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**ORIGINAL ARTICLE**

# Multicentric Analysis of Outcomes of Optical Internal Urethrotomy for Short Segment Bulbar Urethral Strictures

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## Abstract

**Background:** Stricture urethra is a very common disease among men of all ages. It specially affects people of the productive age group (20–50yrs) thereby having both financial and health related implications. Hence there has been a long history of research in identifying the most optimal treatment modality of which optical internal urethrotomy offers a safe, easy and quick mode of treatment. This study aims to identify the best predictive markers for obtaining the optimal results in those patients. **Materials and Methods:** For this prospective observational analysis, 100 patients who had optical internal urethrotomy for small segment strictures between December 2023 and May 2025 are included. 50 patients from the A.C.S Medical College and Hospital, Chennai and 50 patients from the Aarupadai Veedu Medical College and Hospital, Puducherry were chosen for this study. These patients were followed up for a period of about 9 to 12 months with uroloflowmetry and symptomatology and the results are tabulated. **Results:** On analysing the follow up investigation results, it was found that stricture length of less than 1 cm, luminal narrowing of less than 40% and absence of lichen sclerosis were found to be the independent positive predictive factors for the success of optical internal urethrotomy. **Conclusion:** Optical internal urethrotomy is the most effective treatment for patients with short segment bulbar urethral strictures. Treatment outcomes are significantly influenced by the length of the stricture segment, the degree of luminal constriction, and the existence of related illnesses such as lichen sclerosis.

**Keywords:** Stricture Urethra, Optical internal urethrotomy, lichen sclerosis, Bulbar stricture

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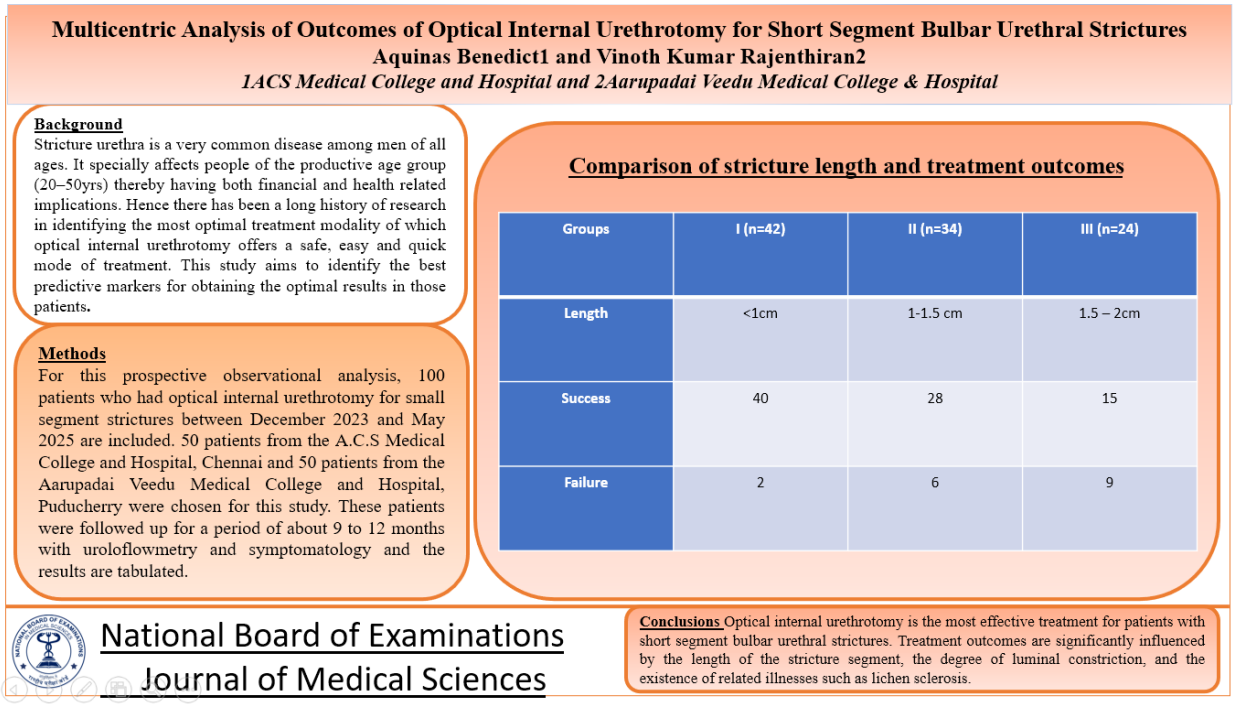
## Graphical Abstract




## Introduction

A stricture in the urethra can be defined as an abrupt narrowing in the urethra associated with some degree of fibrosis in the surrounding spongiosal fibres. It causes obstruction to the free flow of urine and causes all the classical voiding urinary symptoms. Most commonly, it forms following some sort of injury to the urethra. Eventhough less common in females, it can affect both sexes.

