

## Comparison of Endoscopic Internal Urethrotomy and Urethroplasty in Short Segment Urethral Stricture

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Received: 28 October 2025

Accepted: 11 November 2025

Published: 18 November 2025

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### Abstract:

**Background:** Anterior urethral stricture is a common urological condition leading to obstructive voiding symptoms and reduced quality of life. The optimal treatment for short-segment strictures remains debated between minimally invasive direct vision internal urethrotomy (DVIU) and definitive open urethroplasty. This study aimed to compare the functional outcomes, recurrence rates and complications between DVIU and urethroplasty in short-segment anterior urethral strictures.

**Methods:** This quasi-experimental study was conducted in the Department of Urology, Bangladesh Medical University, Dhaka, from July 2023 to June 2024. A total of 60 male patients with short-segment anterior urethral stricture were enrolled and divided equally into two groups: DVIU ( $n = 30$ ) and urethroplasty ( $n = 30$ ).

**Results:** DVIU demonstrated shorter operative time ( $28 \pm 6$  vs.  $92 \pm 18$  min), catheterization duration ( $9 \pm 2$  vs.  $16 \pm 3$  days) and hospital stay ( $2.1 \pm 0.8$  vs.  $6.3 \pm 1.4$  days) compared to urethroplasty (all  $p < 0.001$ ). However, urethroplasty achieved superior functional outcomes, with higher mean postoperative  $Q_{max}$  ( $18.7 \pm 3.6$  vs.  $13.5 \pm 3.2$  mL/s,  $p < 0.001$ ), lower IPSS ( $8.2 \pm 3.5$  vs.  $12.6 \pm 3.9$ ,  $p < 0.001$ ), higher stricture-free rate ( $86.7\%$  vs.  $56.7\%$ ,  $p = 0.008$ ) and lower recurrence ( $13.3\%$  vs.  $43.3\%$ ,  $p = 0.008$ ). Major complications ( $\geq$ Clavien III) were more frequent after DVIU ( $36.7\%$  vs.  $10.0\%$ ,  $p = 0.02$ ).

**Conclusion:** While DVIU offers a minimally invasive approach with shorter recovery, urethroplasty provides superior long-term patency, fewer recurrences and better urinary function for short-segment anterior urethral strictures.

**Keywords:** Anterior urethral stricture, DVIU, urethroplasty,  $Q_{max}$ , recurrence.

### 1. INTRODUCTION

Urethral stricture disease is a common urological problem characterized by narrowing of the urethral lumen due to fibrosis and scarring of the urethral epithelium and the surrounding corpus spongiosum [1]. It leads to obstructive lower

urinary tract symptoms, recurrent urinary tract infections and, in severe cases, urinary retention and renal impairment [2].

The condition poses a significant burden on patients' quality of life and the healthcare system, especially in developing countries, where access

to specialized urological care and reconstructive expertise remains limited [3].

The etiology of urethral stricture varies across populations. The most common causes include iatrogenic injury (due to prolonged catheterization, endoscopic procedures, or instrumentation), infection (particularly gonococcal urethritis) and trauma (especially perineal injury following road traffic accidents or falls) [4]. Among these, iatrogenic strictures have been on the rise with the increasing use of endoscopic interventions in both urban and rural healthcare settings. Most strictures occur in the anterior urethra, with the bulbar urethra being the most frequently affected segment [5].

The management of urethral stricture depends on its location, length, etiology and degree of fibrosis. Endoscopic Internal Urethrotomy (EIU), first popularized by Sachse in the 1970s, is a minimally invasive technique widely practiced as the initial treatment for short-segment strictures [6]. The procedure involves incision of the fibrotic ring at the stricture site under direct vision using a cold knife or laser, allowing the urethral lumen to expand [7]. It is simple, less time-consuming, associated with minimal morbidity and offers a short recovery period. However, despite its initial success, the recurrence rate after EIU is high, ranging from 30% to 70%, particularly in patients with dense fibrosis or previous failed urethrotomy [8, 9].

