

Evaluation of End-to-End Anastomotic Urethroplasty in Patients with Post-Traumatic Posterior Urethral Strictures

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ABSTRACT

Objective: To determine the success rate and postoperative complications of end-to-end anastomotic urethroplasty (EEUP) in patients with post-traumatic posterior urethral stricture.

Study Design: Prospective observational study.

Place and Duration of Study: Department of Urology, Armed Forces Institute of Urology, Rawalpindi, Pakistan from Oct 2025 to Mar 2026.

Methodology: Forty-seven patients aged 18-60 years with confirmed post-traumatic posterior urethral stricture were enrolled by consecutive non-probability sampling. Patients with neurogenic bladder, bladder diverticulae, benign prostatic enlargement causing bladder outlet obstruction, active perineal disease or refusal to participate were excluded. All patients underwent EEUP. Surgical success and postoperative complications were assessed clinically and radiologically/endoscopically according to the departmental protocol. Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 25.

Results: The mean age was 35.2±10.1 years. Most patients were male, 45 (95.7%), and road traffic accident was the most common cause, 30 (63.8%). EEUP was successful in 41 (87.2%) patients, while failure occurred in 6 (12.8%). Postoperative complications were recorded in 10 (21.3%) patients, including wound infection in 4 (8.5%), bleeding in 3 (6.4%) and recurrent stricture in 3 (6.4%). No statistically significant association was found between surgical outcome and age group, etiology, profession or residence ($p>0.05$).

Conclusion: EEUP showed a high early success rate and acceptable complication profile in post-traumatic posterior urethral stricture. It remains a safe and effective reconstructive option when patients are selected and followed systematically.

Keywords: Pelvic Bones; Treatment Outcome; Urethral Stricture; Urethroplasty; Wounds and Injuries

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INTRODUCTION

Post-traumatic posterior urethral stricture is more than a radiological narrowing; it can keep a young patient on suprapubic diversion, repeated dilatation and delayed return to work. Urethral stricture disease has a reported prevalence of 229-627 per 100,000 males. Pelvic fractures occur at about 20 per 100,000 men and 29 per 100,000 women; urethral injury complicates 1.6-25% of pelvic fractures, and motor vehicle accidents account for 54-71% of pelvic fractures in several series.^{1,2}

International data show that delayed anastomotic urethroplasty is the standard operation for suitable pelvic-fracture urethral injuries, but results vary with defect length, fibrosis, bladder neck status, previous manipulation and surgeon experience. Multicenter and high-volume series report good patency, although

recurrence and functional outcomes remain important concerns.³⁻⁵

Regional evidence from South Asia also supports anastomotic repair, with a northern Indian tertiary center reporting 93.1% success after primary deferred repair and 86.3% after redo repair. Southeast Asian data show higher resticture risk in posterior traumatic strictures than in anterior strictures after end-to-end repair.^{6,7} In Pakistan, urethral stricture disease contributes 4-5% of urological workload; a review of 5,021 patients found road-traffic trauma to be a major cause, particularly in younger men.⁸ Local studies have reported 71.8% to 79.9% success in posterior distraction defects and 79.9% long-term success after pelvic-fracture urethral injury repair, but follow-up methods and outcome definitions differ from study to study.^{9,10} These differences leave a practical gap for local tertiary-care units: patients are counselled using mixed international and local data, while local complication patterns are still incompletely described. In the present study, success was

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operationally defined as urethral patency without the need for a secondary procedure during the 3-month follow-up period. The present study was therefore conducted to measure EEUP success and early postoperative complications in patients with post-traumatic posterior urethral stricture at AFIU Rawalpindi, where such data are directly available for patient management.

METHODOLOGY

This prospective observational study was conducted in the Department of Urology, Armed Forces Institute of Urology, Rawalpindi, for a duration of six months after approval of the synopsis by the College of Physicians and Surgeons Pakistan and the institutional ethics committee. Ethical Review Committee approval number Uro-Trg-1/IRB/2025/27 was obtained on 30 July 2025. The sample size was calculated using the OpenEpi calculator by taking an anticipated EEUP success rate of 87.5%, absolute precision of 9.5% and confidence level of 95%, which yielded a sample size of 47 patients. The precision was selected to keep the confidence interval clinically acceptable while remaining feasible for the approved six-month single-centre study.

Inclusion Criteria: Patients aged 18-60 years with radiologically and/or endoscopically confirmed post-traumatic posterior urethral stricture who were planned for delayed end-to-end anastomotic urethroplasty and consented to participate were included.

Exclusion Criteria: Patients with neurogenic bladder, bladder diverticulae, benign prostatic enlargement causing bladder outlet obstruction, active perineal disease or infection, and those unwilling to participate were excluded.

Consecutive non-probability sampling was used. Written informed consent was obtained from all participants after explaining the purpose, benefits and possible risks of surgery and data use. The patient enrollment and analysis pathway is presented in Figure.

