



Original Article

A Sectional Observational Study for Evaluating a Urethral Scoring System for Predicting Complex Urethroplasty in Urethral Stricture Cases

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ABSTRACT

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Background: Urethral stricture disease is a common urological condition associated with significant morbidity and impaired quality of life. Accurate preoperative assessment is essential for optimal surgical planning, as treatment varies based on stricture characteristics. Urethral scoring systems have been developed to objectively evaluate stricture severity and predict surgical complexity. This study aimed to evaluate the effectiveness of a urethral scoring system in predicting the need for complex urethroplasty.

Methods: This prospective cross-sectional observational study was conducted in the Department of General Surgery at M.G.M. Medical College and M.Y. Hospital, Indore, over one year. A total of 60 patients aged 18–65 years with urethral stricture undergoing urethroplasty were included. Patients were evaluated using a urethral scoring system based on etiology, location, length, and number of strictures. Data were analyzed using JAMOVI software, with statistical significance set at $p < 0.05$.

Results: All patients were male, with the majority (31.7%) in the 20–30 years age group. Iatrogenic (36.7%) and traumatic (35%) etiologies predominated. The bulbar urethra (55%) was the most common site, and single strictures (86.7%) were most frequent. Complex urethroplasty was performed in 60% of cases. The overall success rate was 93.3%, with low intraoperative (5%) and postoperative complications (18.3%). Higher urethral scores were associated with increased surgical complexity.

Conclusion: The urethral scoring system is a reliable tool for predicting the complexity of urethroplasty. It facilitates improved surgical planning, patient counseling, and resource optimization, thereby enhancing clinical outcomes.

Keywords: Urethral stricture, Urethroplasty, Urethral scoring system, Surgical complexity, Buccal mucosal graft.

INTRODUCTION

Urethral stricture disease is a common urological condition characterized by narrowing of the urethral lumen, resulting in obstructive voiding symptoms, recurrent urinary tract infections, and significant impairment in quality of life [1]. Successful management requires accurate preoperative assessment and careful surgical planning, as treatment options vary depending on stricture characteristics such as etiology, location, length, and number. Although minimally invasive techniques such as urethral dilatation and direct vision internal urethrotomy (DVIU) are widely used, they are associated with high recurrence rates and often provide only temporary relief [2]. Urethroplasty remains the gold standard for definitive management, offering superior long-term success rates and improved patient outcomes [3].

Predicting the complexity of urethroplasty and its outcomes remains challenging. A reliable preoperative assessment tool is essential for guiding surgical decision-making and facilitating patient counseling regarding risks and expected benefits. In this context, urethral scoring systems have been developed to objectively quantify stricture severity based on clinical and anatomical parameters. These scoring systems incorporate variables such as etiology, anatomical location, stricture length, and number of strictures to estimate surgical complexity and prognosis.

The U-Score is one such system that assigns numerical values to key variables including location (1–2), etiology (1–2), stricture length (1–3), and number (1–2), generating a total score ranging from 4 to 9. Another classification method, the LSE system, evaluates Length, Segment (location), and Etiology to provide a structured description of urethral strictures. While originally designed for standardized reporting, recent adaptations of the LSE system have incorporated composite scoring to enhance its clinical utility [4,5]. Both systems have shown associations with operative difficulty, duration of surgery, and recurrence rates; however, their validation in larger populations with long-term follow-up remains limited.

Recent studies have attempted to refine predictive models using multivariable statistical techniques. Retrospective analyses, such as those conducted at the University of Alberta, have evaluated variables including stricture location, etiology, length, number, prior urethroplasty, and prior endoscopic interventions using Cox regression analysis to predict outcomes [6]. Surgical success has been defined by the ability to pass a flexible cystoscope at follow-up without deterioration in urinary function.

Given these considerations, the present study aims to evaluate the effectiveness of a urethral scoring system in predicting the need for complex urethroplasty in patients with urethral stricture. By correlating scoring parameters with surgical complexity, this study seeks to improve preoperative planning, enable individualized treatment strategies, and enhance overall patient outcomes.

MATERIAL AND METHODS

This prospective cross-sectional observational study was conducted in the Department of General Surgery, M.G.M. Medical College & M.Y. Hospital, Indore over a period of 1 year after obtaining approval from the Institutional Ethics Committee. Prior to enrollment, all patients provided written informed consent in their vernacular language.