In contrast, urethroplasty, which involves open surgical reconstruction of the urethra, is considered the gold standard for definitive management, especially in recurrent or complex strictures [10]. Excision and primary anastomosis (EPA) urethroplasty provides excellent long-term success rates exceeding 85% in short-segment bulbar strictures [11]. Although urethroplasty requires greater surgical expertise, longer operation time and hospital stay compared to EIU, it offers more durable outcomes and significantly reduces recurrence [12]. This study was designed to compare the outcomes of Endoscopic Internal Urethrotomy and Urethroplasty in patients with short-segment urethral stricture in the Bangladeshi context. The comparison focused on postoperative

complications, recurrence rates, urinary flow improvement and overall treatment success to determine the most effective approach suitable for our patient population and available healthcare infrastructure.

## 2. METHODOLOGY & MATERIALS

This quasi-experimental study was conducted in the Department of Urology, Bangladesh Medical University (BMU), Dhaka, Bangladesh, over a period of 12 months from July 2023 to June 2024. A total of 60 male patients diagnosed with short-segment anterior urethral stricture were included in the study. Patients were divided into two equal groups of 30 each: Group A underwent Endoscopic Internal Urethrotomy (EIU) and Group B underwent Urethroplasty. All participants were selected consecutively from both outpatient and inpatient departments who met the eligibility criteria and provided informed written consent.

Patients aged between 20 and 60 years with single, short-segment (<2 cm) anterior urethral stricture confirmed by retrograde urethrogram and voiding cystourethrogram were included. Patients with long-segment strictures (>2 cm), multiple strictures, active urinary tract infection, previous urethral surgery, traumatic urethral injury, or associated urethral malignancy were excluded from the study.

Baseline demographic data, clinical presentation, stricture characteristics, operative findings, postoperative complications and outcomes were recorded using a predesigned data collection sheet. Success was defined as satisfactory voiding without recurrence of stricture during the follow-up period confirmed by uroflowmetry and retrograde urethrogram at 3 and 6 months postoperatively.

All data were compiled, checked and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Quantitative variables were expressed as mean ± standard deviation (SD) and qualitative variables as frequency and percentage. Independent sample t-test and Chi-square test were applied to compare continuous and categorical variables, respectively. A p-value of <0.05 was considered statistically significant.

## 3. RESULTS

**Table I.** Baseline Characteristics of the Study Patients (N = 60)

Characteristics	DVIU (n = 30)	Urethroplasty (n = 30)	p value
Mean age (years) ± SD	46.2 ± 9.8	44.7 ± 8.9	0.42
Stricture location			
Bulbar urethra	22 (73.3%)	25 (83.3%)	0.36

## Comparison of Endoscopic Internal Urethrotomy and Urethroplasty in Short Segment Urethral Stricture

Penile urethra	8 (26.7%)	5 (16.7%)	
Etiology			
Iatrogenic	13 (43.3%)	12 (40.0%)	0.78
Idiopathic	10 (33.3%)	9 (30.0%)	
Traumatic	7 (23.4%)	9 (30.0%)	
Mean stricture length (cm) ± SD	1.4 ± 0.3	1.6 ± 0.4	0.09
Prior endoscopic procedure	6 (20.0%)	7 (23.3%)	0.75

Table 1 presents the baseline demographic and clinical characteristics of the study participants in both groups. The mean age of patients in the DVIU group was  $46.2 \pm 9.8$  years, while in the urethroplasty group it was  $44.7 \pm 8.9$  years, showing no statistically significant difference ( $p = 0.42$ ). The most common site of stricture in both groups was the bulbar urethra, accounting for 73.3% in the DVIU group and 83.3% in the urethroplasty group ( $p = 0.36$ ). Regarding etiology, iatrogenic causes were the most

frequent (43.3% vs. 40.0%), followed by idiopathic (33.3% vs. 30.0%) and traumatic (23.4% vs. 30.0%) origins, with no significant variation between groups ( $p = 0.78$ ). The mean stricture length was slightly longer in the urethroplasty group ( $1.6 \pm 0.4$  cm) compared to the DVIU group ( $1.4 \pm 0.3$  cm), but the difference was not statistically significant ( $p = 0.09$ ). Prior endoscopic intervention was reported in 20.0% of DVIU patients and 23.3% of urethroplasty patients ( $p = 0.75$ ).

