

INCIDENCE OF URETHRAL STRICTURE FOLLOWING BIPOLAR TRANSURETHRAL RESECTION OF PROSTATE

INAMULLAH S*, KHAN F

Department of Urology, Lady Reading Hospital Peshawar KPK, Pakistan

*Correspondence author email address: Dr.syednamullah@hotmail.com

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Abstract: Benign prostatic hyperplasia (BPH) is a prevalent condition among older men, often treated with transurethral resection of the prostate (TURP). Bipolar TURP (B-TURP) has gained popularity due to its reduced risk of complications compared to monopolar TURP. However, postoperative urethral stricture remains a significant concern. **Objective:** This study aims to evaluate the incidence and risk factors associated with urethral stricture following B-TURP in a cohort of patients from a tertiary care center at the Urology Department, Lady Reading Hospital Peshawar KPK, Pakistan. **Methods:** This prospective study analyzed 136 patients who underwent B-TURP. Patient demographics, clinical parameters, perioperative details, and postoperative complications were recorded. Statistical analyses were performed to identify factors significantly associated with urethral stricture development. **Results:** The incidence of urethral stricture was 5.9%. A smaller metal caliber was significantly associated with stricture formation (mean caliber 25 Fr in patients with strictures vs. 28 Fr without; $P = 0.001$). Other factors such as prostate volume, diabetes mellitus, resectoscope sheath size, resection time, capsular perforation, and perioperative complications did not show a significant correlation with stricture development. **Conclusion:** Urethral stricture following B-TURP is relatively uncommon, with meatal caliber being an important predictor of risk. These findings align with recent literature, highlighting the importance of preoperative and perioperative factors in managing and mitigating the risk of strictures. Further, multi-center studies are needed to validate these results and explore additional preventive measures.

Keywords: Benign prostatic hyperplasia, Bipolar transurethral resection of the prostate, Urethral stricture, Meatal caliber, Risk factors, Postoperative complications.

Introduction

Benign prostatic hyperplasia (BPH) is one of the most common urological conditions affecting older men, characterized by the enlargement of the prostate gland, which leads to obstructive and irritative lower urinary tract symptoms (LUTS) (1). The standard treatment for moderate to severe BPH unresponsive to medical therapy has been transurethral resection of the prostate (TURP) (2, 3). In recent years, bipolar TURP (B-TURP) has emerged as a viable alternative to the traditional monopolar TURP, offering potential advantages such as reduced risk of TUR syndrome, decreased blood loss, and shorter hospital stays. (4, 5).

Despite these benefits, B-TURP is not without complications. One of the notable postoperative complications is urethral stricture, which can significantly impact the patient's quality of life by causing recurrent urinary symptoms and necessitating further interventions. (6, 7). The incidence of urethral stricture following B-TURP varies across studies, with reported rates ranging from 2% to 9% (8, 9). Identifying the risk factors associated with developing urethral strictures is crucial for improving patient outcomes and guiding clinical practice.

This study evaluates the incidence and risk factors associated with urethral stricture formation following B-TURP in a cohort of patients treated at a tertiary care center in Pakistan. By examining demographic, clinical, and perioperative parameters, this study seeks to identify significant predictors of urethral stricture development. Additionally, the study aims to compare its findings with the

existing literature from the past five years, thereby contextualizing its results within the broader framework of contemporary urological research.

Understanding these risk factors will enhance not only preoperative patient counseling and risk stratification but also inform surgical techniques and postoperative care strategies to minimize the incidence of this complication. This research ultimately aims to contribute to the optimization of B-TURP outcomes and the overall management of patients with BPH.

Methodology

This prospective observational study was conducted on patients with symptomatic benign prostatic enlargement (BPE) who underwent bipolar transurethral resection of the prostate (B-TURP) at the Urology Department, Lady Reading Hospital Peshawar KPK, Pakistan, from April 2023 to March 2024. The study received approval from the institutional ethical and scientific committee, and informed consent was obtained from all patients before their surgical intervention.

The study included patients with symptomatic BPE. The exclusion criteria were bladder stones, Penile lichen sclerosis, Previous endoscopic interventions, History of urethral stricture, and Patients using a catheter before B-TURP.