A total of 60 patients aged 18–65 years, diagnosed with urethral stricture and planned for urethroplasty, were included in the study. All patients were evaluated preoperatively through detailed history, clinical examination, and relevant investigations as per institutional protocol.

Sample size was calculated using Cochran's formula based on a prevalence rate of 0.6%, with a 95% confidence interval and 2% margin of error. The calculated sample size was 57, which was adjusted for a 10% non-response rate, resulting in a final sample size of 60 patients.

Inclusion Criteria

- Age between 18–65 years
- Diagnosed cases of urethral stricture planned for urethroplasty
- Patients willing to provide informed consent

Exclusion Criteria

- Patients with untreated urethral malignancy or other conditions affecting surgical outcomes
- Patients not willing to participate
- Patients lost to follow-up

METHODOLOGY

After obtaining informed consent, patients fulfilling the inclusion criteria were enrolled in the study. Baseline data were collected using a prestructured proforma, including demographic details such as age and sex, along with clinical presentation.

All patients underwent routine preoperative investigations, including complete blood count (CBC), liver function test (LFT), renal function test (RFT), and serum electrolytes. Additional evaluation included urine analysis, uroflowmetry, retrograde urethrogram (RGU), and/or voiding cystourethrogram (VCUG) to assess stricture characteristics such as location, length, and number.

Each patient was assessed preoperatively using a urethral scoring system based on parameters including etiology, anatomical location, length, and number of strictures. Urethroplasty was performed according to standard surgical protocols, and intraoperative findings were recorded to determine surgical complexity.

The correlation between urethral scoring system parameters and the complexity of urethroplasty was analyzed. Postoperative follow-up was conducted to assess outcomes and complications.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using JAMOVI software. Continuous variables were expressed as mean \pm standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons were performed using the unpaired t-test for continuous variables and Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

The present study included **60 patients** diagnosed with urethral stricture and undergoing urethroplasty. The age of the study population ranged widely, with the majority of patients (31.7%) belonging to the **20–30 years age group**, followed by 31–40 years and >60 years (21.7% each). Very few patients (5.0%) were in the 51–60 years age group. The difference in age distribution was statistically significant ($\chi^2 = 11.0$, $p \approx 0.026$). All patients in the study were **male (100%)**, which is consistent with the known epidemiology of urethral stricture disease ($p < 0.00001$). [Table 1]

Table 1: Demographic Characteristics

Variable	Category	No.	Percentage	P Value
Age Group	20–30	19	31.7	$p \approx 0.026$
	31–40	13	21.7	
	41–50	12	20	
	51–60	03	5.0	
	>60	13	21.7	
Gender	Male	60	100	$p < 0.00001$
	Female	00	00	

With respect to etiology, the most common causes of urethral stricture were **iatrogenic (36.7%)** and **trauma (35%)**, followed by idiopathic (15%) and infection (13.3%). The variation in etiology was statistically significant ($\chi^2 \approx 10.27$, $p \approx 0.016$). The **bulbar urethra (55%)** was the most frequent site of stricture, followed by penile (21.7%), posterior (13.3%), and pan-urethral (10%), showing a highly significant distribution ($\chi^2 \approx 26.53$, $p < 0.0001$). Most patients had **single strictures (86.7%)**, while multiple strictures were less common (13.3%), which was statistically significant ($\chi^2 \approx 32.27$, $p < 0.00001$). Regarding spongiofibrosis, the majority had **moderate (43.3%) or mild (38.3%) fibrosis**, with fewer cases of severe fibrosis (18.3%) ($\chi^2 \approx 6.7$, $p \approx 0.035$). [Table 2]

Table 2: Etiology and Stricture Characteristics

Variable	Category	No.	Percentage	Chi square value	P Value
Etiology	Iatrogenic	22	36.7	$\chi^2 \approx 10.27$	$p \approx 0.016$
	Idiopathic	09	15		
	Infection	08	13.3		
	Trauma	21	35		
Stricture Location	Bulbar	33	55	$\chi^2 \approx 26.53$	$p < 0.0001$
	Pan-urethral	06	10		
	Penile	13	21.7		
	Posterior	08	13.3		
No. of Strictures	Single	52	86.7	$\chi^2 \approx 32.27$	$p < 0.00001$
	Multiple	08	13.3		
Spongiofibrosis	Mild	23	38.3	$\chi^2 \approx 6.7$	$p \approx 0.035$
	Moderate	26	43.3		
	Severe	11	18.3		

