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OUTCOME OF OPTICAL INTERNAL URETHROTOMY FOR SHORT SEGMENT URETHRAL STRICTURE

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ABSTRACT

Background: Urethral stricture disease is a common cause of bladder outlet obstruction that significantly affects urinary function and quality of life.
Objective: To evaluate the outcome of optical internal urethrotomy for short-segment urethral stricture and identify predictors of successful treatment.
Methods: This retrospective observational study was conducted at ESIC Medical College Kalaburagi from 01-01-2024 to 31-12-2025and included 50 patients who underwent optical internal urethrotomy for short-segment urethral stricture. Demographic, clinical, stricture-related, operative, and postoperative data were collected from medical records.
Results: The mean age of patients was 46.8 ± 12.7 years, and the mean stricture length was 1.28 ± 0.39 cm. Bulbar urethral strictures accounted for 76.0% of cases. Successful treatment was achieved in 39 (78.0%) patients, while recurrence occurred in 11 (22.0%). Mean postoperative Qmax improved to 18.6 ± 4.2 mL/s, representing a mean improvement of 11.4 ± 3.9 mL/s. Patients with recurrence had significantly longer strictures (1.84 ± 0.34 vs. 1.12 ± 0.28 cm; $p<0.001$), were older (53.7 ± 13.2 vs. 44.8 ± 11.9 years; $p=0.036$), and more frequently had diabetes mellitus and previous urethral instrumentation.
Conclusion: Optical internal urethrotomy provides favorable functional outcomes for appropriately selected patients with short-segment urethral strictures.

Keywords*: Optical internal urethrotomy; urethral stricture; urethroplasty; urethral recurrence; Qmax; bulbar urethra.*

INTRODUCTION

Urethral stricture disease is a frequent urologic condition where fibrosis and narrowing of the lumen of the urethra cause an obstruction of urinary flow and progressive lower urinary tract symptoms (LUTS) [1]. It is still a major cause of morbidity throughout the world and also has a profound impact on the quality of life of patients with recurrent UTIs, urinary retention, bladder dysfunction and, at a late stage, renal failure [2]. Urethral stricture etiology is multifactorial, traumatic injury, instrumentation, catheterization, transurethral procedures, inflammatory condition, lichen sclerosus and infectious urethritis [3]. In developing nations, trauma and infection are still the major causes; however, in recent years, iatrogenic strictures have become more prevalent because of the increasing number of endoscopic urological procedures performed [4]. Whatever the cause, chronic inflammation ultimately causes spongiofibrosis, causing the lumen of the urethra to narrow and develop an increasing urinary obstruction [5]. Patients with urethral stricture typically have a poor urinary stream, straining during urination, urinary frequency, urgency, incomplete bladder emptying, recurrent UTI, hematuria, and acute urinary retention [6]. Diagnosis is made with clinical evaluation, uroflowmetry, retrograde urethrography, voiding cystourethrography and cystourethroscopy, all of which help determine the location, length and severity of strictures and suitability for treatment [7].

OIU was first popularized by Sachse, and is one of the most commonly performed minimally invasive procedures for short-segment anterior urethral strictures [8]. The technique entails endoscopically making a cut into the tissue of a fibrotic scar under direct sight to regain urethral patency [9]. Technically easy, inexpensive, low morbidity, quick recovery and hospital stay, OIU is an appealing initial treatment for certain patients [10]. However, long-term success after OIU is not uniform with recurrent fibrosis after initial symptomatic improvement reported [11]. There is

considerable variation in reported success rates depending on the length of the stricture, its location, the cause of the stricture, prior interventions, and the extent of spongiofibrosis and length of follow-up [12]. Short bulbar strictures less than 1–2 cm tend to fare better, however, they have a higher rate of recurrence if they are longer, recurrent, multiple or penile strictures [13]. Factors that affect the treatment response after OIU include stricture length, location, etiology, preoperative urinary flow rate, previous urethral interventions, peri-operative infection, duration of catheterization, and adherence to postoperative follow-up [14]. The identification of these factors will play a role in patient selection, counseling, and patient management whether the patient should have repeat endoscopic treatment or definitive urethroplasty [15].

