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ORIGINAL ARTICLE

Factors Influencing the Success of Optical Internal Urethrotomy for Short-Segment Bulbar Urethral Strictures

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Abstract

Background: Urethral stricture disease is a common urological condition characterized by fibrosis of the urethral epithelium and corpus spongiosum, leading to narrowing of the urethral lumen and bladder outlet obstruction. Optical Internal Urethrotomy (OIU) is widely used for the management of short-segment bulbar urethral strictures because of its simplicity, safety, and minimal invasiveness. However, recurrence following OIU remains a major challenge. Several factors have been studied as predictors of recurrence, but the role of percentage luminal narrowing on Retrograde Urethrogram (RGU) has not been extensively evaluated. **Methodology:** A prospective observational study was conducted in the Department of Urology, Government Stanley Medical College and Hospital, Chennai, from September 2012 to March 2014. Fifty-one patients were initially evaluated, of whom 37 patients with primary bulbar urethral strictures less than 2 cm in length fulfilled the inclusion criteria and completed follow-up. Patients with previous urethral interventions, complete urethral obliteration, or strictures greater than 2 cm were excluded. Percentage luminal narrowing was calculated from preoperative Retrograde Urethrogram measurements. **Results:** The study included 37 patients, with the majority belonging to the 31–40 years age group (32%). Idiopathic stricture was the most common etiology (41%), followed by traumatic (27%), iatrogenic (19%), and lichen sclerosus-related strictures (13%). Eleven patients (29.7%) achieved successful outcomes, whereas 26 patients (70.3%) experienced recurrence. All patients with luminal narrowing between 40% and 60% had successful outcomes. Among patients with luminal narrowing greater than 60%, 25 out of 28 experienced recurrence. Most recurrences occurred within the first 10 months following surgery. A statistically significant association was observed between percentage luminal narrowing and treatment outcome ($p < 0.001$). **Conclusion:** Percentage luminal narrowing measured on Retrograde Urethrogram is a simple, inexpensive, and reliable predictor of outcome following Optical Internal Urethrotomy for short-segment bulbar urethral strictures. Patients with less than 60% narrowing demonstrated significantly better outcomes than those with greater than 60% narrowing.

Keywords: Urethral stricture, Optical Internal Urethrotomy, Retrograde Urethrogram, Bulbar urethral stricture, Luminal narrowing, Spongiofibrosis, Recurrence

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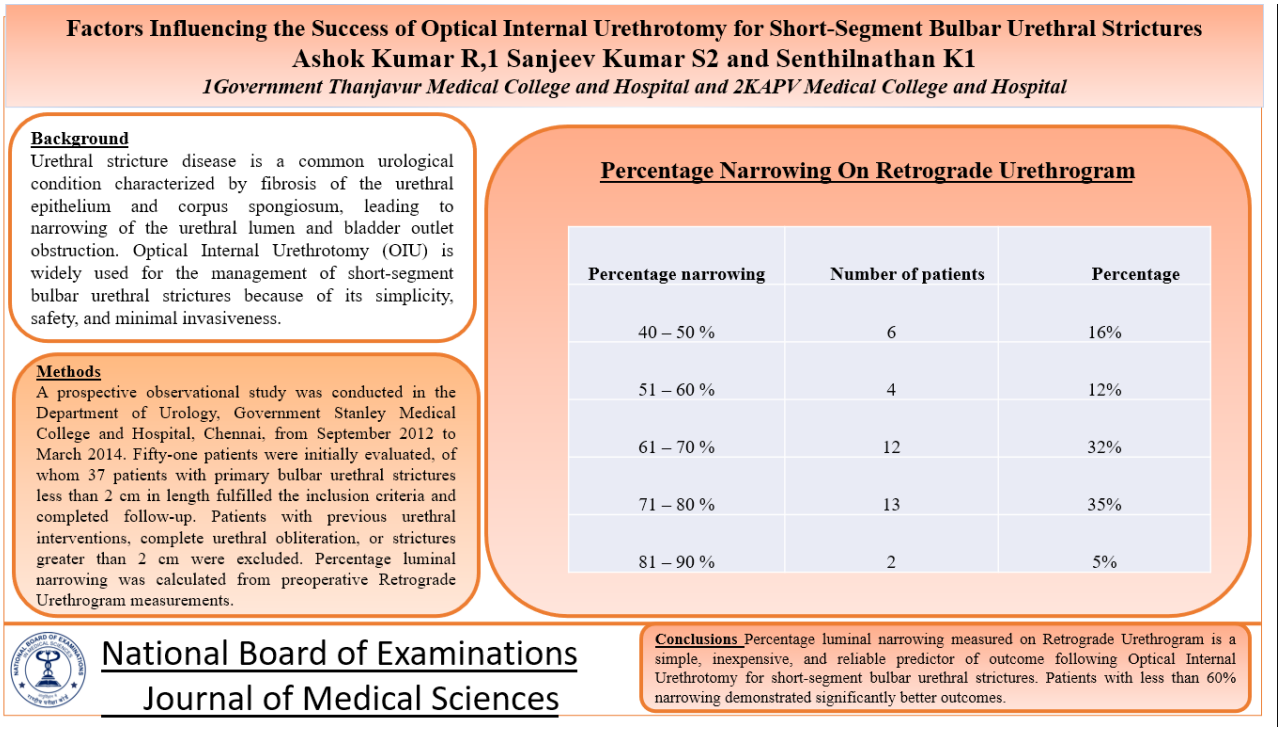
Graphical Abstract