Usually the management of urethral stricture disease requires multiple office visits and admissions. In males, strictures are commonly seen in the Bulbar Urethra. The most common association with stricture urethra is Lichen sclerosis et atrophicus. It usually causes metal and submeatal stenosis which in turn causes increase in the intra urethral pressure. As a result, the urine effluxes into urethral glands causing urethral abscess which eventually leads to fibrosis and stricture formation.

## Materials and Methods

*Study Design*

This was a prospective observational study.

*Duration*

Conducted from December 2023 to May 2025.

*Study Subjects*

The study included 100 patients attending the Urology outpatient departments, with 50 patients from A.C.S. Medical College and Hospital, Chennai, and 50 patients from Aarupadai Veedu Medical College and Hospital, Puducherry.

*Study Population*

The study focused on 100 male patients diagnosed with primary short-segment bulbar urethral strictures who underwent optical internal urethrotomy during the study period.

*Inclusion criteria*

Patients with primary Bulbar Urethral strictures.

*Exclusion criteria*

- Patients with history of prior surgical or endoscopic intervention.
- Complete obliteration of the urethral lumen.
- Strictures longer than 2 cms.

The study was conducted following all proper ethical considerations and proper written informed consent was obtained from all the patients. From December 2023 to May 2025, data from 100 patients with Bulbar stricture who underwent Optical internal urethrotomy were prospectively analysed.

Pre-operative evaluation: All patients with suspected stricture urethra from detailed history and clinical examination were subjected to investigations to establish the diagnosis and aid in surgery. Routine blood and urine investigations were performed. Uroflowmetry and Retrograde Urethrogram were done in all patients to determine the site and length of the stricture and calculate the percentage of narrowing.

Radiological Assessment: On RGU, the site of maximum narrowing is identified. The diameter of the normal distal urethra (x) and the stricture site (y) are measured on digital RGU images (Figure 1).

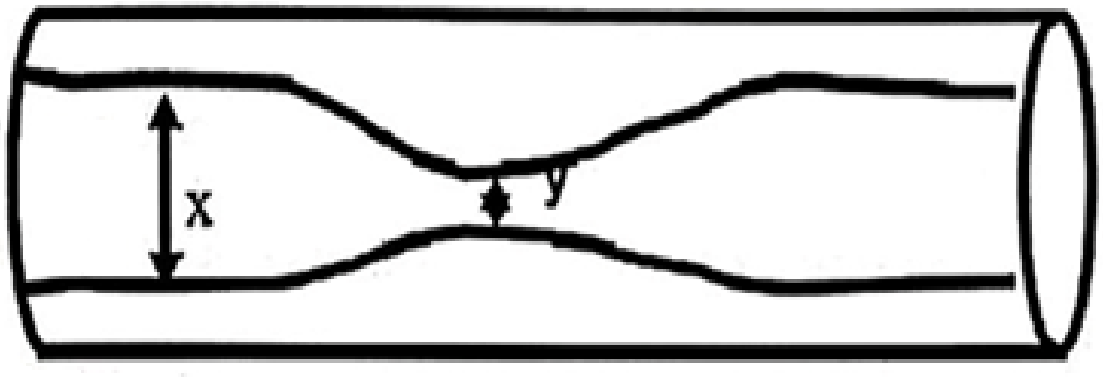



Figure 1. Estimation of luminal narrowing percentage

The percentage of narrowing can be identified using the following formula.

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

*Surgical procedure*

All patients underwent Optical internal urethrotomy under regional or general anaesthesia. The procedure was performed using a standard 21Fr urethrotomy sheath and sacche's urethrotome. A 14 Fr silicone catheter was placed pre-operatively and retained for 5 to 7 days.

Post-operative Management: Patients were instructed to begin self-dilatation using a 14Fr Nelaton catheter 7 days after catheter removal. Self-dilatation is adviced once daily for the first month and then every third day for the following month and gradually spaced there after. Uroflowmetry is repeated 1 month, 3 months and 6 months of follow up.