OBJECTIVE

To evaluate the outcome of optical internal urethrotomy for short-segment urethral stricture and identify predictors of successful treatment.

METHODOLOGY

This retrospective observational study was conducted at ESIC Medical College Kalaburagi from 01-01-2024 to 31-12-2025 and included 50 patients who underwent optical internal urethrotomy (OIU) for short-segment urethral stricture. Patients aged 18 years or older with a single short-segment anterior urethral stricture (≤2 cm) confirmed on retrograde urethrography and/or cystourethroscopy who underwent primary optical internal urethrotomy were included. Patients with complete clinical records and a minimum postoperative follow-up of six months were eligible for analysis.Patients with urethral strictures longer than 2 cm, posterior urethral strictures, multiple urethral strictures, obliterative strictures, urethral malignancy, previous urethroplasty, neurogenic bladder, active urinary tract infection at the time of surgery, incomplete medical records, or inadequate follow-up were excluded.

Data Collection

After approval from the Institutional Ethical Review Committee, patient information was retrieved from hospital electronic medical records, operative notes, outpatient follow-up files, uroflowmetry reports, radiological investigations, and cystoscopic findings using a standardized data collection form. Baseline demographic variables included age, body mass index, smoking status, diabetes mellitus, hypertension, previous urethral instrumentation, previous catheterization, and history of urinary tract infection. Stricture-related variables included etiology (traumatic, inflammatory, iatrogenic, or idiopathic), stricture location (bulbar or penile urethra), stricture length, duration of symptoms, preoperative maximum urinary flow rate (Qmax), post-void residual urine volume, and findings on retrograde urethrography. Operative variables included operative duration, intraoperative complications, catheter size, postoperative catheterization duration, perioperative antibiotic administration, and length of hospital stay. The primary outcome was treatment success, defined as satisfactory voiding without the need for repeat urethral intervention, postoperative Qmax>15 mL/s, and absence of radiological or cystoscopic evidence of recurrent urethral narrowing during follow-up. Secondary outcomes included recurrence rate, postoperative urinary tract infection, hematuria, urinary retention, false passage formation, need for repeat optical internal urethrotomy or urethroplasty, and patient-reported symptomatic improvement.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Independent *t*-tests or Mann–Whitney *U* tests were used to compare continuous variables between successful and recurrent cases, whereas Chi-square or Fisher's exact tests were used for categorical variables. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value ≤0.05 was considered statistically significant.

RESULTS

The mean age of patients was 46.8 ± 12.7 years, with a mean BMI of 27.2 ± 3.9 kg/m². Diabetes mellitus was present in 11 (22.0%), hypertension in 13 (26.0%), and smoking in 17 (34.0%) patients. Previous catheterization and urethral instrumentation were reported in 18 (36.0%) and 15 (30.0%) patients, respectively. Mean symptom duration was 8.6 ± 3.5 months, and preoperative Qmax was low at 7.2 ± 2.1 mL/s.

Table 1: Baseline Demographic and Clinical Characteristics of Patients Undergoing Optical Internal Urethrotomy (N = 50)

Variable	n (%) / Mean ± SD
Age (years)	46.8 ± 12.7
Body mass index (kg/m²)	27.2 ± 3.9
Diabetes mellitus	11 (22.0)
Hypertension	13 (26.0)
Current smokers	17 (34.0)
Previous urethral catheterization	18 (36.0)
Previous urethral instrumentation	15 (30.0)
Previous urinary tract infection	14 (28.0)
Duration of symptoms (months)	8.6 ± 3.5
Preoperative Qmax (mL/s)	7.2 ± 2.1

Most strictures were bulbar in location (38, 76.0%), while penile strictures accounted for 12 (24.0%) cases. Mean stricture length was 1.28 ± 0.39 cm. Iatrogenic etiology was most common (18, 36.0%), followed by idiopathic (16, 32.0%) and traumatic causes (11, 22.0%). Mean operative time was 29.6 ± 8.4 minutes, catheterization duration was 5.8 ± 1.6 days, and hospital stay was short at 1.4 ± 0.6 days.