Analysis of previous interventions showed that **25% of patients had undergone prior dilatation**, while the majority (75%) were primary cases ($\chi^2 = 15$, $p \approx 0.0001$). Similarly, **16.7% had a history of previous DVIU**, and only **8.3% had undergone prior urethroplasty**, indicating that most cases were primary presentations. These findings were statistically significant ($p < 0.00001$). [Table 3]

Table 3: Previous Interventions

Variable	Category	No.	Percentage	Chi square value	P Value
Previous Dilatation	Yes	15	25	$\chi^2 = 15$	$p \approx 0.0001$
	No	45	75		
Previous DVIU	Yes	10	16.7	$\chi^2 \approx 26.67$	$p < 0.00001$
	No	50	83.3		
Previous Urethroplasty	Yes	05	8.3	$\chi^2 \approx 41.67$	$p < 0.00001$
	No	55	91.7		

Regarding operative details, **complex urethroplasty was performed in 60% of patients**, whereas 40% underwent simple procedures; however, this difference was not statistically significant ($\chi^2 = 2.4$, $p \approx 0.12$). Among surgical techniques, **buccal mucosal graft (BMG) urethroplasty (46.7%)** and **excision and primary anastomosis (EPA) (45%)** were most commonly performed, while staged procedures were less frequent (8.3%), with a statistically significant distribution ($\chi^2 \approx 15.7$, $p \approx 0.0004$). Most procedures had an operative time of **121–150 minutes (35%)**, though this variation was not statistically significant ($p \approx 0.088$). Intraoperative complications were rare, occurring in only **5% of patients**, while postoperative complications were observed in **18.3%**. Both findings were statistically significant ($p < 0.00001$). The overall success rate was **93.3%**, with only 6.7% failure, indicating excellent surgical outcomes ($\chi^2 \approx 45.07$, $p < 0.00001$). [Table 4]

Table 4: Operative Details and Outcomes

Variable	Category	No.	Percentage	Chi square value	P Value
Type of Urethroplasty	Complex	36	60	$\chi^2 = 2.4$	$p \approx 0.12$
	Simple	24	40		
Surgical Technique	BMG	28	46.7	$\chi^2 \approx 15.7$	$p \approx 0.0004$
	EPA	27	45		
	Staged	05	8.3		
Operative Time (min)	60–90	15	25	$\chi^2 \approx 6.53$	$p \approx 0.088$
	91–120	17	28.3		
	121–150	21	35		
	151–180	07	11.7		
Intra-op Complications	Yes	03	05	$\chi^2 \approx 48.6$	$p < 0.00001$
	No	57	95		
Post-op Complications	Yes	11	18.3	$\chi^2 \approx 24.07$	$p < 0.00001$
	No	49	81.7		
Outcome	Success	56	93.3	$\chi^2 \approx 45.07$	$p < 0.00001$
	Failure	04	6.7		

Descriptive statistical analysis revealed that the **mean duration of symptoms was 14.1 ± 6.24 months**, with a range of 3–23 months. The **mean stricture length was 2.39 ± 1.12 cm**, while the **average hospital stay was 5.55 ± 1.75 days**. The mean urethral scoring parameters were as follows: length score 1.77 ± 0.72 , location score 1.45 ± 0.50 , etiology score 1.85 ± 0.36 , and fibrosis score 1.80 ± 0.73 . The **mean total urethral score was 6.87 ± 1.20** , indicating a moderate disease burden in the study population. [Table 5]

Table 5: Descriptive Statistics and Urethral Score

Variable	Mean	SD	Minimum	Maximum
Duration of Symptoms (months)	14.1	6.24	3	23
Stricture Length (cm)	2.39	1.12	0.8	4.4
Hospital Stay (days)	5.55	1.75	3	8
Length Score	1.77	0.72	1	3
Location Score	1.45	0.50	1	2
Etiology Score	1.85	0.36	1	2
Fibrosis Score	1.80	0.73	1	3
Total Urethral Score	6.87	1.20	4	10

DISCUSSION

The aim of the present study was to evaluate the effectiveness of a urethral scoring system in predicting the need for complex urethroplasty in patients with urethral stricture disease. With the increasing emphasis on individualized surgical planning and improved outcomes, structured scoring systems have gained importance in objectively assessing disease severity and guiding surgical decision-making. The urethral scoring system used in this study incorporates key parameters such as etiology, location, length, and number of strictures, thereby providing a comprehensive preoperative assessment.