*Definition of outcomes:*

- Success: No recurrence of symptoms and a Q-max of more than 15 ml/sec at

9 months without the need of repeat instrumentation.

- Failure: Recurrence of obstructive symptoms, Inability to pass the catheter or need for repeat OIU.

**Results**

Of the 100 patients, 42 patients had less than 1 cm stricture and 34 had strictures of size 1 to 1.5cm and 26 patients had 1.5 to 2 cm strictures. The success rate was maximum of 95% for the first group of patients and group 3 had the worst results of only 62% success rate (Table 1).

Table 1. Comparison of stricture length and treatment outcomes

| Groups | I (n=42) | II (n=34) | III (n=24) |
|---|---|---|---|
| Length | <1cm | 1-1.5 cm | 1.5 – 2cm |
| Success | 40 | 28 | 15 |
| Failure | 2 | 6 | 9 |

Similarly, patients with less than 40% of luminal narrowing had 91% success rate whereas patients with more than 60% luminal narrowing had 54% success rate only (Table 2).

Table 2. Comparison of degree of luminal narrowing and outcomes

| Groups | A (n=42) | B (n=28) | C (n=26) |
|---|---|---|---|
| %of luminal narrowing | <40 | 40-60 | >60 |
| Success | 42 | 22 | 14 |
| Failure | 4 | 12 | 6 |

The success rate also dramatically decreased when there is associated lichen sclerosis with 34% of the cases failing at 9 months of follow up.

**Discussion**

A urethral stricture is first suspected based on history, physical exam, urinalysis, symptoms, post-void residual volume, and peak flow rate. Persistent obstructive symptoms that do not improve with alpha-blockers point toward a urethral stricture or a weak detrusor muscle. Urethral strictures are confirmed using cystoscopy, retrograde urethrography, or voiding cystourethrography. Blood tests are not useful for diagnosis.

***Uroflowmetry***

Uroflowmetry is the preferred initial test because it offers a simple, noninvasive measure of peak urinary flow. Flow patterns help differentiate normal voiding from prostatic obstruction and urethral strictures. A Qmax below 12 mL/s suggests obstruction or a possible stricture.

Strictures typically create a sharp plateau on the flow curve. For accurate results, the voided volume should be at least 150 mL.

***Post-Void Residual Urine Volume***

Post-void residual urine is useful for assessing bladder emptying but is not very diagnostic. It should be interpreted along with urine flow studies.

***Cystoscopy***

Cystoscopy is a simple, quick procedure that provides a definitive diagnosis of urethral stricture and can be done under local anesthesia in the clinic. It confirms the stricture, allows immediate dilation, and identifies the distal extent. However, if the scope cannot pass the narrowing, it cannot assess stricture length, proximal urethral changes, or the prostate.

A small-caliber ureteroscope may pass through a stricture, giving extra diagnostic detail without trauma or dilation. Cystoscopy, while limited in evaluating surrounding fibrosis, provides a fast and reliable initial diagnosis.

***Retrograde Urethrography***

If the individual undergoing treatment is at ease, retrograde urethrography can display the urethra all the way to the bladder. The proximal urethra may not be entirely visible in cases of severe strictures. Voiding cystourethrography, which is carried out by having the patient void following bladder filling or using a suprapubic catheter, offers crucial extra information in these situations.

An excellent image of the whole urethra can be obtained by combining a retrograde urethrogram with a contemporaneous cystogram or voiding cystourethrography.

However, because these radiological methods, even when combined, only produce a two-dimensional image of a three-dimensional structure, there are certain limits when interpreting the images pertaining to the location of the stricture and the condition of the proximal urethra. According to certain research, sophisticated imaging methods like computed tomography (CT), voiding urethrography, or sonoelastography can offer precise pictures of the stricture and its features.

In complex urethral strictures, especially in women, videourodynamics is useful, combining bladder function assessment with urethral imaging. It helps distinguish true anatomical obstruction from functional urethral issues. High detrusor voiding pressure alongside radiographic narrowing strongly indicates obstruction, such as a stricture.

Significant variability exists among physicians, including radiologists, in interpreting retrograde urethrograms for stricture location, length, and width. A standardized interpretation method is recommended. Machine learning using convolutional neural networks is being developed to improve consistency, and surgeons are encouraged to perform their own urethrograms for best results.