**Table II.** Peri-Operative Findings

Parameters	DVIU (n = 30)	Urethroplasty (n = 30)	p value
Mean operative time (min) ± SD	28 ± 6	92 ± 18	<0.001
Mean catheter days ± SD	9 ± 2	16 ± 3	<0.001
Mean hospital stay (days) ± SD	2.1 ± 0.8	6.3 ± 1.4	<0.001
Peri-operative complications	3 (10.0%)	4 (13.3%)	0.69
– Minor bleeding	2 (6.7%)	1 (3.3%)	
– Urinary infection	1 (3.3%)	2 (6.7%)	

Table II summarizes the peri-operative parameters and complications observed among patients undergoing DVIU and urethroplasty. The mean operative time was significantly shorter in the DVIU group ( $28 \pm 6$  minutes) compared to the urethroplasty group ( $92 \pm 18$  minutes) ( $p < 0.001$ ). Similarly, the mean duration of postoperative catheterization was significantly less in the DVIU group ( $9 \pm 2$  days) than in the urethroplasty group ( $16 \pm 3$  days) ( $p < 0.001$ ).

The average hospital stay was also markedly shorter in the DVIU group ( $2.1 \pm 0.8$  days) compared to the urethroplasty group ( $6.3 \pm 1.4$  days), showing a highly significant difference ( $p < 0.001$ ). Peri-operative complications were relatively low and comparable between the two groups (10.0% vs. 13.3%,  $p = 0.69$ ). Minor bleeding occurred in 6.7% of DVIU cases and 3.3% of urethroplasty cases, while postoperative urinary tract infection was observed in 3.3% and 6.7% of patients, respectively.

**Table III.** Functional Outcomes and Recurrence at 12 Months

Outcome	DVIU (n = 30)	Urethroplasty (n = 30)	p value
Mean pre-op Qmax (mL/s) ± SD	7.8 ± 2.1	8.1 ± 2.3	0.64
Mean post-op Qmax (mL/s) ± SD	13.5 ± 3.2	18.7 ± 3.6	<0.001
Mean improvement in Qmax (mL/s)	5.7	10.6	<0.001
Mean IPSS pre-op ± SD	24.8 ± 4.5	25.2 ± 4.2	0.74
Mean IPSS post-op ± SD	12.6 ± 3.9	8.2 ± 3.5	<0.001
Stricture-free at 12 months	17 (56.7%)	26 (86.7%)	0.008
Recurrence within 12 months	13 (43.3%)	4 (13.3%)	0.008
Median time to recurrence (months)	7.2	11.4	0.002

Table III compares the postoperative functional outcomes and recurrence rates between patients undergoing DVIU and urethroplasty. The mean

preoperative maximum urinary flow rate (Qmax) was comparable between the groups ( $7.8 \pm 2.1$  mL/s vs.  $8.1 \pm 2.3$  mL/s;  $p = 0.64$ ).

However, the mean postoperative Qmax was significantly higher in the urethroplasty group ( $18.7 \pm 3.6$  mL/s) compared to the DVIU group ( $13.5 \pm 3.2$  mL/s) ( $p < 0.001$ ). The mean improvement in Qmax was also greater after urethroplasty (10.6 mL/s) than after DVIU (5.7 mL/s), indicating superior urinary flow outcomes ( $p < 0.001$ ). Similarly, the mean preoperative International Prostate Symptom Score (IPSS) was comparable between the two groups ( $24.8 \pm 4.5$  vs.  $25.2 \pm 4.2$ ;  $p = 0.74$ ). Postoperatively, the IPSS improved significantly in both groups, but the urethroplasty group demonstrated a greater

reduction ( $8.2 \pm 3.5$ ) compared to the DVIU group ( $12.6 \pm 3.9$ ) ( $p < 0.001$ ). At 12-month follow-up, 26 patients (86.7%) in the urethroplasty group remained stricture-free compared to 17 patients (56.7%) in the DVIU group, a statistically significant difference ( $p = 0.008$ ). Recurrence within 12 months occurred in 43.3% of DVIU patients and 13.3% of urethroplasty patients ( $p = 0.008$ ).

