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# Management of Urethral Stricture Disease: A Clinical Outcome Study

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## ABSTRACT

**Background**: Urethral stricture disease is a common urological condition associated with significant morbidity and high recurrence rates despite multiple available treatment options. Selection of an appropriate management strategy is crucial for achieving durable clinical outcomes.
**Objectives**: To evaluate the clinical outcomes of different treatment modalities used in the management of urethral stricture disease and to identify factors associated with treatment success and recurrence.
**Materials and Methods:** This hospital-based observational study included 60 adult male patients diagnosed with urethral stricture disease at a tertiary care center. Patients were evaluated for stricture etiology, location, and length using clinical assessment and radiological investigations. Management included endoscopic procedures (visual internal urethrotomy or urethral dilatation) and open surgical reconstruction (urethroplasty). Patients were followed up clinically and with uroflowmetry, and treatment success was defined as satisfactory voiding without the need for repeat intervention.
**Results**: Trauma was the most common etiology (40%), followed by iatrogenic causes (30%). The bulbar urethra was the most frequently involved segment (53.3%). Endoscopic management showed moderate short-term success but higher recurrence rates, particularly in long-segment strictures. Urethroplasty demonstrated significantly higher success rates (>90%) with minimal recurrence. Stricture length was significantly associated with recurrence ($p < 0.05$).
**Conclusion**: Urethroplasty provides superior and durable outcomes compared to endoscopic management, especially in long-segment and recurrent urethral strictures. Early definitive surgical intervention based on stricture characteristics improves clinical outcomes and reduces recurrence.

***Keywords***: *Urethral stricture disease; Urethroplasty; Visual internal urethrotomy; Urethral dilatation; Clinical outcomes; Recurrence.*

## INTRODUCTION

Urethral stricture disease is a common urological condition characterized by narrowing of the urethral lumen due to fibrosis of the corpus spongiosum, leading to varying degrees of bladder outlet obstruction. It remains a significant cause of lower urinary tract symptoms in men and is associated with substantial morbidity, including recurrent urinary tract infections, acute urinary retention, bladder dysfunction, and impaired quality of life [1].

The epidemiology of urethral stricture disease varies across regions and healthcare settings. In developing countries, traumatic strictures—often secondary to road traffic accidents or pelvic fractures—remain a leading cause, whereas in developed nations, iatrogenic strictures resulting from endoscopic procedures, prolonged catheterization, and prostate surgeries are increasingly prevalent [2,3]. Inflammatory strictures, once common due to untreated sexually transmitted infections, have declined but are still encountered in resource-limited settings [4].

The clinical presentation of urethral stricture disease depends on the severity, length, and location of the stricture. Patients commonly present with weak urinary stream, straining during micturition, incomplete bladder emptying, and recurrent urinary tract infections. Advanced cases may progress to urinary retention, bladder stones, or renal impairment if left untreated [5].

Multiple treatment modalities are available for the management of urethral stricture disease, including urethral dilatation, visual internal urethrotomy (VIU), and open reconstructive surgery (urethroplasty). Minimally invasive procedures such as dilatation and VIU are frequently used as first-line therapies due to their simplicity and short operative time. However, these techniques are associated with high recurrence rates, particularly in long-segment, dense, or recurrent strictures [6,7]. Urethroplasty, encompassing excision and primary anastomosis or substitution using grafts or flaps, is considered the definitive treatment for many strictures. Several studies have demonstrated superior long-term success rates with urethroplasty compared to endoscopic interventions, especially for strictures longer than 2 cm or those that have failed prior treatment [8,9]. Despite this evidence, endoscopic procedures are often repeated multiple times before referral for definitive reconstruction, potentially worsening spongiofibrosis and compromising surgical outcomes [10].

Contemporary guidelines from the American Urological Association and the European Association of Urology emphasize individualized treatment planning based on stricture characteristics, patient factors, and prior interventions. These guidelines advocate early consideration of urethroplasty in appropriate cases to reduce recurrence and healthcare burden [11,12].

Given the variability in clinical practice and outcomes, particularly in tertiary care settings in developing countries, there is a need for continuous evaluation of management strategies and their effectiveness. This study aims to assess the clinical outcomes of different treatment modalities for urethral stricture disease and to identify factors influencing treatment success and recurrence.

## MATERIALS AND METHODS:

### Study Design

This was a hospital-based, cross-sectional observational study conducted to evaluate the clinical outcomes of various treatment modalities used in the management of urethral stricture disease.

### Study Setting

The study was carried out in the Department of Urology at a tertiary care teaching hospital over a period of one year.

### Study Population

All adult male patients presenting to the urology outpatient department or admitted for management of urethral stricture disease during the study period were screened for eligibility.