Patient demographics, clinical examination findings, and International Prostate Symptom Score (IPSS) were documented. Laboratory tests included hemoglobin, serum

creatinine, serum electrolytes, urinalysis, urine culture, and prostate-specific antigen levels. All patients underwent uroflowmetry to determine peak flow rate (Q-max) and ultrasound to measure post-void residual (PVR) urine volume. Prostate volume was assessed using transrectal ultrasonography with the ellipsoidal formula by an experienced radiologist.

B-TURP was performed under regional anesthesia with patients in the lithotomy position by experienced urologists. Cysto-urethroscopy evaluated the urethra, prostate lobe configuration, and bladder. Meatal caliber was assessed using a lubricated metal calibrating instrument. The size of the resectoscope sheath (24-Fr or 26-Fr) was chosen based on the metal caliber and prostate size, with 24-Fr sheaths used for prostates smaller than 40 cm³ and 26-Fr sheaths for larger glands, provided the meatus was sufficiently large.

Patients requiring meatotomy due to a meatus smaller than 24Fr were excluded. The TURis bipolar system (Olympus ESG-400 HF) was used in all procedures. Intraoperative parameters, including resection time and complications, were recorded, with resection time defined as the duration from the start of resection to the end of coagulation. Complications were classified using the modified Clavien classification system (CCS). A 20-Fr, 3-way urethral catheter was placed postoperatively, and bladder irrigation was continued until hematuria resolved. Prostatic tissue was sent for histopathological examination, and patients diagnosed with prostatic adenocarcinoma were excluded. The duration of catheter placement and hospital stay were recorded. Patients needing additional procedures, such as endoscopic clot evacuation, were excluded.

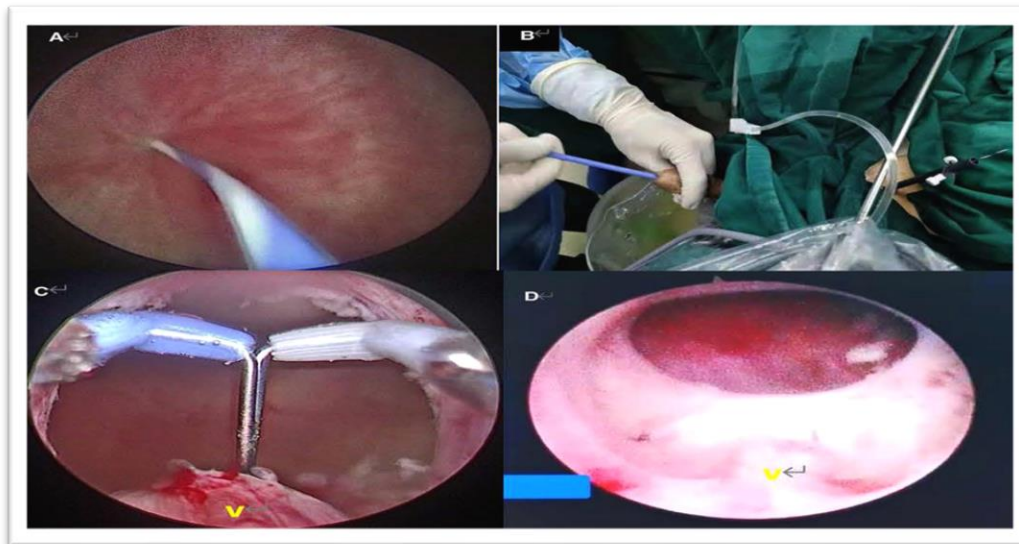


Figure 1: Intraoperative and Postoperative Images of Bipolar Transurethral Resection of the Prostate (B-TURP)

A: Intraoperative view showing the resectoscope entering the urethra. **B:** Set up continuous bladder irrigation postoperatively. **C:** Active resection of prostatic tissue using the bipolar resectoscope. **D:** The postoperative view of the prostatic fossa indicates a clear and adequately resected area.