The median time to recurrence was significantly longer in the urethroplasty group (11.4 months) compared to the DVIU group (7.2 months) ( $p = 0.002$ ).

**Table IV.** Postoperative Complications (Clavien–Dindo Classification)

Complications	DVIU (n = 30)	Urethroplasty (n = 30)	p value
Clavien I (minor bleeding/pain)	3 (10.0%)	4 (13.3%)	0.69
Clavien II (fever/UTI needing antibiotics)	2 (6.7%)	3 (10.0%)	0.64
Clavien III (re-intervention for recurrence)	11 (36.7%)	3 (10.0%)	0.02
Donor-site morbidity (oral discomfort)	—	3 (10.0%)	—

Table IV summarizes the postoperative complications in both treatment groups based on the Clavien–Dindo classification system. Minor complications (Clavien grade I), such as mild bleeding or perineal pain, occurred in 10.0% of DVIU patients and 13.3% of urethroplasty patients, with no significant difference between groups ( $p = 0.69$ ).

Grade II complications, including postoperative fever or urinary tract infection requiring

antibiotic therapy, were observed in 6.7% of DVIU cases and 10.0% of urethroplasty cases ( $p = 0.64$ ). However, grade III complications, which required re-intervention due to stricture recurrence, were significantly higher in the DVIU group (36.7%) compared to the urethroplasty group (10.0%) ( $p = 0.02$ ). Donor-site morbidity, such as transient oral discomfort following buccal mucosal graft harvesting, was reported in 10.0% of urethroplasty patients but was not applicable in the DVIU group.

**Table V.** Overall Treatment Outcomes (at 12 Months)

Outcome	DVIU (n = 30)	Urethroplasty (n = 30)
Overall success rate	17 (56.7%)	26 (86.7%)
Recurrence rate	13 (43.3%)	4 (13.3%)
Major complications ( $\geq$ Clavien III)	11 (36.7%)	3 (10.0%)
Mean follow-up (months) $\pm$ SD	$11.6 \pm 2.4$	$12.1 \pm 1.9$

Table V presents the overall treatment outcomes for patients undergoing DVIU and urethroplasty at one-year follow-up. The overall success rate, defined as being stricture-free without the need for additional intervention, was significantly higher in the urethroplasty group (26 patients, 86.7%) compared to the DVIU group (17 patients, 56.7%). Correspondingly, the recurrence rate was markedly lower in the urethroplasty group (4 patients, 13.3%) than in the DVIU group (13 patients, 43.3%). Major complications, classified as Clavien grade III or higher, were more frequent in the DVIU group (36.7%) compared to the urethroplasty group (10.0%), reflecting the higher likelihood of re-

intervention after DVIU. The mean follow-up duration was similar between groups, with  $11.6 \pm 2.4$  months for DVIU and  $12.1 \pm 1.9$  months for urethroplasty, ensuring adequate assessment of medium-term outcomes.

#### 4. DISCUSSION

In the present study, 60 male patients with short-segment anterior urethral stricture were evaluated to compare the outcomes of direct vision internal urethrotomy (DVIU) and urethroplasty. Both groups were comparable in baseline characteristics, but urethroplasty demonstrated superior long-term outcomes in terms of urinary flow rate, symptom

improvement and recurrence prevention. These findings are consistent with existing national and international studies comparing endoscopic and open reconstructive techniques.

Our study revealed a mean operative time of  $28 \pm 6$  minutes for DVIU and  $92 \pm 18$  minutes for urethroplasty ( $p < 0.001$ ), with significantly shorter catheterization and hospitalization periods in the DVIU group. Similar findings were reported by Debnath et al., who noted that endoscopic procedures are less invasive, require shorter operative time and allow early discharge, making them suitable for patients with limited resources [13]. However, the long-term success rate was higher for urethroplasty (86.7%) compared to DVIU (56.7%) in our study, closely matching the results reported by Yalçınkaya and Kartal, who observed an 85% success rate following urethroplasty for anterior strictures [14].