Introduction

Urethral stricture disease is a common urological disorder that continues to pose a significant clinical and economic burden worldwide. The condition is characterized by fibrosis of the urethral epithelium and corpus spongiosum, resulting in narrowing of the urethral lumen and varying degrees of bladder outlet obstruction [2]. Historically, urethral stricture was described by the ancient Indian surgeon Sushruta as "Mutra Marga Sankocha," which was managed by dilatation using lubricated instruments [1].

The incidence of urethral stricture disease in Western populations has been estimated at approximately 0.6%, although the actual incidence may be higher in developing countries such as India [2]. Over the years, the etiology of urethral stricture disease has undergone a significant shift. While infectious causes were previously predominant, trauma and iatrogenic instrumentation have now emerged as the leading causes of urethral strictures [3]. Additionally, inflammatory conditions such as lichen sclerosus contribute significantly to the burden of urethral stricture disease [7].

The pathological hallmark of urethral stricture disease is spongiofibrosis, which results in progressive narrowing of the urethral lumen and deterioration of urinary flow [5,6]. Patients commonly present with lower urinary tract symptoms including poor urinary stream, straining, hesitancy, intermittency, post-void dribbling, recurrent urinary tract infections, and urinary retention. Severe untreated disease may lead to complications such as urethrocutaneous fistula, Fournier's gangrene, and renal dysfunction [2].

Retrograde urethrography (RGU) remains the standard imaging modality for evaluating urethral strictures, providing

valuable information regarding stricture location, length, and severity. Although sonourethrography is useful for assessing the degree of spongiofibrosis, its availability is limited and it remains highly operator dependent [6,22]. Consequently, there is a need for a simple, reproducible, and widely available method of predicting treatment outcomes.

Optical Internal Urethrotomy (OIU), first popularized by Sachse, remains one of the most commonly performed minimally invasive procedures for short-segment bulbar urethral strictures due to its simplicity, safety, and short learning curve [12,13]. However, long-term outcomes following OIU remain variable, with recurrence rates ranging from 25% to 68% in different studies [20,21]. Several factors including stricture length, location, degree of spongiofibrosis, previous interventions, infection, and urethral calibre have been identified as predictors of recurrence [15–27].

Mandhani et al. demonstrated that the degree of luminal narrowing on Retrograde Urethrogram could serve as a predictor of OIU outcome in short-segment bulbar strictures [27]. However, limited data exist regarding its applicability in routine clinical practice. Therefore, the present study was undertaken to evaluate whether the percentage luminal narrowing measured on preoperative Retrograde Urethrogram can predict the outcome of Optical Internal Urethrotomy in patients with short-segment bulbar urethral strictures.