### Eligibility Criteria

#### Inclusion Criteria

- Male patients aged 18 years and above
- Patients with a confirmed diagnosis of urethral stricture disease based on clinical evaluation and radiological/endoscopic findings
- Patients undergoing either endoscopic or open surgical management
- Patients who provided informed written consent

#### Exclusion Criteria

- Congenital urethral anomalies
- Malignancy involving the urethra
- Neurogenic bladder dysfunction
- Patients with incomplete medical records or lost to follow-up

### Preoperative Evaluation

A detailed clinical history was obtained for all patients, including presenting urinary symptoms, duration of illness, history of trauma, previous urethral instrumentation, catheterization, or surgery. Physical examination included general examination and focused genitourinary assessment.

Baseline laboratory investigations such as complete blood count, renal function tests, urine routine examination, and urine culture were performed. Imaging evaluation included retrograde urethrogram (RUG) and micturating cystourethrogram (MCU) to assess the site, length, and severity of the stricture. Uroflowmetry was used to document baseline urinary flow parameters, and cystourethroscopy was performed when indicated.

**Stricture Characteristics**
Strictures were categorized based on:

- **Location:** anterior (penile and bulbar) or posterior urethra
- **Length:** short (<2 cm) or long (≥2 cm)
- **Etiology:** traumatic, iatrogenic, inflammatory, or idiopathic
- **Previous interventions:** primary or recurrent stricture

**Treatment Protocol**
The choice of treatment modality was individualized based on stricture characteristics, previous treatment history, patient comorbidities, and surgeon expertise.

**Endoscopic Management**
Patients with short-segment, primary strictures underwent urethral dilatation or visual internal urethrotomy (VIU). VIU was performed under regional or general anesthesia using a cold-knife urethrotome. Post-procedure, a Foley catheter was placed and maintained for 3–5 days.

**Open Surgical Management**
Patients with long-segment, recurrent, or complex strictures were managed by urethroplasty. Excision and primary anastomotic urethroplasty was performed for short bulbar strictures, while substitution urethroplasty using buccal mucosal graft was employed for longer strictures. Postoperative catheterization was maintained for 2–3 weeks depending on the procedure performed.

**Postoperative Care and Follow-up**
Patients were followed up at 1 month, 3 months, and 6 months post-procedure. Follow-up evaluation included assessment of urinary symptoms, uroflowmetry, and need for additional interventions. Retrograde urethrogram was performed selectively in patients with suspected recurrence or poor flow rates.

**Outcome Measures**
The primary outcome measure was treatment success, defined as satisfactory voiding without the need for repeat surgical or endoscopic intervention during the follow-up period. Secondary outcomes included recurrence rate, complications, and improvement in uroflowmetry parameters.

**Data Collection and Management**
All clinical and investigative data were recorded in a structured proforma. Data were entered into Microsoft Excel spreadsheets and cross-verified for accuracy before analysis.

**Statistical Analysis**
Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software (version XX). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test was used to assess associations between categorical variables, and Student's t-test was applied for continuous variables. A p-value of $<0.05$ was considered statistically significant.

**Ethical Considerations**
The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment. Confidentiality of patient data was maintained throughout the study.

**RESULTS:**
A total of **60 male patients** with urethral stricture disease were included in the study. Clinical outcomes were analyzed based on demographic characteristics, etiology, stricture features, treatment modality, and recurrence during follow-up.

Urethral stricture disease was predominantly observed in the middle-aged population, with the highest number of patients in the 31–40-year age group as shown in Table 1

**Table 1: Age Distribution**

| Age Group (years) | Number of Patients | Percentage (%) |
|---|---|---|
| 18–30 | 10 | 16.7 |
| 31–40 | 18 | 30.0 |
| 41–50 | 14 | 23.3 |
| 51–60 | 11 | 18.3 |

| Age Group (years) | Number of Patients | Percentage (%) |
|---|---|---|
| >60 | 7 | 11.7 |
| **Total** | **60** | **100** |

Trauma was the most common etiological factor, followed by iatrogenic and inflammatory causes as shown in Table 2.

**Table 2: Etiology of Urethral Stricture**

| Etiology | Number of Patients | Percentage (%) |
|---|---|---|
| Traumatic | 24 | 40.0 |
| Iatrogenic | 18 | 30.0 |
| Inflammatory | 12 | 20.0 |
| Idiopathic | 6 | 10.0 |
| **Total** | **60** | **100** |

The bulbar urethra was the most frequently involved segment among the study population as shown in Table 3

**Table 3: Location of Stricture**

| Stricture Location | Number of Patients | Percentage (%) |
|---|---|---|
| Bulbar | 32 | 53.3 |
| Penile | 14 | 23.3 |
| Bulbo-penile | 8 | 13.3 |
| Posterior | 6 | 10.0 |
| **Total** | **60** | **100** |