Patients were followed up for at least six months, with evaluations at three months, six months, and one year. Postoperative outcome measures were recorded at each follow-up visit, including IPSS, Q-max, and PVR. Patients with obstructive voiding symptoms (IPSS >19) and poor flow rate (Q-max <12 mL/s) underwent retrograde urethrography (RGU) and cystourethroscopy to diagnose urethral stricture, defined as a narrowing of the urethral lumen requiring instrumentation to improve urinary flow. Data were presented as the mean and standard deviation for normally distributed variables and as the median for non-normally distributed variables. Categorical data were presented as percentages. The Chi-square and Student's t-test were used to compare categorical data and group means, respectively. Statistical significance was set at $P < 0.05$. All statistical analyses were conducted using IBM SPSS Statistics (version 25).

Results:

The study included 136 patients who underwent bipolar transurethral resection of the prostate (B-TURP). The average age of the patients was 66 years, indicating a relatively older population undergoing this procedure. The mean International Prostate Symptom Score (IPSS) was 20, reflecting the severity of urinary symptoms experienced by the patients. The average prostate volume was 60.2 cm³, and the mean post-void residual urine volume was 64.5 mL. The mean peak urinary flow rate was seven mL/s. Regarding the physical status, 37% of patients had no comorbidities (ASA I), 54.4% had diabetes, hypertension, or other conditions (ASA II), and 8.6% had more severe conditions like cerebrovascular accidents or coronary artery disease (ASA III) (Figure 2). Additionally, 25.7% of the patients were on antiplatelet therapy. The average serum creatinine level was

1.1 mg/dL, the mean hemoglobin level was 13.2 g/dL, and the mean packed cell volume was 39% (Table 1)

Table 1: Demographics and Preoperative Parameters of Patients

Parameter	Value
Age (years), mean ± SD	66 ± 8.2
IPSS, mean ± SD	20 ± 3.8
Total prostate volume (cm ³), mean ± SD	60.2 ± 30.5
PVR (mL), mean ± SD	64.5 ± 48.9
Q-max (mL/s), mean ± SD	7 ± 2.8
Physical status: ASA classification, n (%)	
ASA I (no comorbidities)	50 (37)
ASA II (diabetes/hypertension/others)	74 (54.4)
ASA III (CVA/CAD/others)	12 (8.6)
Antiplatelets, n (%)	35 (25.7)
Serum creatinine, mean ± SD	1.1 ± 0.4
Hemoglobin (g/dL), mean ± SD	13.2 ± 1.5
Packed cell volume, mean ± SD	39 ± 3.2

SD: Standard Deviation, IPSS: International Prostate Symptom Score, Q-max: Peak Urinary Flow Rate PVR: Postvoid Residue, ASA: American Society of Anesthesiologists Classification, CAD: Coronary Artery Disease, CVA: Cerebrovascular Accident

