length of 0.868 cm on radiographic film.

The study exhibited treatment failure in 24 patients as defined by the recurrence of symptoms. The

recurrences were frequent between 7-12 months and comparatively less after 12 months. This was comparable to the study reporting recurrence after urethrotomy in 56% of patients within 12 months, followed by 26% of patients within 24 months.¹⁰ Generally, longer strictures are more likely to recur, with a recurrence rate at 12 months of approximately 40% for strictures shorter than 2 cm, 50% for strictures between 2-4 cm, and 80% for strictures longer than 4 cm.¹⁷ Recurrence after urethrotomy also vary based on stricture location, with recurrence rate of 58% for bulbar strictures, compared to 84% for penile strictures and 89% for membranous strictures.¹⁰ In this study, the percentage of narrowing assessed on RGU film significantly affected the outcome after optical internal urethrotomy. A treatment success was achieved in only 16 patients, a large majority of which had a lumen narrowing of $\leq 70\%$. Precisely, all patients with a narrowing in the range of 40-70% had good results with no recurrence throughout the study. On the contrary, amongst the 24 patients with treatment failure, majority had a lumen narrowing of $> 70\%$. The data indicates that an increase in lumen narrowing significantly increases the risk of treatment failure after urethrotomy. Along the same lines, previous study reported that the mean percentage narrowing was significantly higher with treatment failure (69.9% vs 48.55%; $P < 0.0001$).⁸ Despite the relatively small sample size, the present study provides a preliminary indication that patients with a lumen narrowing of $< 70\%$ on the retrograde urethrogram tend to achieve more favorable outcomes following optical internal urethrotomy. Several factors, including penile and membranous strictures, long ($> 2\text{cm}$) and multiple strictures, a previous internal urethrotomy, untreated perioperative urinary infection and extensive periurethral spongiositis, influence the internal urethrotomy treatment failure in terms of disease recurrence.⁷ The finding of present study carries substantial clinical relevance, underscoring the importance of considering the severity of narrowing when assessing the outcomes of urethrotomy procedures.

CONCLUSION

In conclusion, the study highlights the importance of lumen narrowing as a critical factor in predicting the success of optical internal urethrotomy for short segment bulbar urethral strictures. Patients with lumen narrowing of $\leq 70\%$ on the RGU tend to have a significantly higher chance of treatment success and lower risk of recurrence. Further research with larger

sample sizes is warranted to confirm and extend these observations and to explore potential strategies for improving the outcomes of urethrotomy.

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