Aims and objectives

To predict the outcome of Optical Internal Urethrotomy in patients with short-segment bulbar urethral strictures by measuring the percentage luminal narrowing at the stricture site on Retrograde Urethrogram.

Materials and Methods

Study Design

This prospective observational study was conducted in the Department of Urology, Government Stanley Medical College and Hospital, Chennai, between September 2012 and March 2014.

Study Population

Patients presenting with primary bulbar urethral strictures were considered for inclusion in the study.

Inclusion Criteria

- Primary bulbar urethral stricture.
- Stricture length less than 2 cm.

Exclusion Criteria

- Previous intervention in the form of urethral dilatation, Optical Internal Urethrotomy, or urethroplasty.
- Complete obliteration of the urethral lumen.
- Stricture length greater than 2 cm.

Methodology

A total of 51 patients were initially evaluated, of whom 37 fulfilled the study criteria and completed follow-up. All patients underwent detailed clinical evaluation, routine laboratory investigations, uroflowmetry, and high-quality Retrograde Urethrogram.

On the Retrograde Urethrogram, the site of maximum narrowing was identified and measured. The diameter of the normal distal urethral lumen was used as the reference diameter because this segment was maximally distended during contrast injection. The

percentage luminal narrowing was calculated by comparing the diameter at the stricture site with the normal distal urethral diameter.

All patients subsequently underwent Optical Internal Urethrotomy using a standard 20 Fr Sachse urethrotome. Following surgery, a Foley catheter was retained for seven days. After catheter removal, patients were instructed to perform Clean Intermittent Self-Catheterization (CISC) using a 14 Fr Tiemann catheter once daily for one month and subsequently once every three days.

Follow-up evaluation included clinical assessment and uroflowmetry at three and six months. Treatment failure was defined as recurrence of symptoms, inability to pass the self-catheter, or the requirement for repeat Optical Internal Urethrotomy.

Statistical Analysis

The relationship between percentage luminal narrowing and treatment outcome was analyzed. A p-value <0.001 was considered statistically significant.

Results

Table 1. Age distribution

Age in years	**Number of patients**	**Percentage**
21 – 30	4	11%
31 – 40	12	32%
41 – 50	10	27%
>50	11	30%

In our study of 37 patients, majority of the patients, i.e., 32% of them were in the age group of 31–40 years;30% more than 50 years; 27 % in 41–50 years and 4 patients in the age group 21–30 years.

Table 2. Etiology distribution

Etiology	**Number of patients**	**Percentage**
Idiopathic	15	41%
Traumatic	10	27%
Iatrogenic	7	19%
Lichen sclerosus	5	13%

In our study, the most common etiology was found to be idiopathic (41%) followed by traumatic (10%), iatrogenic (19%) and finally lichen sclerosus (13%). Iatrogenic causes include traumatic catheterization or instrumentation.

Table 3. Stricture Length distribution

Stricture length	**Number of patients**	**Percentage**
< 1cm	15	41 %
1 – 2 cm	22	59%

In our study, 15 patients (41%) had a stricture length below 1 cm and 22 patients. (59%) had a stricture length between 1 and 2 cm.

Table 4. Percentage Narrowing on Retrograde Urethrogram

Percentage narrowing	**Number of patients**	**Percentage**
40 – 50 %	6	16%
51 – 60 %	4	12%
61 – 70 %	12	32%
71 – 80 %	13	35%
81 – 90 %	2	5%

The percentage narrowing was calculated from the retrograde urethrogram as described previously with the help of a scale or a vernier calipers. It was found that out of the 37 cases, 13 patients had a narrowing in the range of 71 – 80%; 12 patients in the range of 62 – 70%; 6 patients in the range of 40 – 50%; 4 patients in the range of 51 – 60% and 2 patients in the range of 81 – 90%.