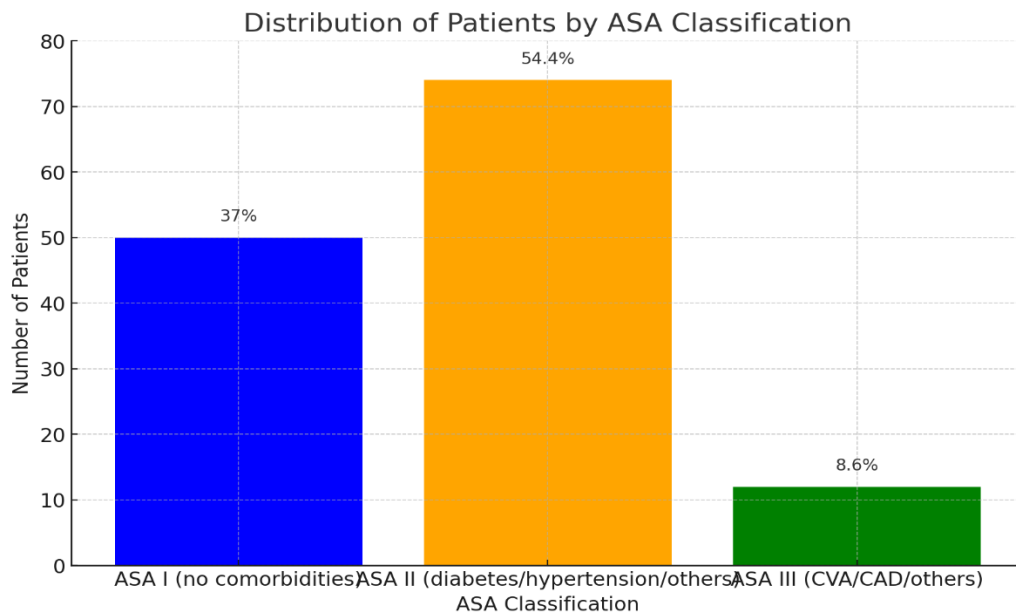


Figure 2: Distribution of Patients by ASA Classification

Perioperative parameters and complications associated with B-TURP were also recorded. The average meatal calibre was 27 French (Fr). A 24-Fr resectoscope sheath was used in 58.8% of the patients, while a 26-Fr sheath was used in 41.2%. The mean resection time was 35 minutes for the 24-Fr sheath and 62 minutes for the 26-Fr sheath. Catheter traction was applied in 44.1% of the patients, and the

average duration of catheter placement was 2.7 days. Complications were mostly minor; grade 1 complications included haematuria managed with saline irrigation (2.9%), catheter block requiring bedside catheter change or flush (2.9%), and failure to void after catheter removal (1.5%). Grade 2 complications included urinary tract infections (3.7%) and blood transfusions (1.5%) (Table 2).

Table 2: Perioperative Parameters and Complications Following Bipolar Transurethral Resection of the Prostate

Parameter	Value
Meatal caliber (Fr), mean ± SD	27 ± 2.5
Resectoscope sheath (Fr), n (%)	
24-Fr	80 (58.8)
26-Fr	56 (41.2)
Mean resection time with resectoscope sheaths (min), mean ± SD	
Resection time with 24-Fr sheath	35 ± 18.5
Resection time with 26-Fr sheath	62 ± 29

Catheter traction, n (%)	60 (44.1)
Duration of catheter placement (days), mean ± SD	2.7 ± 0.6
Complications, n (%)	
Grade 1	
Haematuria (managed with saline irrigation)	4 (2.9)
Catheter block-required bedside catheter change/flush	4 (2.9)
Failure to void after catheter removal	2 (1.5)
Grade 2	
Urinary tract infection	5 (3.7)
Blood transfusion	2 (1.5)

The correlation between various parameters and urethral stricture development was also assessed. Among the 136 patients, 8 developed urethral strictures. The incidence of stricture was not significantly different between patients with smaller (<40 cm³) and larger (>40 cm³) prostate volumes. Similarly, diabetes mellitus did not significantly correlate with the development of strictures. However, the meatal caliber was considerably smaller in patients who developed strictures, with an average caliber of 25 Fr compared to 28 Fr in patients without strictures (P = 0.001).

The size of the resectoscope sheath and the resection time did not show a significant correlation with stricture formation. Capsular perforation was observed in 12.5% of patients with strictures compared to 3.9% without, although this difference was not statistically significant. Other factors such as postoperative haematuria, catheter block requiring flush or change, catheter traction, duration of catheter removal, and postoperative urinary tract infections also did not significantly correlate with the development of strictures (Table 3).

Table 3: Correlation of Various Parameters with Stricture

Parameter	Stricture (Yes, n=8)	Stricture (No, n=128)	P-value
Total volume of prostate (cm³), n (%)			
<40	3 (37.5)	39 (30.5)	0.72*
>40	5 (62.5)	89 (69.5)	
Diabetes mellitus, n (%)	3 (37.5)	54 (42.2)	0.40*
Meatal caliber, mean ± SD	25 ± 2.2	28 ± 2.5	0.001†
Resectoscope sheath, n (%)			
24-Fr	5 (62.5)	75 (58.6)	1.20*
26-Fr	3 (37.5)	53 (41.4)	
Resection time (min), mean ± SD	44.5 ± 19.8	48.2 ± 27.3	0.78†
Capsular perforation, n (%)	1 (12.5)	5 (3.9)	0.15*
Postoperative haematuria, n (%)	1 (6.3)	6 (4.7)	0.60*
Catheter block - flush/changed, n (%)	1 (6.3)	3 (2.3)	0.35
Catheter traction, n (%)	4 (50)	58 (45.3)	0.40*
Duration of catheter removal, mean ± SD	2.8 ± 0.7	2.7 ± 0.6	0.53†
Postoperative urinary tract infections, n (%)	1 (6.3)	5 (3.9)	0.50*