In the current study, all patients were male, which is consistent with the epidemiology of urethral stricture disease. The majority of patients belonged to the younger age group (20–40 years), which correlates with findings reported by Raykar et al. [7], who observed a similar age distribution with a mean age of 34.5 years. The predominance of bulbar urethral strictures (55%) in our study is also in agreement with previous literature, where the bulbar urethra is most frequently affected due to its anatomical and vascular characteristics [7].

The etiological distribution in the present study showed that iatrogenic (36.7%) and traumatic (35%) causes were the most common, together accounting for the majority of cases. This is comparable to findings by Raykar et al. [7], where traumatic strictures were predominant. The increasing incidence of iatrogenic strictures reflects the growing use of urethral instrumentation and catheterization in clinical practice. These etiological factors are clinically significant as they are often associated with longer strictures and increased spongiositis, thereby contributing to increased surgical complexity.

The most important finding of this study is the significant association between the urethral scoring system and surgical complexity. Higher scores were associated with complex urethroplasty procedures such as buccal mucosal graft (BMG) and staged repairs, whereas lower scores were associated with simpler procedures such as excision and primary anastomosis (EPA). These findings are consistent with the study by Wiegand et al. [8], who introduced the UREThRAL stricture score and demonstrated a strong correlation between increasing scores and surgical complexity.

Similarly, Eswara et al. [9] validated the U-score and reported that higher scores were significantly associated with high-complexity urethroplasty and increased operative time. Alwaal et al. [10] further supported these findings by demonstrating that higher U-scores not only predict surgical complexity but are also associated with increased recurrence rates. Mathur

et al. [11] also reported that higher urethral stricture scores correlate with more complex surgical procedures, with stricture length and location being the most influential parameters.

Tobia et al. [12] demonstrated that higher U-scores significantly increase the probability of complex urethroplasty, with high-risk groups showing up to 77.9% likelihood of complex surgery. Additionally, Kurtzman et al. [13] reported that both the LSE system and urethral stricture score are significantly associated with surgical complexity, further validating the role of structured scoring systems in clinical practice.

However, some variability exists in the literature. Chaitanya et al. [14] reported no statistically significant correlation between urethral stricture score and surgical complexity in their study. This discrepancy may be attributed to differences in study design, patient selection, or variability in surgical expertise.

The present study demonstrated a high overall success rate of 93.3%, with minimal intraoperative (5%) and postoperative complications (18.3%). These findings are comparable to previous studies, including Raykar et al. [7], who reported success rates of approximately 80% for urethroplasty. The low complication rates observed in this study highlight the importance of proper preoperative assessment and surgical planning.

Operative time was relatively longer in patients undergoing complex urethroplasty, which is consistent with findings reported by Eswara et al. [9], who demonstrated a linear relationship between U-score and operative duration. The ability of the scoring system to predict surgical complexity preoperatively allows for better preparation, including allocation of operative time and resources.

The clinical implications of this study are significant. The urethral scoring system provides an objective and reproducible method for evaluating urethral strictures, thereby improving surgical planning, optimizing resource utilization, and enhancing patient counseling. Surgeons can anticipate the complexity of the procedure and select the most appropriate surgical technique, reducing intraoperative uncertainty and improving outcomes.

Despite these promising findings, certain limitations must be considered. The study was conducted in a single tertiary care center with a relatively small sample size, which may limit the generalizability of the results. Additionally, long-term follow-up was not included, preventing assessment of recurrence rates. Variability in surgical expertise and lack of incorporation of advanced imaging modalities may also influence outcomes.

Further multicentric studies with larger sample sizes and long-term follow-up are required to validate the predictive accuracy of urethral scoring systems. Incorporation of imaging modalities such as urethral ultrasonography or MRI, along with patient-specific factors, may further enhance the predictive value. Prospective studies evaluating score-based surgical planning may help establish this scoring system as a standard tool in the management of urethral stricture disease.

CONCLUSION

Urethral stricture disease requires precise preoperative evaluation to ensure optimal surgical outcomes. A structured urethral scoring system provides an objective method to assess stricture characteristics and predict the need for complex urethroplasty. Higher scores correlate with increased surgical complexity, facilitating better planning, appropriate selection of surgical technique, and improved patient counseling. The observed high success rates and low complication profile reinforce its clinical applicability. Such scoring systems can enhance decision-making and resource utilization in routine practice. Further large-scale, multicentric studies with long-term follow-up are recommended to validate its predictive accuracy and establish its role in standard clinical protocols.

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