Baseline demographic and clinical information was recorded on a predesigned proforma, including age, gender, etiology of trauma, profession and area of residence. Preoperative evaluation included history, physical examination, routine urinalysis, complete blood count, renal function tests and appropriate urethral imaging according to departmental practice. Patients confirmed to have post-traumatic posterior

urethral stricture underwent EEUP under spinal or regional anesthesia in the lithotomy position.

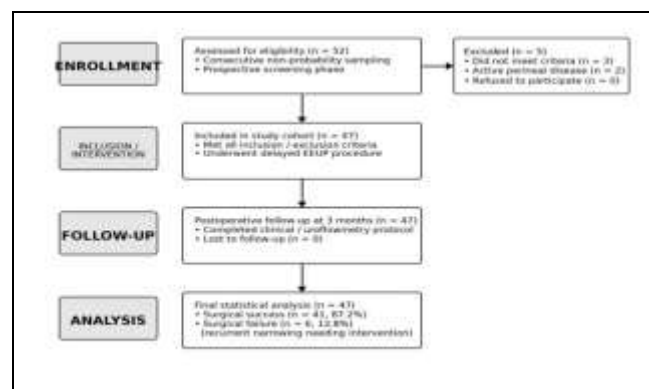


Figure: Patient Flow Diagram

A midline perineal incision was made and dissection was deepened to expose the bulbar urethra. The strictured segment was identified with the help of a metal bougie where required. The fibrotic segment was mobilized and excised up to healthy urethral ends. Spatulation was performed at both ends and a tension-free mucosa-to-mucosa anastomosis was fashioned using interrupted sutures with PDS 4/0. Hemostasis was secured and wound closure was performed in layers. Postoperative care, catheter kept for 14 days and antibiotic use followed departmental protocol.

Surgical success was defined as satisfactory voiding (UFM performed with Qmax >15 ml/sec) with urethral patency and no need for catheterization, urethral dilation, direct visual internal urethrotomy, redo urethroplasty or suprapubic diversion during the predefined follow-up period of 3 months. Assessment was based on clinical voiding status, physical examination and uroflowmetry, with radiologic or endoscopic confirmation where clinically indicated. Failure was defined as recurrent narrowing requiring dilation, direct visual internal urethrotomy, redo urethroplasty, persistent suprapubic diversion or radiologic/endoscopic evidence of resticture. Postoperative complications, including wound infection, bleeding, recurrent stricture, urinary incontinence and erectile dysfunction, were documented.

Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 25. Age was the only quantitative variable and its normality was assessed using the Shapiro-Wilk test. Age was normally distributed and therefore summarized as

mean±standard deviation. Categorical variables, including gender, etiology, profession, residence, surgical outcome and postoperative complications, were summarized as frequencies and percentages; normality testing was not applicable to these variables. Effect modifiers, including age group, etiology, profession and residence, were controlled through stratification. Post-stratification Chi-square test or Fisher's exact test was applied where appropriate. The p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 47 patients with post-traumatic posterior urethral stricture were enrolled and completed the study. There was no loss to follow-up during the study period. The mean age was 35.2 ± 10.1 years, with a range of 18-60 years. The Shapiro-Wilk test showed normal distribution of age ($p=0.21$). Baseline demographic and clinical characteristics are summarized in Table-I. Table-II showed the surgical outcome and postoperative complications.

Table-I: Baseline demographic and clinical characteristics (n=47)

Variable	n (%) / Mean±SD
Age (years), mean±SD	35.2±10.1
Age Groups	
18-30 years	18 (38.3%)
31-45 years	21 (44.7%)
46-60 years	8 (17.0%)
Gender	
Male	45 (95.7%)
Female	2 (4.3%)
Etiology	
Road Traffic Accident	30 (63.8%)
Fall from Height	11 (23.4%)
Others	6 (12.8%)
Profession	
Laborer	16 (34.0%)
Office Worker	12 (25.5%)
Farmer	10 (21.3%)
Others	9 (19.1%)
Residence	
Urban	27 (57.4%)
Rural	20 (42.6%)

Table-II: Surgical outcome and postoperative complications (n=47)

Variable	n (%)
Surgical Outcome	
Successful	41(87.2%)
Failure	6(12.8%)
Postoperative Complications	
None	37(78.7%)
Wound Infection	4(8.5%)
Bleeding	3(6.4%)
Recurrent Stricture	3(6.4%)

Stratified analysis did not show a statistically significant association between surgical outcome and

age group ($p=0.38$), etiology ($p=0.49$), profession ($p=0.57$) or residence ($p=0.40$), as shown in Table-III. Fisher's exact test was used where expected cell counts were less than five.