*SD: Standard Deviation, Fr: French Scale, *: Assessed by Chi-square test, †: Means assessed by independent t-test (P < 0.05 was significant)*

Discussion

The study's results reveal several critical insights into the outcomes and complications associated with bipolar transurethral resection of the prostate (B-TURP) in a relatively older patient population. The average age of the patients was 66 years, with a mean IPSS of 20, indicating severe urinary symptoms. The average prostate volume and post-void residual urine volume were consistent with moderate to severe benign prostatic hyperplasia (BPH). Our study found that 37% of patients had no comorbidities (ASA I), 54.4% had diabetes, hypertension, or other conditions (ASA II), and 8.6% had more severe conditions like cerebrovascular accidents or coronary artery disease (ASA III). This distribution aligns with findings by Sugihara, T. et al who reported a similar distribution of ASA classifications in their B-TURP study cohort, with a predominant presence of ASA II patients (10) . The perioperative parameters indicated that the average meatal caliber was 27 Fr, with most procedures using a 24-Fr resectoscope sheath. The mean resection times varied

significantly between the sheath sizes, highlighting the impact of instrument size on surgical duration. A comparable study by Pirola et al. reported that larger resectoscope sheaths were associated with prolonged operative times and increased perioperative complications. (11).

The complication rates in our study were relatively low, with grade 1 complications including haematuria (2.9%) and catheter block (2.9%) and grade 2 complications such as urinary tract infections (3.7%) and blood transfusions (1.5%). These findings are consistent with those of Mbaeri et al., who reported similar rates of minor complications in their multi-center trial of B-TURP. (12).

The incidence of urethral stricture post-B-TURP was 5.9%, with a significant correlation between smaller meatal caliber and stricture development. Patients with strictures had an average meatal caliber of 25 Fr compared to 28 Fr in those without strictures. This finding aligns with the study by Elshal et al., which demonstrated that smaller meatal calibers are associated with a higher risk of urethral stricture

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following endoscopic prostate surgery. However, unlike our study, Kachrilas et al. found that resection time was also a significant factor, which we did not observe (13). Interestingly, diabetes mellitus did not significantly correlate with stricture formation in our cohort. This contrasts with the findings of Mannemet al., who reported a higher incidence of urethral stricture in diabetic patients undergoing B-TURP. The disparity may be attributed to differences in study populations and follow-up durations. (14). Furthermore, capsular perforation was more frequent in patients with strictures (12.5%) than those without (3.9%), though this difference was not statistically significant. This observation aligns with the study by Mao et al., which indicated that intraoperative complications such as capsular perforation could predispose patients to postoperative urethral strictures, even if the correlation were not strong enough to reach statistical significance. (15). Our study underscores the importance of preoperative and perioperative factors in predicting complications such as urethral strictures post-B-TURP. Specifically, meatal caliber emerged as a significant predictor, suggesting that careful selection and preparation of surgical instruments could mitigate stricture risks. Future research should focus on larger, multi-center trials to validate these findings and develop guidelines for optimizing surgical outcomes in B-TURP.

Conclusion

This study highlights that the incidence of urethral stricture following bipolar transurethral resection of the prostate (B-TURP) is 5.9%, with meatal caliber being a significant predictor of stricture formation. Smaller metal calibers were associated with a higher risk of developing strictures. Other factors, such as prostate volume, diabetes mellitus, resectoscope sheath size, resection time, capsular perforation, and perioperative complications, did not significantly correlate with stricture development.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department concerned. (IRB/LRHP-141 dated 15-08-22)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

SYED INAMULLAH (PGR)

Final Approval of version & Drafting

FAISAL KHAN (PGR)

Revisiting Critically, Data Analysis, Concept & Design of Study

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