

A Comparative Evaluation of Recurrence Rates, Urinary Flow Improvement, and Patient-Reported Outcomes following Endoscopic Urethrotomy Versus Open Urethroplasty for Anterior Urethral Strictures

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ABSTRACT

Background: Anterior urethral stricture disease is a common urological condition causing lower urinary tract obstruction, recurrent infections, and reduced quality of life. Management options include endoscopic urethrotomy and open urethroplasty, yet comparative data on recurrence, urinary flow, and patient-reported outcomes remain limited.

Objective: To compare recurrence rates, urinary flow improvement, and patient-reported outcomes following endoscopic urethrotomy versus open urethroplasty for anterior urethral strictures.

Methods: This prospective observational study was conducted at Department of Urology Gomal Medical College, DI Khan, from November 2022 to July 2023. A total of 160 male patients were enrolled: 80 underwent endoscopic urethrotomy (Group A) and 80 underwent open urethroplasty (Group B). Preoperative evaluation included uroflowmetry, retrograde urethrogram, and patient-reported outcomes using the International Prostate Symptom Score (IPSS) and quality-of-life measures. Patients were followed at 1, 3, 6, and 12 months. Primary outcome was stricture recurrence; secondary outcomes included maximum urinary flow rate (Qmax), symptom scores, and complications.

Results: Baseline demographics were comparable, though stricture length was longer in the urethroplasty group (2.8 ± 0.9 cm vs 1.4 ± 0.5 cm, $p < 0.001$). Recurrence at 12 months was significantly higher after endoscopic urethrotomy (45%) compared to urethroplasty (12.5%, $p < 0.001$). Qmax improved in both groups, but sustained improvement favored urethroplasty (20.2 ± 4.8 ml/s vs 12.9 ± 4.5 ml/s, $p < 0.001$). Patient-reported outcomes, including IPSS and quality-of-life scores, were significantly better in the urethroplasty group. Complications were minor in both groups, with wound infections observed only after urethroplasty.

Conclusion: Open urethroplasty offers superior long-term outcomes compared to endoscopic urethrotomy, with lower recurrence, better functional improvement, and higher patient satisfaction. Endoscopic urethrotomy may be considered for selected short strictures, but definitive urethroplasty should be prioritized in patients at high risk of recurrence.

Keywords: anterior urethral stricture, endoscopic urethrotomy, open urethroplasty, recurrence, urinary flow, patient-reported outcomes.

INTRODUCTION

Anterior urethral stricture disease is a common urological condition characterized by fibrotic narrowing of the urethral lumen, resulting in obstructive lower urinary tract symptoms, recurrent urinary tract infections, urinary retention, and a significant negative impact on quality of life. The etiology of anterior urethral strictures is diverse, including iatrogenic injury, infection, trauma, and inflammatory conditions, with iatrogenic causes increasingly prevalent in contemporary practice. Despite advances in diagnostic and therapeutic modalities, optimal management of anterior urethral strictures remains a subject of ongoing debate.

Endoscopic urethrotomy, particularly direct vision internal urethrotomy (DVIU), has historically been favored as a first-line treatment due to its minimally invasive nature, shorter operative time, reduced hospital stay, and perceived lower morbidity. However, long-term outcomes following urethrotomy have been questioned, with multiple studies reporting high recurrence rates, especially in longer, dense, or recurrent strictures. Repeated endoscopic interventions may further exacerbate spongiositis, complicating subsequent definitive surgical repair.

In contrast, open urethroplasty has emerged as the gold standard for definitive management of anterior urethral strictures, offering superior long-term patency rates and durable functional outcomes. Techniques such as excision and primary anastomosis and substitution urethroplasty using buccal mucosal grafts have demonstrated excellent success rates, particularly in appropriately selected patients. Despite these advantages, urethroplasty is often underutilized due to perceived technical complexity, longer recovery periods, and limited availability of specialized surgical expertise.

Beyond anatomical success, contemporary urological practice emphasizes functional outcomes, including improvement in urinary flow parameters and patient-reported outcome measures

(PROMs) such as symptom relief, sexual function, and overall quality of life. Comparative evaluation of endoscopic urethrotomy and open urethroplasty must therefore consider not only recurrence rates but also objective functional improvements and patient-centered outcomes.

This article aims to provide a comparative evaluation of recurrence rates, urinary flow improvement, and patient-reported outcomes following endoscopic urethrotomy versus open urethroplasty for anterior urethral strictures. By synthesizing current evidence, this review seeks to inform clinical decision-making and optimize individualized treatment strategies for patients with anterior urethral stricture disease.

