

# COMPARISON OF STRICTURE RECURRENCE RATE BETWEEN EARLY AND LATE REMOVAL OF FOLEY CATHETER AFTER DIRECT VISION INTERNAL URETHROTOMY

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## ABSTRACT

**Objective:** Assess the urethral stricture recurrence rates in relation to the timing of the Foley catheter removal post direct vision internal urethrotomy (DVIU), i.e., early versus late.

**Methods:** The cross-sectional study comparing patient groups according to the timing of Foley catheter removal was carried out at the Armed Forces Institute of Urology, Rawalpindi, for a period of six months, from September 2025 to March 2026. Male patients aged 18 to 60 with single, short-segment (<2 cm) bulbar urethral strictures were selected for enrollment through non-probability consecutive sampling. The total number of patients was 158. The patients were monitored for three months in monthly visits. Stricture recurrence was diagnosed as the return of obstructive lower urinary tract symptoms, which were validated by cystoscopy. Data were analyzed using SPSS version 27, and a chi-square test and independent sample t-test were performed with  $p \leq 0.05$  set as the threshold for statistical significance.

**Results:** The mean age of patients was similar in both groups. Stricture recurrence was recorded in 20.3% of patients in the early removal group, while 35.4% was the figure for the late removal group. The difference in recurrence rates was statistically significant ( $p=0.033$ ). The patients in the early removal group also exhibited significantly greater maximum urinary flow rates than those in the late removal group ( $p < 0.001$ ).

**Conclusion:** The early removal of the Foley catheter after DVIU is associated with a significantly lower rate of urethral stricture recurrence and better postoperative urinary flow, thus suggesting it as a favorable postoperative strategy.

**KEYWORDS:** Direct Vision Internal Urethrotomy; Recurrence; Urethral Stricture; Urethroplasty; Urethrotomy

## INTRODUCTION

Urethral stricture disease is a problem of international public health, with the annual incidence rate of 200-1200 per 100,000 males worldwide, which can go up to more than 600 per 100,000 in the age group of men above 65 years(1,2). In Pakistan, it constitutes 4-5% of the total urological admissions, and its incidence is approximately 14 per 100,000 hospital patients, mainly affecting younger males under 40 years due to trauma from road traffic accidents(3). Direct vision internal urethrotomy (DVIU) is still the primary endoscopic treatment for short segment strictures, but the recurrence rate is between 30-60% within two years after the procedure, and the rate gets higher (50-100%) after repeated interventions(4,5).

There is no consensus about the duration of post-DVIU urethral catheterization, but it typically lasts 3-7 days(6). Some evidence suggests that prolonged catheterization might increase the likelihood of recurrence. Recent studies have found that shorter catheterization (less than 5-7 days) and smaller catheter diameters (14-16 Fr) are associated with lower stricture recurrence than longer periods (7 days or more) or larger sizes (22 Fr)(7). The discussion continues on optimal timing—removal at early (within 3 days) versus late (after 7 days)—as the factors of prolonged indwelling causing mucosal ischemia and fibrosis on one hand and premature removal causing acute obstruction on the other are valid arguments to consider(8,9).

The stricture recurrence rates after DVIU for early and late Foley catheter removal are compared in this comparative cross-sectional study, thus providing essential evidence for the development of the best postoperative protocols. The high recurrence rates are the main factor influencing DVIU's ineffectiveness and causing healthcare costs to rise in Pakistan, where trauma is the main reason for the epidemiology. If the ideal catheter duration is determined, it could help improve outcomes, minimize the need for reinterventions, and direct the making of guidelines, especially in settings with limited resources.

## MATERIALS AND METHODS

The research comparing different groups was carried out at the Armed Forces Institute of Urology (AFIU), situated in Rawalpindi, within the span of six months (from September 2025 to March 2026), right after the study synopsis was approved. The hospital's ethical review committee granted ethical clearance, and the study was done according to the Declaration of Helsinki. Written informed consent was acquired from each participant before they were included.

By employing the WHO sample size calculator, the researchers calculated a total sample size of 158 patients with a confidence level of 95% and power of 80%. The anticipated recurrence rates were considered as 8.3% for the early catheter removal group and 25% for the late removal group. A non-probability consecutive sampling method was applied for patients' recruitment, and they were then randomly divided into two groups of 79 participants each (10,11). The criteria for inclusion were as follows: male patients aged 18-60 years with single, short-segment (<2 cm) bulbar urethral stricture diagnosed through retrograde urethrogram (RUG) and a negative urine culture. To reduce confounding factors and bias, patients with the following conditions were excluded: those who had undergone previous urethral surgery, dilatation, or DVIU, complicated strictures (diverticulum, fistula, or stone), complete urethral obstruction, or multiple strictures.

All patients received direct vision internal urethrotomy (DVIU) performed with a cold knife at the 12 o'clock position using a 21 Fr Storz urethrotome under spinal or general anesthesia. In all patients, an 18 Fr Foley catheter was introduced at the conclusion of the procedure. In Group A (early removal group), the catheter was removed on the 3rd postoperative day, while in Group B (late removal group), removal was done on the 5th postoperative day. All procedures were carried out by consultant urologists with at least five years of post-fellowship experience to guarantee uniformity of technique.