Table-III: Association of surgical outcome with selected variables (n=47)

Parameters	Study Groups		p-value
	Surgical Outcome: Successful (n=41)	Surgical Outcome: Failure (n=6)	
Age Group n(%)			0.375
• 18-30 years	16 (34.0%)	2 (4.3%)	
• 31-45 years	17 (36.2%)	4 (8.5%)	
• 46-60 years	8 (17.0%)	0 (0.0%)	0.491
Etiology n(%)			
• Fall from Height	10 (21.3%)	1 (2.1%)	
• Others	6 (12.8%)	0 (0.0%)	0.569
• Road Traffic Accident	25 (53.2%)	5 (10.6%)	
Profession n(%)			0.403
• Farmer	8 (17.0%)	2 (4.3%)	
• Laborer	15 (31.9%)	1 (2.1%)	
• Office Worker	11 (23.4%)	1 (2.1%)	0.403
• Others	7 (14.9%)	2 (4.3%)	
Residence n(%)			
• Urban	25 (53.2%)	2 (4.3%)	
• Rural	16 (34.0%)	4 (8.5%)	

Note: Chi-square tests were used to assess the association of surgical outcome with age group, etiology, profession and residence. Fisher's exact test was applied where any cell had an expected count of less than 5. McNemar's test was not applicable because there were no paired (pre- and post-) measurements on the same patients.

DISCUSSION

The present study showed that EEUP achieved successful urethral patency in 87.2% of patients with post-traumatic posterior urethral stricture, with failure in 12.8%. The observed failures were most likely related to recurrent narrowing during follow-up, which may occur due to local fibrosis, tension at the anastomosis or tissue ischemia. Current trauma-focused reviews emphasize early diagnosis, urinary diversion where needed and delayed reconstruction after tissue stabilization.¹¹ The observed outcome is comparable with major posterior urethroplasty series and local reports, including the long University of California experience and Pakistani institutional data.^{4,6,9,10,12}

Road traffic accident was the leading cause of injury in the present cohort, accounting for nearly two-thirds of cases. This pattern agrees with broader pelvic fracture literature and with Pakistani epidemiology, where trauma related to road traffic accidents remains a dominant contributor to anterior and posterior urethral strictures in younger men.^{2,8} The predominance of males and economically active age groups also highlights the wider impact on work, family income and quality of life.

The complication profile was acceptable. Wound infection was the commonest postoperative

complication, followed by bleeding and recurrent stricture. These complications had a limited early impact on overall outcome because most patients maintained urethral patency and did not require a secondary procedure during the 3-month follow-up period. No statistically significant association was seen between surgical outcome and age group, etiology, profession or residence. This may reflect the limited sample size and the low number of failures. Previous studies have shown that prior urethral manipulation, surgical complexity, distraction-defect length and tissue quality may influence outcome more strongly than baseline demographic variables.^{4,13,14}

Operative strategy for pelvic-fracture urethral injury continues to evolve. Progressive perineal reconstruction is designed to stop at the least morbid step that gives a tension-free anastomosis, while selected complex cases may require inferior pubectomy, rerouting or substitution.^{5,15} Bulbar artery-sparing repair has also been described to preserve urethral vascularity in suitable patients, although its use depends on anatomy, fibrosis and surgical expertise.¹⁶

The current study adds short-term local institutional evidence, but it does not replace longer follow-up. Pediatric and adult series show that delayed perineal or anastomotic repair can provide durable patency, yet recurrence and patient-reported outcomes may appear after the early postoperative period.^{17,18} Future local studies should therefore include uroflowmetry values, validated symptom scores, sexual function, continence assessment and patient-reported quality of life.

Complex posterior urethral injuries may need individualized planning. Recent literature on pelvic fracture urethral injury associated with urethrectal fistula shows that fistula, rectal wall weakness and bladder neck issues can change the operative plan and complication risk.^{19,20} Although such complex fistulating injuries were not the focus of the present cohort, these reports support careful preoperative imaging and structured documentation of defect length, bladder neck status, previous manipulation and associated injuries.

This study has limitations. It was conducted at a single tertiary care center with a small sample size and a short follow-up interval. Longer surveillance may identify late recurrence not captured within three months. Functional outcomes such as objective postoperative maximum flow rate, validated lower

urinary tract symptom scores, sexual function and patient satisfaction were not fully reported. Multicenter prospective studies with standardized definitions and longer follow-up are needed to define predictors of success and recurrence in the local population.

CONCLUSION

End-to-end anastomotic urethroplasty demonstrated high early success with mostly minor postoperative complications in patients with post-traumatic posterior urethral stricture. No significant association was observed between surgical outcome and age group, etiology, profession or residence. EEUP is a safe short-term reconstructive option after appropriate patient selection, operative planning and follow-up.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

IK & HSK: Data acquisition, data analysis, critical review, approval of the final version to be published.

YH & MH: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AAQ & M: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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