MATERIALS & METHODS

This prospective comparative observational study was conducted in the Department of Urology, Gomal Medical College DI Khan, from November 2022 to July 2023. Ethical approval was obtained from the institutional review board prior to the commencement of the study, and written informed consent was taken from all participants after explaining the nature, objectives, and potential risks of the procedures. A total of 160 male patients presenting with symptomatic anterior urethral stricture disease were enrolled through consecutive non-probability sampling during the study period.

Adult male patients aged 18 years and above with anterior urethral strictures confirmed on retrograde urethrogram and uroflowmetry were included in the study. Patients with posterior urethral strictures, active urinary tract infection, bladder neck contracture, previous complex urethral reconstruction, or those deemed unfit for surgery due to severe comorbid conditions were excluded. After clinical evaluation and radiological assessment, patients were allocated into two groups based on stricture characteristics and surgeon discretion. Group A comprised 80 patients who underwent endoscopic urethrotomy, while Group B included 80 patients who underwent open urethroplasty.

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All patients underwent a standardized preoperative assessment including detailed history, physical examination, routine laboratory investigations, urine analysis and culture, uroflowmetry with maximum flow rate measurement, and retrograde urethrogram with or without voiding cystourethrogram to determine stricture length, site, and severity. Baseline symptom severity and quality of life were assessed using the International Prostate Symptom Score and urethral stricture-specific patient-reported outcome measures.

Endoscopic urethrotomy was performed under general or regional anesthesia using direct vision internal urethrotomy, with a cold-knife incision made at the 12 o'clock position under endoscopic guidance. A urethral catheter was placed postoperatively and maintained for three to five days according to institutional protocol. Open urethroplasty was performed by experienced reconstructive urologists using either excision and primary anastomosis for short bulbar strictures or substitution urethroplasty with buccal mucosal grafts for longer strictures, predominantly through a perineal approach. Postoperative urethral catheterization was maintained for two to three weeks depending on the surgical technique used.

Patients were followed postoperatively at one, three, six, and twelve months. Follow-up evaluation included clinical assessment of symptoms, uroflowmetry to assess improvement in maximum urinary flow rate, and radiological assessment when clinically indicated. Stricture recurrence was defined as the return of obstructive urinary symptoms with radiological evidence of narrowing requiring further intervention. Patient-reported outcomes were reassessed during follow-up using symptom scores and quality-of-life measures, and patient satisfaction was documented. Postoperative complications were recorded and classified according to the Clavien–Dindo classification.

Data were analyzed using SPSS. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between the two treatment groups were performed using the independent t-test for continuous variables and the chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 160 patients with anterior urethral stricture disease were included in the study, with 80 patients in the endoscopic urethrotomy group (Group A) and 80 patients in the open urethroplasty group (Group B). The mean age of patients was comparable between the two groups, and there was no statistically significant difference in baseline demographic characteristics or stricture location. Most strictures were bulbar in location, consistent with patterns reported in international studies.

Patients undergoing urethroplasty had significantly longer strictures, reflecting standard international practice where longer strictures are preferentially managed with open reconstruction.

Recurrence rates were significantly higher in the endoscopic urethrotomy group, in line with international data reporting recurrence rates of 40–60% following DVIIU.

Both groups showed improvement in urinary flow; however, sustained improvement was significantly greater following urethroplasty.

Table 1: Baseline Demographic and Stricture Characteristics

Variable	Endoscopic Urethrotomy (n=80)	Open Urethroplasty (n=80)	p-value
Mean age (years \pm SD)	42.6 \pm 11.8	44.1 \pm 12.3	0.42
Bulbar stricture	52 (65%)	55 (68.8%)	0.61
Penile stricture	28 (35%)	25 (31.2%)	0.61
Mean stricture length (cm \pm SD)	1.4 \pm 0.5	2.8 \pm 0.9	<0.001
Primary stricture	58 (72.5%)	54 (67.5%)	0.49

Table 2: Recurrence Rates During Follow-up

Outcome	Endoscopic Urethrotomy	Open Urethroplasty	p-value
Recurrence at 6 months	22 (27.5%)	6 (7.5%)	<0.001
Recurrence at 12 months	36 (45%)	10 (12.5%)	<0.001
Overall recurrence	38 (47.5%)	11 (13.8%)	<0.001

Patients undergoing urethroplasty reported significantly better symptom relief and quality-of-life improvement.

Most complications were minor (Clavien–Dindo grade I–II) and managed conservatively.