***Ultrasonography***

Ultrasound is mainly used to evaluate the bladder and upper urinary tract. While it cannot directly show a urethral stricture, it can assess spongiofibrosis and post-void residual urine, indicating obstruction severity. Filling the urethra with fluid via a catheter may help visualize strictured areas. Some experts use urethral ultrasound to measure stricture length and

spongiofibrosis, though it is not widely adopted in routine practice.

***Magnetic Resonance Imaging***

The role of MRI in simple urethral strictures is limited. It is valuable when malignancy is suspected, as it shows tumor location and invasion.

*Treatment*

When there are no complications, treatment focuses on symptom relief. Decisions should consider symptom severity, stricture location and length, and patient preference. Asymptomatic or mild cases typically do not require intervention. Treatment is indicated for recurrent infections, acute retention, or other complications to relieve symptoms and prevent urinary tract damage. If infection is suspected, a course of antibiotics may be trialed, continuing if symptoms improve.

In healthy young men, normal peak urine flow exceeds 15 mL/s. Most stricture patients have a flow under 12 mL/s. Those with 10–15 mL/s are usually asymptomatic and typically do not need intervention if bladder emptying is complete and wall thickness is normal. Flow rates of 5–10 mL/s often cause obstructive symptoms, warranting treatment only if symptoms or bladder changes are significant, with active monitoring if untreated. Patients with flow below 5 mL/s face a higher risk of acute retention and should be offered treatment even if asymptomatic.

*Urgent treatment*

This is required when the patient has sudden painful distension of the urinary bladder. This can be either simple dilation, cystoscopy, DVIU, or suprapubic cystostomy. Suprapubic cystostomy prevents further urethral trauma and allows a 4–6 week “urethral rest” period for healing and accurate imaging before definitive treatment like urethroplasty. Any urinary infection should be treated with antibiotics, and once stabilized, definitive stricture management can proceed.

*Urethral dilation*

Urethral dilation with sounds or bougies has long been a standard initial treatment. Gradually increasing dilator size stretches and widens the stricture. Using a guide wire, especially for tight strictures, is recommended. Goodwin metal sounds, which taper gently and work over guide wires, help dilate strictures safely while minimizing urethral trauma, false passages, or bladder injury. Outcomes are similar to DVIU, with about 65% requiring retreatment within three years. Dilation is usually done under local anesthesia and may cause discomfort and bleeding. Balloon dilation may reduce frictional trauma and show lower recurrence rates than traditional techniques.

Direct vision internal urethrotomy:

DVIU involves a transurethral incision at the 12 o’clock position, allowing the stricture to heal by secondary intention and widening the urethral lumen. It is first-line for short (<2 cm) bulbar strictures with no prior treatment, but recurrence can reach 65% within three years. Complications occur in about 6.5%, including erectile dysfunction (5%), incontinence (4%), extravasation (3%), UTI (2%), and hematuria (2%).

There is debate on repeat DVIU versus moving directly to urethroplasty after recurrence. Some recommend one additional DVIU, while others prefer urethroplasty. Recurrences often involve longer strictures due to incision of adjacent healthy tissue. Prophylactic antibiotics are

advised, and the Foley catheter is typically removed after 72 hours.

The AUA recommends dilation, DVIU, or urethroplasty as initial treatment for short bulbar strictures. Experimental intralesional botulinum toxin during DVIU has shown improved outcomes in trials, suggesting it may be a useful adjunct.

*Paclitaxel-coated urethral balloon dilation therapy*

Combining paclitaxel-coated balloon dilation with DVIU significantly improves outcomes for recurrent bulbar urethral strictures <3 cm compared to DVIU alone. Paclitaxel, an anti-inflammatory and anti-proliferative agent, delivered uniformly via the balloon, reduces scar formation and recurrence. One-year urethral patency was 83.2% versus 21.7% for DVIU alone, and three-year functional success remained 67%. Overall, studies report over 90% success in small anterior strictures, with more than 70% of patients remaining intervention-free at 2–5 years. FDA-approved for anterior urethral strictures, its efficacy in penile strictures and repeat treatments is unclear. Men should use contraception for six months due to detectable paclitaxel in semen. Further research is needed to validate these results.