Short-segment strictures (<2 cm) were more commonly encountered than long-segment strictures as shown in Table 4

**Table 4: Stricture Length**

| Stricture Length | Number of Patients | Percentage (%) |
|---|---|---|
| < 2 cm | 34 | 56.7 |
| ≥ 2 cm | 26 | 43.3 |
| **Total** | **60** | **100** |

Endoscopic procedures were used more frequently than open surgical reconstruction as shown in Table 5

**Table 5: Treatment Modalities Employed**

| Treatment Modality | Number of Patients | Percentage (%) |
|---|---|---|
| Visual Internal Urethrotomy (VIU) | 24 | 40.0 |
| Urethral Dilatation | 8 | 13.3 |
| Excision & Primary Anastomosis | 18 | 30.0 |
| Substitution Urethroplasty | 10 | 16.7 |
| **Total** | **60** | **100** |

Urethroplasty demonstrated a higher success rate compared to endoscopic procedures as shown in Table 6

**Table 6: Treatment Outcome**

| Treatment Modality | Success | Recurrence | Success Rate (%) |
|---|---|---|---|
| VIU | 14 | 10 | 58.3 |
| Urethral Dilatation | 4 | 4 | 50.0 |
| Excision & Anastomosis | 17 | 1 | 94.4 |
| Substitution Urethroplasty | 9 | 1 | 90.0 |

Long-segment strictures were associated with a significantly higher recurrence rate compared to short-segment strictures as shown in Table 7

**Table 7: Association Between Stricture Length and Recurrence**

| Stricture Length | Recurrence Present | Recurrence Absent | Total |
|---|---|---|---|
| < 2 cm | 6 | 28 | 34 |
| ≥ 2 cm | 10 | 16 | 26 |

*Chi-square test: $p < 0.05$ (statistically significant)*

## DISCUSSION

Urethral stricture disease continues to be a challenging condition in urological practice due to its recurrent nature and the variability in treatment outcomes. The present study evaluated the clinical outcomes of different management strategies in 60 patients and identified factors influencing success and recurrence.

### Age Distribution

In the present study, urethral stricture disease was most commonly observed in patients aged 31–40 years. This age predominance reflects the higher exposure of this group to trauma, instrumentation, and occupational hazards. Similar age distribution has been reported by Kulkarni et al. and Singh et al., who observed peak incidence in the third and fourth decades of life [13,14]. The higher prevalence in economically productive age groups underscores the significant social and functional impact of the disease.

### Etiology of Urethral Stricture

Trauma was the most common etiological factor in this study, accounting for 40% of cases, followed by iatrogenic causes. This pattern is consistent with reports from developing countries, where road traffic accidents and pelvic fractures remain major contributors [15]. Iatrogenic strictures, particularly following catheterization and endoscopic procedures, constituted 30% of cases, reflecting the increasing use of minimally invasive urological interventions. Comparable findings have been documented in Indian and international studies [16,17].

### Stricture Location and Length

The bulbar urethra was the most frequently affected segment in the present study. This observation aligns with previous studies that identify the bulbar urethra as particularly vulnerable due to its anatomical position and blood supply [18]. Short-segment strictures (<2 cm) were more common than long-segment strictures; however, long-segment strictures were associated with higher recurrence rates. Similar associations between stricture length and recurrence have been well documented [19].

### Treatment Modalities and Outcomes

Endoscopic procedures such as visual internal urethrotomy (VIU) and urethral dilatation were commonly employed, particularly for short-segment strictures. However, the success rates of these procedures were modest, with recurrence rates exceeding 40%. These findings are consistent with studies by Santucci et al., who demonstrated limited long-term efficacy of repeated VIU [20].

In contrast, urethroplasty—both excision with primary anastomosis and substitution urethroplasty—showed significantly higher success rates (>90%) in the present study. These results support existing evidence that urethroplasty provides durable outcomes, especially for long-segment and recurrent strictures [21,22]. Early definitive reconstruction has been shown to reduce the need for repeated interventions and prevent progression of spongiofibrosis.

### Recurrence and Associated Factors

The present study demonstrated a statistically significant association between stricture length and recurrence. Long-segment strictures had a higher likelihood of recurrence, particularly when managed with endoscopic techniques. Previous studies have emphasized that repeated minimally invasive procedures increase periurethral fibrosis, making subsequent surgical repair more complex and less successful [23].

## CONCLUSION:

Urethral stricture disease requires an individualized management strategy to achieve optimal outcomes. Endoscopic procedures such as visual internal urethrotomy and dilatation provide short-term relief but are associated with higher recurrence rates. Urethroplasty demonstrates superior and durable success, particularly in long-segment and recurrent strictures. Early selection of definitive surgical management reduces the need for repeated interventions and limits disease progression. An evidence-based approach tailored to stricture characteristics improves long-term patient outcomes.

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