Table 5. Treatment Result According to Percentage Narrowing on the Retrograde Urethrogram

Percentage Narrowing	**Treatment Success**	**Treatment Failure**
40 – 50%	6	-
51– 60%	4	-
61 – 70%	1`	11
71 – 80%	-	13
81 – 90%	-	2

In our study, out of the 11 patients who did not have recurrence, 6 patients had a percentage narrowing in the range of 40 – 50%; 4 patients had a percentage narrowing in the range of 51–60% and one patient had a percentage narrowing in the range of 61–70%.

Table 6. Time of Recurrence in Failure Cases

Time of Recurrence	**Number of Patients**
5 – 7 months	13
8 – 10 months	8
>10 months	5

Most of the recurrences in the failure patients occurred in the first 5 to 7 months. In our study, out of the 26 treatment failure cases, around 13 patients failed in the first 5 to 7 months. Around 8 patients failed in the first 8 to 10 months and the remaining 5 failure patients had recurrence after 10 months.

Discussion

Optical Internal Urethrotomy remains one of the most frequently performed procedures for short-segment bulbar urethral strictures because of its technical simplicity, low morbidity, and ease of learning [12,13]. Despite its widespread use, recurrence remains a major limitation, with reported long-term success rates varying considerably across different studies [18–21].

In the present study, the percentage luminal narrowing measured on Retrograde Urethrogram was found to be significantly associated with treatment outcome. Among the 11 patients who achieved successful outcomes, 10 had luminal narrowing between 40% and 60%, whereas 26 of the 28 patients with narrowing greater than 60% experienced recurrence. This association was statistically significant ($p<0.001$).

The degree of luminal narrowing can be considered a surrogate marker for the severity of underlying spongiofibrosis. Previous studies have demonstrated that dense spongiofibrosis is associated with poorer outcomes following Optical Internal Urethrotomy and often necessitates urethroplasty [22]. Sonourethrography has traditionally been used to assess spongiofibrosis; however, its utility is limited by availability and operator dependency [6,22]. In contrast, Retrograde Urethrogram is routinely performed in almost all patients undergoing evaluation for urethral stricture and therefore offers a practical alternative for predicting outcomes.

The findings of the present study are consistent with those of Mandhani et al., who reported that the degree of narrowing on urethrography could predict the success of Optical Internal Urethrotomy in short-segment bulbar strictures [27]. Similarly, Pansadoro and Emiliozzi demonstrated that shorter strictures with larger luminal calibres had better long-term outcomes following OIU [21]. Albers et al. also reported recurrence rates ranging from 26.9% to 44.6% depending on patient characteristics and duration of follow-up [20].

Several additional factors have been implicated in recurrence following OIU, including stricture length, site, prior intervention, infection, and number of strictures [15,19,23–26]. Bulbar strictures less than 2 cm in length are generally associated with more favourable outcomes because of their superior vascularity and lower degree of fibrosis [15,24].

Most recurrences in the present study occurred within the first 10 months following surgery. This observation is in agreement with previous studies demonstrating that the majority of restrictures develop during the first postoperative year [18–21]. Consequently, careful follow-up during this period is essential for early detection and intervention.

The present study suggests that percentage luminal narrowing measured on Retrograde Urethrogram is a simple, inexpensive, reproducible, and clinically useful predictor of OIU outcome. Patients demonstrating severe narrowing (>60%) should be counselled regarding the high

likelihood of recurrence and may benefit from early consideration of definitive reconstructive procedures such as urethroplasty [8,9].

Conclusion

Optical Internal Urethrotomy remains a safe and effective minimally invasive treatment option for carefully selected patients with short-segment bulbar urethral strictures. However, the procedure should not be performed indiscriminately because inappropriate patient selection may result in repeated interventions, increased healthcare costs, and reduced quality of life.

The present study demonstrates that percentage luminal narrowing measured at the site of maximum stricture on Retrograde Urethrogram serves as a practical surrogate marker for the degree of spongiofibrosis and can be used to predict treatment outcome following Optical Internal Urethrotomy.

Patients with less than 60% luminal narrowing experienced significantly better outcomes than those with narrowing greater than 60% ($p<0.001$). Therefore, measurement of percentage narrowing on Retrograde Urethrogram should be considered during preoperative assessment to facilitate patient counseling, optimize treatment selection, and improve long-term outcomes.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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