*Intermittent self-catheterization:*

Regular intermittent self-catheterization helps maintain urethral patency after treatment, typically using a 14- or 16-French catheter. Patients usually start with daily catheterization, gradually extending the interval to once or twice a month as tolerated. If passage is difficult, frequency is increased or a smaller catheter is used. Video training aids can improve technique. Longer self-catheterization (≥4 months) reduces recurrence compared to shorter durations, though the optimal length is unclear. Some experts suggest continuing once or twice monthly indefinitely for early detection of recurrence. Urethroplasty remains a safe, effective alternative for those reliant on self-catheterization.

*Urethroplasty*

Urethroplasty involves opening or removing the stricture, followed by either direct anastomosis for short (<2 cm) bulbar strictures, grafting with buccal mucosa or foreskin, or using a skin flap for longer strictures. Success rates exceed 85%, and complications—such as erectile dysfunction, UTIs, fistulas, incontinence, chordee, and neuropraxia—are uncommon. Recurrent strictures previously treated with dilation, meatotomy, or DVIU often fail with repeated procedures (>80% failure), making urethroplasty the preferred option, especially for blind-ending strictures, hypospadias repairs, or lichen sclerosus–related strictures.

*Optimal duration of Foley catheterization after urethroplasty*

The optimal duration of Foley catheterization after urethroplasty is debated, generally ranging from 3 to 21 days. Prolonged catheterization is uncomfortable and limits activity. Evidence suggests early removal at 7 days does not increase complications, extravasation, infection, or recurrence.

Pelvic fracture–related strictures are best managed with delayed urethroplasty, typically around 3 months after stabilization, with delays beyond 6 months not recommended. Selected patients may undergo repair in as little as 6 weeks to reduce suprapubic catheter time.

Bladder neck strictures can be managed with dilation, incision, or transurethral resection; recurrent or complex cases may require open or robotic reconstruction. Patients should be counseled about potential postoperative incontinence.

*Anastomotic urethroplasty*

Anastomotic urethroplasty, or stricture resection with end-to-end anastomosis, is ideal for short (<2 cm) bulbar strictures, often from traumatic straddle injuries. It is also suitable after failed dilation or DVIU, preferably in patients without prior instrumentation, which can reduce success.

*Substitution or graft urethroplasty*

Substitution urethroplasty involves mobilizing the urethra at the stricture, opening it lengthwise, and grafting tissue to widen the lumen. The procedure can be approached ventrally, dorsally, or laterally. Grafts are typically taken from oral mucosa, foreskin, or occasionally the upper inner thigh. Oral mucosa is preferred for its durability and resistance to urine, though donor-site discomfort, scarring, and numbness can occur. Lingual mucosa may reduce donor-site complications. Hair-bearing skin, allografts, xenografts, or synthetic materials are generally avoided outside clinical trials.

This approach is used for bulbar strictures too long for anastomotic urethroplasty or any penile urethral stricture. When local tissue is unsuitable, a skin flap is preferred. Complex cases, including prior hypospadias repair or lichen sclerosus, often require a two-stage procedure: first, stricturotomy with a grafted urethral plate; later, urethral closure over a catheter with a voiding trial after about three weeks. Various single- and two-stage techniques combining grafts and flaps are described depending on stricture complexity.

*Perineal urethrostomy (Boutonnière)*

Perineal urethrostomy is a palliative option for patients with multiple prior surgeries, complex strictures, or those unable or unwilling to undergo extensive procedures. It is also suitable for patients with significant comorbidities. The bulbar urethra is opened through a perineal incision, and the urethral edges are sutured to the skin to create a urethrostomy, preserving sphincter function and continence. Most patients report high satisfaction.

Recently, a single-stage preputial spiral graft using foreskin has been proposed as an alternative for extensive strictures in select patients. All stricture patients require regular follow-up to monitor for recurrence.

**Conclusion**

Optical internal urethrotomy offers a good outcome in select patients with short segment Bulbar Urethral strictures, particularly in those with idiopathic etiology, minimal narrowing and short stricture length. However, a particular subset of patients with more than 60 percentage luminal narrowing and those with lichen sclerosis demonstrate poor outcomes and benefit with alternative surgical strategies.

A majority of treatment failures occur within first nine months following the procedure underlining the need for vigilant follow up during that period. This study establishes that the RGU based estimation of the percentage of luminal narrowing is a good predictor for the post operative

outcome after OIU and may serve aa a decision making tool in stricture management. Longitudinal studies with larger cohorts, standardized treatment outcomes and incorporation of novel imaging techniques are required to further refine the predictive factors of OIU outcomes.

**Statements and Declarations**

**Conflicts of interest**

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

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