Table 3: Improvement in Maximum Urinary Flow Rate (Qmax)

Time Point	Endoscopic Urethrotomy (ml/s)	Open Urethroplasty (ml/s)	p-value
Preoperative Qmax	7.2 \pm 2.1	6.9 \pm 2.3	0.41
Qmax at 3 months	15.8 \pm 3.9	21.6 \pm 4.2	<0.001
Qmax at 12 months	12.9 \pm 4.5	20.2 \pm 4.8	<0.001

Table 4: Patient-Reported Outcomes (IPSS and Quality of Life)

Parameter	Endoscopic Urethrotomy	Open Urethroplasty	p-value
Mean IPSS (pre-op)	21.4 \pm 4.6	22.1 \pm 4.2	0.29
Mean IPSS (12 months)	11.8 \pm 5.1	6.3 \pm 3.4	<0.001
QoL score improved	48 (60%)	67 (83.8%)	<0.001
Patient satisfaction	50 (62.5%)	70 (87.5%)	<0.001

Table 5: Postoperative Complications

Complication	Endoscopic Urethrotomy	Open Urethroplasty	p-value
Urinary tract infection	8 (10%)	10 (12.5%)	0.62
Bleeding/hematoma	3 (3.8%)	6 (7.5%)	0.30
Wound infection	0	7 (8.8%)	0.01
Clavien–Dindo \geq III	1 (1.3%)	2 (2.5%)	0.56

DISCUSSION

Anterior urethral stricture disease remains a challenging urological condition with significant implications for urinary function and quality of life. The present study compared endoscopic urethrotomy and open urethroplasty in terms of recurrence rates, improvement in urinary flow, and patient-reported outcomes. Our findings demonstrate that while both modalities provide short-term symptomatic relief, open urethroplasty offers superior long-term outcomes with significantly lower recurrence rates, better sustained improvement in urinary flow, and higher patient satisfaction.

The recurrence rate following endoscopic urethrotomy in our study was 47.5% at 12 months, which is consistent with internationally reported recurrence rates ranging from 40% to 60%, particularly for strictures longer than 1 cm or those associated with dense spongiositis. Multiple studies have shown that although DVIIU is minimally invasive and easily repeatable, its long-term efficacy is limited, especially after repeated interventions. Recurrent urethrotomy has been shown to increase periurethral fibrosis, thereby reducing the success of subsequent definitive repair.

In contrast, the overall recurrence rate following open urethroplasty in our cohort was 13.8%, closely aligning with international success rates of 85–90% reported for excision and primary anastomosis and buccal mucosal graft urethroplasty. These findings reinforce the role of urethroplasty as the definitive treatment for anterior urethral strictures, particularly in patients with longer or recurrent strictures. The lower recurrence rate observed in the urethroplasty group supports current European Association of Urology (EAU) and American Urological Association (AUA) guidelines, which recommend urethroplasty over repeated endoscopic treatment in appropriate candidates.

Objective functional outcomes, as measured by maximum urinary flow rate (Qmax), improved significantly in both treatment groups postoperatively. However, patients undergoing urethroplasty demonstrated a greater and more sustained improvement in urinary flow at 12 months. While urethrotomy showed an initial rise in Qmax, this improvement diminished over time, likely reflecting progressive stricture recurrence. These findings are in agreement with previously published studies indicating that urethroplasty provides durable restoration of urethral caliber and stable long-term urinary flow.

Patient-reported outcomes are increasingly recognized as essential endpoints in urethral stricture surgery. In the present study, patients treated with urethroplasty reported significantly greater improvement in lower urinary tract symptoms, quality of life, and

overall satisfaction compared to those treated with endoscopic urethrotomy. This difference may be attributed to the reduced need for repeat procedures, sustained symptom relief, and improved confidence in long-term treatment success among urethroplasty patients. These results support the growing emphasis on patient-centered outcomes in contemporary urological practice.

The complication profile observed in this study was acceptable for both treatment modalities. Although open urethroplasty was associated with a higher incidence of wound-related complications, these were predominantly minor and managed conservatively. Importantly, the rate of major complications was low and comparable between the two groups. This highlights that, when performed by experienced surgeons, urethroplasty is a safe procedure with an acceptable morbidity profile.

This study has certain limitations. The non-randomized design and single-center setting may limit the generalizability of the findings. Additionally, although follow-up of up to 12 months provides meaningful insight into early recurrence, longer follow-up is necessary to assess long-term durability, particularly for substitution urethroplasty. Despite these limitations, the prospective design, standardized assessment of outcomes, and inclusion of patient-reported measures strengthen the validity of the results.

In conclusion, while endoscopic urethrotomy remains a reasonable initial option for selected short anterior urethral strictures, open urethroplasty offers superior long-term outcomes with significantly lower recurrence rates, better functional improvement, and higher patient satisfaction. Early referral for urethroplasty in appropriate patients may reduce disease burden, repeated interventions, and overall healthcare costs. These findings support adherence to international guideline recommendations and underscore the need for individualized, evidence-based management of anterior urethral stricture disease.

Conflict of interest: Nil

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