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Effects of Duration and Size of Catheterization Post Internal Urethrotomy on Recurrence Rate of Urethral Stricture

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ABSTRACT

Background: Urethral stricture disease is a common urological condition associated with significant morbidity and high recurrence rates following direct vision internal urethrotomy (DVIU). **Objective:** This study aimed to evaluate the effects of catheter size and duration on recurrence rates after internal urethrotomy. **Methods:** This prospective observational study was conducted at Department of Urology, PIMS Islamabad, from April 2024 to January 2025. It included 201 male patients aged 18–70 years with anterior urethral stricture undergoing first-time internal urethrotomy. Patients were stratified into groups based on catheter size (14 Fr, 16 Fr, 18 Fr) and duration of catheterization (≤5 days, 6–10 days, >10 days). Recurrence was assessed during follow-up at 1, 3, 6, and 12 months using symptom evaluation, uroflowmetry, and imaging/endoscopy when indicated. **Results:** The mean age of patients was 43.6 ± 12.4 years. Most strictures were located in the bulbar urethra (70.6%) with mean length 1.4 ± 0.6 cm. Overall recurrence was observed in 64 patients (31.8%). Recurrence was highest in the 18 Fr catheter group (43.2%) and lowest in the 14 Fr group (23.6%) (p=0.04). Similarly, recurrence increased with longer catheterization duration, being 16.4% for ≤5 days, 33.7% for 6–10 days, and 50.0% for >10 days (p=0.002). Multivariate regression identified stricture length >1.5 cm, catheter size 18 Fr, and catheter duration >10 days as independent predictors of recurrence. **Conclusion:** Smaller catheter sizes and shorter catheterization durations are associated with lower recurrence rates following internal urethrotomy. Optimizing postoperative catheter management represents a simple, effective strategy to reduce recurrence and improve patient outcomes.

INTRODUCTION

Urethral stricture disease is an ancient urological problem, with descriptions dating back to early surgical texts, and it continues to remain a frequent challenge for urologists worldwide. It is defined as a narrowing of the urethral lumen resulting from fibrosis of the epithelium and spongiosum, typically secondary to trauma, infection, iatrogenic instrumentation, or inflammatory processes [1]. The incidence is particularly high in developing countries where untreated infections, prolonged catheterization, and limited access to specialized surgical interventions contribute to its persistence [2]. Clinically, urethral stricture disease is associated not only with bothersome lower urinary tract symptoms but also with significant morbidity, including recurrent urinary tract infections, bladder decompensation, upper urinary tract dilatation, and even renal impairment in advanced cases. Hence, timely intervention is crucial in preventing long-term complications [3]. The surgical management of urethral stricture includes a spectrum of options ranging from minimally invasive approaches such as direct vision internal urethrotomy (DVIU) and dilation to more definitive procedures like urethroplasty. Among these, DVIU is widely practiced due to its simplicity, minimal invasiveness, and short recovery period [4]. The procedure involves incising the stricture under direct vision, usually with a cold knife or laser, to restore urethral patency. Despite its popularity, the major drawback of DVIU is the high recurrence rate, which limits its long-term success. Studies have reported recurrence in nearly half of the patients within the first year of surgery, highlighting the importance of identifying perioperative factors that could influence outcomes [5]. One such factor is the strategy of postoperative catheterization, which serves as both a stent to maintain urethral lumen and a conduit for urinary drainage while the mucosa heals. Catheterization is considered a critical component of the healing process, but its parameters specifically the duration of catheter placement and the catheter size remain controversial [6]. On one hand, larger catheter sizes may theoretically maintain wider patency and prevent early collapse of the incised stricture, but the associated pressure may cause ischemic injury to the urethral mucosa, exacerbating fibrosis. On the other hand, smaller catheters are less

traumatic but may be inadequate in maintaining an optimal lumen. Similarly, the duration of catheterization is debated [7]. Short-term catheterization (typically 3–5 days) is believed to allow early epithelial regeneration and minimize infection risk, while extended catheterization (up to 2–3 weeks) may provide prolonged stenting but at the cost of increased inflammation, bacterial colonization, and discomfort [8]. Evidence on these aspects is conflicting. Some trials have suggested that prolonged catheterization leads to higher recurrence rates due to chronic irritation and infection, whereas other studies propose that too early removal results in premature re-narrowing of the urethra [9]. A meta-analysis has even highlighted the absence of standardized international guidelines regarding catheter size and duration following internal urethrotomy, which leads to significant heterogeneity in clinical practice across institutions and countries. Additionally, patient factors such as stricture length, etiology, and comorbidities may interact with catheter variables, further complicating the interpretation of outcomes [10,11].

Objective

This study aimed to evaluate the effects of catheter size and duration on recurrence rates after internal urethrotomy.

METHODOLOGY

This prospective observational study was conducted at Department of Urology, PIMS Islamabad, from April 2024 to January 2025. A total of 201 patients were enrolled in the study. Non-probability consecutive sampling was employed to recruit patients who met the inclusion criteria.