Patients were monitored for three months after surgery, and the follow-up was done once a month. Recurrence of urethral stricture was interpreted as a return of obstructive lower urinary tract symptoms, with cystoscopy as a confirmatory test. Suspected patients in the follow-up would go through diagnostic cystoscopy for confirmation. And those lost for follow-up were replaced using the same sampling method.

Patient data were collected on a pre-designed proforma, and statistical analysis was conducted using SPSS version 27. The Shapiro-Wilk test was used to check the normality of all continuous variables. The age variable was normally distributed ( $W = 0.994$ ,  $p = 0.768$ ). The symptom duration variable also followed a normal distribution ( $W = 0.989$ ,  $p = 0.273$ ). The highest flow rate was normally distributed ( $W = 0.996$ ,  $p = 0.929$ ). On the contrary, stricture length did not indicate normal distribution ( $W = 0.959$ ,  $p < 0.001$ ). Age, symptom duration, stricture length, and maximum urinary flow rate were trained as mean  $\pm$  standard deviation, whereas stricture etiology and recurrence, being qualitative variables, were reported as frequencies and percentages. The independent sample t-test enabled the comparison of mean values between early and late catheter removal groups. The association of stricture recurrence with the timing of catheter removal was evaluated using a chi-square test. A p-value of  $\leq 0.05$  was noted as statistically significant.

## RESULTS

The mean age of the patients was similar between the early and late removal of the Foley catheter groups ( $34.27 \pm 7.56$  vs  $35.76 \pm 7.48$  years). The patients of the late removal group showed a longer mean duration of symptoms ( $6.08 \pm 1.46$  months) when compared to the early removal group ( $4.14 \pm 1.25$  months). Likewise, the mean stricture length was longer in the late removal group ( $11.73 \pm 3.11$  mm) than in the early removal group ( $8.14 \pm 1.80$  mm). The maximum urinary flow rate was greater for the patients who had the catheter removed early ( $17.62 \pm 3.00$  ml/sec) than for those who had late removal ( $12.38 \pm 3.03$  ml/sec). The overall mean values of the total cohort are also shown.

**Table I: Group-wise Comparison of Clinical Characteristics of Study Participants (n = 158)**

Variable	Early Removal (n = 79) Mean $\pm$ SD	Late Removal (n = 79) Mean $\pm$ SD	Total (n = 158) Mean $\pm$ SD
Age (years)	34.27 $\pm$ 7.56	35.76 $\pm$ 7.48	35.01 $\pm$ 7.53
Duration of Symptoms (months)	4.14 $\pm$ 1.25	6.08 $\pm$ 1.46	5.11 $\pm$ 1.67
Stricture Length (mm)	8.14 $\pm$ 1.80	11.73 $\pm$ 3.11	9.94 $\pm$ 3.10
Maximum Flow Rate (ml/sec)	17.62 $\pm$ 3.00	12.38 $\pm$ 3.03	15.00 $\pm$ 3.99

In both groups, the most common cause of stricture was idiopathic, followed by iatrogenic and inflammatory causes. Strictures due to trauma were the least frequently observed. Concerning results, the incidence of stricture recurrence was 20.3% for the early removal group and 35.4% for the late removal group; however, most patients in both groups stayed recurrence-free through the follow-up period.

**Table II: Distribution of Stricture Etiology and Recurrence by Group (n = 158)**

Variable	Category	Early Removal (n = 79) n (%)	Late Removal (n = 79) n (%)	Total (n = 158) n (%)
<b>Stricture Etiology</b>	Idiopathic	35 (44.3)	32 (40.5)	67 (42.4)
	Iatrogenic	23 (29.1)	25 (31.6)	48 (30.4)
	Inflammatory	13 (16.5)	11 (13.9)	24 (15.2)
	Traumatic	8 (10.1)	11 (13.9)	19 (12.0)
<b>Stricture Recurrence</b>	No	63 (79.7)	51 (64.6)	114 (72.2)
	Yes	16 (20.3)	28 (35.4)	44 (27.8)

There was a statistically significant difference in the duration of symptoms; the late removal group had a longer duration than the early removal group ( $p < 0.001$ ). The length of the stricture was also significantly longer in the late removal group ( $p < 0.001$ ). On the other hand, the maximum flow rate of urine was significantly higher in the early removal group than in the late removal group ( $p < 0.001$ ), which suggested that early catheter removal resulted in better postoperative urinary flow.

**Table III: Independent Sample T-Test**

Variable	Early Removal (n = 79) Mean $\pm$ SD	Late Removal (n = 79) Mean $\pm$ SD	p-value
Duration of Symptoms (months)	4.14 $\pm$ 1.25	6.08 $\pm$ 1.46	<0.001
Stricture Length (mm)	8.14 $\pm$ 1.80	11.73 $\pm$ 3.11	<0.001
Maximum Flow Rate (ml/sec)	17.62 $\pm$ 3.00	12.38 $\pm$ 3.03	<0.001

The occurrence of recurrence was found to be significantly higher in the group of patients with late catheter removal (35.4%) as compared to those with early removal (20.3%). The statistical significance of this relationship was confirmed ( $p = 0.033$ ), indicating that the early Foley catheter removal after DVIU is connected to a lower stricture recurrence rate.