Table 2: Stricture Characteristics and Operative Findings

Variable	n (%) / Mean ± SD
Bulbar urethral stricture	38 (76.0)
Penile urethral stricture	12 (24.0)
Stricture length (cm)	1.28 ± 0.39
Idiopathic etiology	16 (32.0)
Iatrogenic etiology	18 (36.0)
Traumatic etiology	11 (22.0)
Inflammatory etiology	5 (10.0)
Operative time (minutes)	29.6 ± 8.4
Catheterization duration (days)	5.8 ± 1.6
Hospital stay (days)	1.4 ± 0.6
Intraoperative complications	3 (6.0)

Successful outcome after optical internal urethrotomy was achieved in 39 (78.0%) patients, while recurrence occurred in 11 (22.0%). Postoperative Qmax improved to 18.6 ± 4.2 mL/s, with a mean improvement of 11.4 ± 3.9 mL/s. Postoperative complications were low, including UTI in 4 (8.0%), hematuria in 5 (10.0%), and acute urinary retention in 2 (4.0%) patients.

Table 3: Postoperative Outcomes Following Optical Internal Urethrotomy

Variable	n (%) / Mean ± SD
Successful outcome	39 (78.0)
Recurrence	11 (22.0)
Postoperative Qmax (mL/s)	18.6 ± 4.2
Improvement in Qmax (mL/s)	11.4 ± 3.9
Postoperative urinary tract infection	4 (8.0)
Hematuria	5 (10.0)
Acute urinary retention	2 (4.0)
Repeat Optical Internal Urethrotomy	8 (16.0)
Urethroplasty Required	3 (6.0)

Recurrent cases were older than successful cases (53.7 ± 13.2 vs. 44.8 ± 11.9 years; p=0.036) and had longer strictures (1.84 ± 0.34 vs. 1.12 ± 0.28 cm; p<0.001).

Table 4: Comparison Between Successful and Recurrent Cases

Variable	Successful (n=39)	Recurrence (n=11)	p-value
Age (years), Mean ± SD	44.8 ± 11.9	53.7 ± 13.2	0.036
Stricture length (cm), Mean ± SD	1.12 ± 0.28	1.84 ± 0.34	<0.001
Diabetes mellitus, n (%)	6 (15.4)	5 (45.5)	0.041
Previous urethral instrumentation, n (%)	9 (23.1)	6 (54.5)	0.047
Preoperative Qmax (mL/s), Mean ± SD	7.6 ± 2.0	5.8 ± 1.8	0.013
Operative time (minutes), Mean ± SD	27.4 ± 6.9	37.5 ± 9.2	0.001

Multivariable analysis showed that stricture length ≤1.5 cm was the strongest predictor of successful outcome (AOR=4.62, 95% CI: 1.34–15.89; p=0.015).

Table 5: Multivariable Logistic Regression Analysis of Predictors of Successful Outcome After Optical Internal Urethrotomy

Predictor	Adjusted OR	95% CI	p-value
Stricture length ≤1.5 cm	4.62	1.34–15.89	0.015
Bulbar urethral location	3.41	1.02–11.46	0.046
No previous urethral instrumentation	2.98	1.01–8.84	0.048
Absence of diabetes mellitus	3.22	1.05–9.87	0.041