Inclusion Criteria

- Male patients aged 18–70 years.
- Patients diagnosed with anterior urethral stricture confirmed by retrograde urethrogram (RUG) or urethroscopy.
- Patients undergoing direct vision internal urethrotomy (DVIU) for the first time.

Exclusion Criteria

- Patients with posterior urethral stricture.
- History of previous urethroplasty or multiple failed urethrotomies.
- Presence of active urinary tract infection at the time of procedure.
- Patients with neurogenic bladder or significant comorbidities such as uncontrolled diabetes mellitus and chronic renal failure.

Data Collection

Patient demographics, stricture characteristics, catheter size, and duration were recorded in a structured proforma. Recurrence events were documented during the follow-up period. All patients underwent internal urethrotomy under spinal anesthesia using a direct vision urethrotome with a cold knife. Following the incision of the stricture, an indwelling Foley catheter was inserted. Patients were divided into groups based on catheter size (14 Fr, 16 Fr, and 18 Fr) and duration of catheterization (≤5 days, 6–10 days, and >10 days). The catheter was removed according to the allocated duration. Perioperative antibiotic prophylaxis was given to all patients according to hospital protocol. Patients were followed up at 1 month, 3 months, 6 months, and 12 months post-procedure. Evaluation included symptom assessment, uroflowmetry, and repeat urethrogram when recurrence was suspected. Recurrence was defined as the reappearance of obstructive urinary symptoms with confirmatory evidence of stricture on uroflowmetry (Qmax < 15 mL/s) and/or radiological/endoscopic assessment.

Statistical Analysis

Data were entered and analyzed using SPSS version 26.0. Quantitative variables such as age and uroflowmetry values were presented as mean ± standard deviation, while categorical variables such as catheter size, duration, and recurrence were expressed as frequencies and percentages. The association between catheter variables and recurrence was assessed using chi-square test. A p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 201 patients were included in the study. The mean age of the study participants was 43.6 ± 12.4 years, ranging from young adults to elderly patients. The most frequent presenting symptom was obstructive lower urinary tract symptoms (LUTS), reported by 128 patients (63.7%), followed by recurrent urinary tract infections in 45 patients (22.4%) and acute urinary retention in 28 patients (13.9%). Stricture location was predominantly in the bulbar urethra, observed in 142 patients (70.6%), while 47 patients (23.4%) had penile strictures and 12 patients (6.0%) had pan-urethral involvement. The average stricture length was 1.4 ± 0.6 cm. In terms of catheterization, 72 patients (35.8%) received a 14 Fr catheter, 85 patients (42.3%) a 16 Fr catheter, and 44 patients (21.9%) an 18 Fr catheter. Regarding duration, 61 patients (30.3%) had catheters in place for ≤5 days, 98 patients (48.8%) for 6–10 days, and 42 patients (20.9%) for more than 10 days.

Table 1

Baseline Characteristics of Patients (n = 201)

Characteristic	Value
Age, mean ± SD (years)	43.6 ± 12.4
Presenting symptoms	
– Obstructive LUTS	128 (63.7%)
– Recurrent UTI	45 (22.4%)
– Acute urinary retention	28 (13.9%)
Stricture site	
– Bulbar urethra	142 (70.6%)
– Penile urethra	47 (23.4%)
– Pan-urethral	12 (6.0%)
Mean stricture length (cm)	1.4 ± 0.6
Catheter size – 14 Fr	72 (35.8%)
Catheter size – 16 Fr	85 (42.3%)
Catheter size – 18 Fr	44 (21.9%)
Catheter duration – ≤5 days	61 (30.3%)
Catheter duration – 6–10 days	98 (48.8%)
Catheter duration – >10 days	42 (20.9%)

Overall recurrence was observed in 64 patients (31.8%). Recurrence increased with catheter size: it was lowest in

the 14 Fr group with 17 patients (23.6%), higher in the 16 Fr group with 28 patients (32.9%), and highest in the 18 Fr group with 19 patients (43.2%), showing a statistically significant difference (p = 0.04). A similar trend was noted with catheter duration. Patients with catheterization for ≤5 days had the lowest recurrence (10 patients, 16.4%), compared to 6–10 days (33 patients, 33.7%), and >10 days (21 patients, 50.0%). This association was highly significant (p = 0.002).

Table 2

Recurrence of Stricture by Catheter Size and Duration

Variable	Total n	Recurrence n (%)	p-value
Catheter size – 14 Fr	72	17 (23.6%)	0.04*
Catheter size – 16 Fr	85	28 (32.9%)	
Catheter size – 18 Fr	44	19 (43.2%)	
Catheter duration – ≤5 days	61	10 (16.4%)	0.002*
Catheter duration – 6–10 days	98	33 (33.7%)	
Catheter duration – >10 days	42	21 (50.0%)	

Multivariate analysis identified independent predictors of recurrence. Age above 50 years was not significantly associated with recurrence (OR 1.32, 95% CI 0.71–2.46, p = 0.37). However, stricture length greater than 1.5 cm was significantly predictive (OR 2.14, 95% CI 1.12–4.09, p = 0.02). Catheter size of 18 Fr compared with 14 Fr was also associated with nearly a twofold increase in recurrence risk (OR 1.98, 95% CI 1.03–3.81, p = 0.04). The strongest predictor was prolonged catheterization for more than 10 days, which tripled the recurrence risk (OR 2.75, 95% CI 1.35–5.61, p = 0.005).