**Table IV: Association of Catheter Removal Timing with Stricture Recurrence (n = 158)**

Stricture Recurrence	Early Removal (n = 79) n (%)	Late Removal (n = 79) n (%)	p-value
Yes	16 (20.3)	28 (35.4)	<b>0.033</b>
No	63 (79.7)	51 (64.6)	

## DISCUSSION

The research conducted at the Armed Forces Institute of Urology (AFIU), Rawalpindi, which is a cross-sectional study that compares different methods, proves that early removal of the Foley catheter after direct vision internal urethrotomy (DVIU) for urethral strictures leads to a significant decline in recurrence rates when compared to late removal (20.3% vs 35.4%,  $p=0.033$ ). The patients who had the catheter removed early were also found to have a shorter period of symptoms (4.14  $\pm$  1.25 vs 6.08  $\pm$  1.46 months,  $p<0.001$ ), shorter stricture length (8.14  $\pm$  1.80 vs 11.73  $\pm$  3.11 mm,  $p<0.001$ ), and higher maximum urinary flow rates (17.62  $\pm$  3.00 vs 12.38  $\pm$  3.03 ml/sec,  $p<0.001$ )(12,13). Idiopathic etiology was the most common in both groups, which is in line with the conventional pattern of strictures(14).

Recently, studies have given the thumbs up to shorter periods of catheterization after DVIU as a measure to reduce recurrence. The analysis of 193 patients with bulbar stricture done in 2022 found that the overall recurrence rate was 23.31%, and the mean dwell time was longer in recurrence cases (7.47 $\pm$ 4.03 vs 4.79 $\pm$ 1.94 days,  $p=0.0001$ ); dwell time $\geq$ 5 days risk was tripled(15–17). The 20.3% recurrence rate in the early group is lower than their range of 23-65% for prolonged dwell, which is a possible result of stricter early removal protocols at AFIU.

A Pakistani study in 2025 reported that early (1.23 $\pm$ 0.93 days) vs late (4.13 $\pm$ 1.65 days) removal was associated with lower hospitalization but similar recurrence trends favoring early groups, although exact rates differed (not specified beyond flow improvements)(18). The  $p=0.033$  significance of our study is higher than their non-significant flow differences, thus illustrating the homogeneity of AFIU's cohort (comparable ages: 34-35 years).

In a TURP analogy performed in 2024, the early removal led to the reduction of urinary tract infections without increasing catheterization, reflecting our better flow (17.62 ml/sec) and lower recurrence. A 2022 study reported 30-60% 2-year recurrence post-first DVIU, which was raised to 50-100% later; our overall rate of around 28% (blended groups) is in line with this, but early removal has cut the late group risk by half(19–21).

The 2025 prolonged DVIU review for bulbar strictures below 2 cm showed reasonable efficacy with approximately 70% success, but more failed cases with >2 cm or recurrent cases; our early group had shorter strictures (8.14 mm),

thus, the success rate was 79.7% compared to the late group's 64.6%. Data from the Chinese 2025 study covering 128 strictures with a median follow-up of 26-43 months estimated balloon dilation/ DVIU recurrence at ~40-50%; lower rates in our case indicate that there were early catheter benefits over the standard 3-5 days dwell time. The iatrogenic and traumatic causes in the literature raise the recurrence rate to double that of idiopathic; our lead in idiopathic cases (both groups) indicates a lower baseline risk, which is further enhanced by early removal(13,22).

The current research presents multiple strengths. It sheds light on a clinically significant but still not well-studied side of DVIU postoperative management, especially in the Pakistani local context, where stricture disease is common. Highly skilled consultants adopted a consistent surgical method, which led to the reduction of bias in the procedure. Strict inclusion and exclusion criteria provided internal validity; meanwhile, the uniform catheter size and follow-up protocol maintained consistency. Besides, recurrence was diagnosed with improved accuracy due to the objective confirmation via cystoscopy.

On the other hand, some limitations should be mentioned at the same time. The single-center approach makes it difficult to apply the findings to a wider population. The follow-up period of three months, which was relatively short, might overlook long-term structure recurrence that is known to happen later. The use of non-probability sampling might lead to the occurrence of selection bias. Also, differences between groups in terms of baseline structure length and symptom duration might have affected the results. Larger, multicenter randomized studies with longer follow-up are needed to confirm these results.

## CONCLUSION

The Foley catheter removal done early after direct vision internal urethrotomy is correlated with a significant reduction of urethral stricture recurrence as well as better urinary flow outcomes when compared with late removal. Reduced catheterization may lead to reduced urethral ischemia and fibrosis, thereby resulting in better postoperative outcomes. The use of early catheter removal protocols may improve patient outcomes, lower morbidity due to recurrence, and facilitate the standardization of postoperative care in financially constrained areas.

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