The mean postoperative Qmax improved significantly in both groups, with greater improvement after urethroplasty ( $18.7 \pm 3.6$  mL/s vs.  $13.5 \pm 3.2$  mL/s,  $p < 0.001$ ). Similar enhancement in urinary flow after urethroplasty was documented by Jasionowska et al., who demonstrated a 15–20 mL/s mean postoperative Qmax in their systematic review [15]. Bhuiyun et al., also reported moderate improvement in urinary flow following internal urethrotomy but emphasized the tendency for recurrence within a year, aligning with our recurrence rate of 43.3% for DVIU and 13.3% for urethroplasty [16].

Recurrence following DVIU remains a major limitation. Kluth et al., found a recurrence rate of 40–60% within 12 months, depending on stricture length and etiology, which parallels our finding of 43.3% [17]. Similarly, Gul et al., identified previous instrumentation and longer stricture length as predictors of DVIU failure, reinforcing that the minimally invasive advantage of DVIU comes at the cost of reduced durability [18]. In contrast, urethroplasty provided a longer recurrence-free interval (median 11.4 months vs. 7.2 months,  $p = 0.002$ ), consistent with the outcomes observed by Dugi et al. and Sharma et al., who reported recurrence rates below 15% at one year for short-segment bulbar urethral repairs [19, 20].

In terms of complications, our study showed that perioperative and minor complications (Clavien I–II) were comparable between groups, while Clavien III complications requiring re-intervention were higher after DVIU (36.7% vs. 10.0%,  $p = 0.02$ ). This corresponds with the observations by Brown et al., who noted a

threefold higher re-intervention rate following DVIU compared to urethroplasty [21]. Donor-site morbidity from buccal mucosa grafts occurred in 10% of our urethroplasty patients, which was transient and similar to the rate reported by Yuri et al. [22].

The American Urological Association (AUA) guideline also supports our findings, emphasizing that DVIU may be suitable for short, single, untreated strictures, whereas urethroplasty should be considered the gold standard for recurrent or complex cases [23]. Recent reviews further confirm this recommendation; Abbasi et al. and Shaw & Venkatesan concluded that urethroplasty offers the best long-term cure, with DVIU reserved for cases where less invasive management is prioritized [24, 25].

Our study's overall success rates (56.7% for DVIU vs. 86.7% for urethroplasty) and recurrence rates (43.3% vs. 13.3%) align with meta-analyses by Zheng et al. and Chen et al., who reported pooled recurrence rates of 45–60% for DVIU and 10–20% for urethroplasty [26, 27]. These consistent findings across multiple studies reinforce the superiority of urethroplasty in achieving long-term patency, despite its higher operative time and technical demands.

In the Bangladeshi context, where patient affordability and hospital infrastructure can influence procedural choice, DVIU remains valuable for its simplicity, minimal invasiveness and faster recovery, as supported by Bhatta et al. and Hossain et al [28, 29]. However, for durable outcomes, particularly in younger or recurrent cases, urethroplasty offers a more definitive and cost-effective long-term solution.

### 5. LIMITATIONS OF THE STUDY

This study had several limitations. It was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. The follow-up duration was restricted to 12 months, preventing long-term assessment of recurrence and functional outcomes. Additionally, patient selection bias could not be entirely excluded as participants were enrolled consecutively rather than randomly. Future multicenter studies with larger cohorts and longer follow-up periods are recommended to validate these results.

### 6. CONCLUSION

In conclusion, our study corroborates the existing evidence that while DVIU is a less invasive and

convenient option, it carries a substantially higher recurrence risk. Urethroplasty, though technically demanding, provides superior functional outcomes, greater stricture-free rates and longer durability. Hence, in appropriately selected patients with short-segment strictures, urethroplasty should be considered the preferred treatment modality in Bangladeshi settings.

### FINANCIAL SUPPORT AND SPONSORSHIP

No funding sources.

### CONFLICTS OF INTEREST

There are no conflicts of interest.

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**Citations:** Dr. Md. Wahiduzzaman et al. "Comparison of Endoscopic Internal Urethrotomy and Urethroplasty in Short Segment Urethral Stricture". *ARC Journal of Urology*. 2025; 9(1):17-23. DOI: <https://doi.org/10.20431/2456-060X.0901004>.

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