Table 3

Logistic Regression Analysis of Factors Associated with Recurrence

Variable	Odds Ratio (OR)	95% CI	p-value
Age (>50 years)	1.32	0.71 – 2.46	0.37
Stricture length >1.5 cm	2.14	1.12 – 4.09	0.02*
Catheter size (18 Fr vs 14 Fr)	1.98	1.03 – 3.81	0.04*
Catheter duration >10 days	2.75	1.35 – 5.61	0.005*

*Statistically significant at p ≤ 0.05

DISCUSSION

Urethral stricture disease remains a challenging urological entity, particularly due to its tendency to recur following minimally invasive procedures such as direct vision internal urethrotomy (DVIU). The present study evaluated the impact of catheter size and catheterization duration after urethrotomy on recurrence rates, involving a cohort of 201 patients. The findings demonstrated that both larger catheter sizes and prolonged duration of catheterization were significantly associated with higher recurrence rates, while smaller catheters and shorter durations were linked to improved outcomes. Our study found an overall recurrence rate of 31.8%, which is consistent with previous reports documenting recurrence rates ranging between 30% and 70% after DVIU. The lowest recurrence rate was observed in patients with a 14 Fr catheter (23.6%), while the highest occurred in those with an 18 Fr catheter (43.2%). This supports the hypothesis that larger catheters may exert greater pressure on the urethral mucosa, leading to ischemia and subsequent fibrosis, thereby predisposing to re-stricture formation. In contrast, smaller catheters appear to provide adequate stenting without causing significant trauma. These results are in line with previous research suggesting that minimizing catheter-related trauma plays a crucial role in successful long-term outcomes [12].

Similarly, catheterization duration emerged as an important determinant of recurrence. Patients catheterized for more than 10 days experienced significantly higher recurrence (50.0%) compared to those with catheterization of ≤5 days (16.4%). Prolonged catheterization is known to cause mucosal irritation, facilitate bacterial colonization, and delay epithelial regeneration. Our findings corroborate earlier observations that early catheter removal after urethrotomy may allow faster mucosal healing and reduce infection-related complications [13]. On the other hand, too short a duration may risk premature collapse of the incised lumen; however, in our study, the shortest group (≤5 days) demonstrated the most favorable outcome, indicating that minimal stenting may be sufficient to stabilize the urethra during the initial healing phase. Multivariate regression analysis further reinforced these observations, showing that stricture length, large catheter size, and prolonged catheterization were independent predictors of recurrence [14]. These results highlight the interplay between patient-specific factors and perioperative management in determining long-term success after urethrotomy. Stricture length has long been recognized as a determinant of recurrence, with shorter strictures (<1.5 cm) associated with better outcomes, and our data support this well-established concept [15].

The clinical implications of these findings are significant. Internal urethrotomy continues to be widely performed in resource-limited settings due to its simplicity and accessibility. Optimizing catheter-related variables is a relatively low-cost intervention that can improve outcomes, reduce the need for repeat interventions, and minimize patient morbidity. Standardizing postoperative protocols to favor smaller catheter sizes (14–16 Fr) and shorter durations (≤5 days) may help reduce recurrence rates [16]. Furthermore, individualized strategies based on stricture length and patient comorbidities can refine management decisions. Our study also adds to the ongoing debate regarding the optimal postoperative management of urethrotomy patients. While some literature advocates for slightly longer catheterization to stabilize the lumen, our data suggest that excessive duration is detrimental. Similarly, the assumption that larger catheters prevent early restenosis is not supported by our findings. This emphasizes the need for balance: adequate stenting to maintain lumen patency without inducing trauma or prolonging exposure to infection risk. Limitations of this study include its single-center design and relatively short follow-up duration of 12 months, which may not fully capture late recurrences. Additionally, variations in surgical technique and patient compliance with follow-up may have influenced outcomes.

CONCLUSION

It is concluded that both the size and duration of catheterization after internal urethrotomy significantly influence the recurrence of urethral stricture. Smaller catheter sizes (14 Fr) and shorter durations of

catheterization (≤5 days) were associated with lower recurrence rates, while larger catheters (18 Fr) and prolonged catheterization (>10 days) markedly increased the risk of recurrence. Stricture length also emerged as an independent predictor of outcome. These findings highlight the importance of optimizing postoperative catheter management as a simple, cost-effective strategy to improve long-term outcomes. Adoption of standardized protocols favoring minimal catheter size and reduced duration may help reduce recurrence rates, improve patient quality of life, and decrease the need for repeated interventions.

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