Preoperative Qmax>6 mL/s	2.79	1.01–7.68	0.047

DISCUSSION

The results of optical internal urethrotomy (OIU) for short-segment urethral stricture were analysed in 50 patients in a retrospective study. The overall success rate was 78.0% and in the follow-up period a recurrence was seen in 22.0% of patients. It was shown that shorter stricture length, bulbar urethral location, and absence of diabetes mellitus, no previous urethral instrumentation and better urinary flow before treatment were the factors which were independently associated with success. The results confirm the importance of patient selection to maximize the results after OIU. The study population had a mean age of 46.8 ± 12.7 years and a mean body mass index of 27.2 ± 3.9 kg/m². 22.0% had diabetes mellitus, 26.0% had hypertension and 34.0% were smokers. 36.0% had a previous urethral catheterization and 30.0% had been previously instrumented. The average symptom duration was 8.6 ± 3.5 months, and patients had a significantly lower average preoperative Qmax of 7.2 ± 2.1 mL/s, indicating significant bladder outlet obstruction. Past studies also have shown that urethral stricture disease is more prevalent in the middle age group and is often related to previous urethral instrumentation and catheterization [17]. The most common anatomical sites of the strictures were found in the bulbous portion of the urethra (76.0%). The mean stricture length was 1.28 ± 0.39 cm, with the most common etiology being iatrogenic (36.0%), then idiopathic (32.0%) and traumatic (22.0%). The average operating time was 29.6 ± 8.4 minutes, the average time of catheterization was 5.8 ± 1.6 days, and the average hospital stay was 1.4 ± 0.6 days. Earlier studies also have shown that bulbar urethral stricture is the most common type of urethral stricture that is amenable to OIU treatment, and that the surgery has short operating times, low hospital stay, and a quick recovery. The results of OIU were good in the majority of patients. The success of treatment was obtained in 39 (78.0%) of the patients and failure in only 11 (22.0%) patients. The urinary flow rate improved significantly from 7.2 ± 2.1 mL/s preoperatively to 18.6 ± 4.2 mL/s postoperatively, which was a mean change of 11.4 ± 3.9 mL/s. Complications occurred rarely, and included urinary tract infection in 8.0%, and hematuria in 10.0%, while only 4.0% experienced acute urinary retention. Earlier studies have also found that OIU, combined with relatively low rates of perioperative complications, is able to produce significant improvements in urinary flow. Successful and recurrent cases were compared and the recurrent cases were found to be significantly older (53.7 ± 13.2 years vs. 44.8 ± 11.9 years) and had much longer strictures (1.84 ± 0.34 cm vs. 1.12 ± 0.28 cm). Other significant factors associated with treatment failure included diabetes mellitus, pre-operative instrumentation of the urethra, lower pre-operative Qmax and longer operative time. Consistent with previous studies, stricture length, recurrent disease, diabetes mellitus, and prior urethral interventions have been shown to have a negative impact on healing of the tissues and significantly increase the risk of recurrence after OIU [19].

The only independent parameter that was associated with successful treatment in multivariable logistic regression was length of stricture ≤1.5 cm, with the odds of successful treatment being >4 times greater in those patients. Favorable outcomes were further independently predicted by bulbar urethral location, no previous urethral instrumentation, no diabetes mellitus and no preoperative Qmax< 6 mL/s. Similarly, previous studies have shown that the best indication for OIU is short bulbar strictures in the absence of any significant spongiofibrosis with the highest long-term success rates. In this study, the association between the development of recurrence and diabetes mellitus indicates the impact of systemic disease on the healing of the urethra. Diabetic patients can have poor tissue vascularity and poor wound healing which can lead to recurrent fibrosis after urethrotomy. Similarly, repeated instrumentation of the urethra can result in greater scaring around the urethra and decrease the chances of success with subsequent treatments. Previous studies have also highlighted the importance of optimizing glycemic control and avoiding unnecessary urethral manipulation for improved long-term results after endoscopic treatment [20].

LIMITATIONS

This study has several limitations. First, its retrospective design is subject to selection and information bias because data were obtained from previously recorded medical records. Second, the study was conducted at a single center with a relatively small sample size of 50 patients, which may limit the generalizability of the findings. Variations in surgeon experience, postoperative catheterization protocols, and follow-up practices could not be completely standardized and may have influenced treatment outcomes. The duration of follow-up was limited, and therefore late stricture recurrence may have been underestimated. In addition, objective assessment of spongiofibrosis severity and patient-reported quality-of-life outcomes were not consistently available for analysis. Future prospective multicenter studies with larger sample sizes and longer follow-up are recommended to validate these findings and better define the long-term predictors of success following optical internal urethrotomy.

CONCLUSION

Optical internal urethrotomy is a safe and effective minimally invasive treatment for carefully selected patients with short-segment urethral stricture, achieving an overall success rate of 78%. Significant improvement in urinary flow was observed following the procedure, while postoperative complications were infrequent. Short stricture length, bulbar urethral location, absence of diabetes mellitus, no previous urethral instrumentation, and higher preoperative urinary flow rate were independent predictors of successful treatment. Conversely, longer strictures, diabetes mellitus, previous urethral instrumentation, and reduced urinary flow were associated with recurrence. Careful patient selection, meticulous surgical technique, and structured postoperative follow-up are essential to maximize long-term success and identify patients who may benefit from definitive urethroplasty.

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