Original Article

Incidence of urethral stricture following bipolar transurethral resection of prostate: A single-center study

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ABSTRACT

Introduction: Bipolar transurethral resection of the prostate (B-TURP) is a commonly performed procedure, although it has not yet surpassed the gold standard monopolar TURP. The incidence and contributing factors to the development of urethral stricture following B-TURP are still a matter of debate and were analyzed in the present study.

Methods: This prospective study evaluated patients who underwent B-TURP. Demographic characteristics, clinical data, and data on other specific investigations were analyzed. B-TURP was performed using an Olympus TURis bipolar system. Patients were followed up for 6 months with the International Prostate Symptom Score (IPSS), peak flow rate (Q-max), and residual urine estimation. Urethral stricture was defined as narrowing of the urethral lumen requiring instrumentation to improve the urinary flow rate.

Results: A total of 352 patients were enrolled, with a mean age of 67 ± 8.6 years. The mean preoperative IPSS, prostate volume, and Q-max were 21 ± 4, 58.8 ± 31.7 cm^3, and 8 ± 3 mL/sec, respectively. The mean meatal caliber was 28 ± 2 Fr. In 209 patients (59.4%), B-TURP was performed using a 24-Fr resectoscope, while in the remaining 143 (40.6%), a 26-Fr resectoscope was used. The mean resection times with the 24-Fr and 26-Fr resectoscopes were 36.5 ± 19.8 min and 63.5 ± 30 min, respectively. Urethral strictures were identified in 15 patients, with an incidence of 4.3%. Mean meatal caliber was significantly related to the risk of stricture formation ($P = 0.001$).

Conclusions: The incidence of urethral stricture after B-TURP was 4.3%. We found that small meatal caliber was associated with an increased risk of urethral stricture following B-TURP.

INTRODUCTION

Transurethral resection of the prostate (TURP) is considered the gold standard treatment for benign prostate enlargement (BPE). It is the commonest surgical treatment for BPE, against which all the other modalities are compared.[1] In the last decade, several modifications have been introduced to improve the safety of BPE treatment. For example, bipolar technology has been introduced into TURP. Many randomized controlled trials have evaluated the perioperative and postoperative morbidity and the outcomes of bipolar TURP (B-TURP).[2] All have found that B-TURP has a clinical efficacy similar to that of monopolar TURP (M-TURP). However, the incidence of complications such as urethral stricture and other factors associated with B-TURP are still a matter of debate.[3,4] The present study aimed to evaluate the incidence and perioperative factors associated with the development of urethral stricture following B-TURP.

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METHODS

This was a prospective observational study of patients with symptomatic BPE who underwent B-TURP at our institute between August 2018 and January 2020. We received the approval to conduct the study from our institutional ethical and scientific committee. Informed consent was obtained from all the patients before the surgical intervention. Patients with symptomatic BPE were included in the study and those with vesical calculus, penile lichen sclerosus, previous history of endoscopic intervention, history of urethral stricture, and patients on catheter prior to B-TURP were excluded. Patient demographics, clinical examination findings and the International Prostate Symptom Score (IPSS) were recorded. Laboratory investigations were performed to measure the hemoglobin, serum creatinine, serum electrolytes, urinalysis, urine culture, and prostate-specific antigen. All the patients underwent uroflowmetry (peak flow rate; Q-max) and ultrasonographic measurement of the post-void residual (PVR) urine volume. To measure the prostate volume, trans-rectal ultrasonography was performed by a single experienced radiologist using the ellipsoidal formula.[5]

Technique and equipment

The procedure was performed in the lithotomy position under regional anesthesia. All the procedures were performed by a group of seasoned urologists with vast experience in minimally invasive urological procedures. Cysto-urethroscopy was performed to assess the urethra, prostate lobe configuration, and the bladder. The meatal caliber was assessed using a lubricated meatal calibrating instrument [Figure 1]. The appropriate size of the resectoscope sheath to perform the bipolar TURP was determined based on the meatal caliber and the prostate size. For prostate glands <40 cm^3 in volume, a 24-Fr resectoscope sheath was used; for glands larger and equal to 40 cm^3, a 26-Fr sheath was used, provided the meatus was of adequate caliber. Patients in whom a 24-Fr scope was not negotiable due to the small size of the meatus (<24 Fr) were excluded from the study, as they required a meatotomy. In patients with a prostate ≥40 cm^3 in volume, if the meatal caliber was <26 Fr, the resection was performed with a 24-Fr resectoscope. The TURis bipolar system (Olympus ESG-400 HF) was used in all the patients. Intraoperative parameters, such as the resection time and the complications, were assessed. Resection time was measured starting from the resection of the first chip to the end of the coagulation. Perioperative complications were assessed using the modified Clavien classification system (CCS).[6] Following the completion of the procedure, a 20-Fr, 3-way urethral catheter was placed in all the patients. Bladder irrigation was instituted until the haematuria resolved. Traction was placed when deemed necessary and was documented. Prostatic tissue was sent for histopathological examination. All the patients, in whom the histopathological report showed prostatic adenocarcinoma, were excluded from the study. The duration of the catheter placement and the hospital stay were recorded. Patients who required auxiliary procedures such as endoscopic clot evacuation were also excluded from the study.

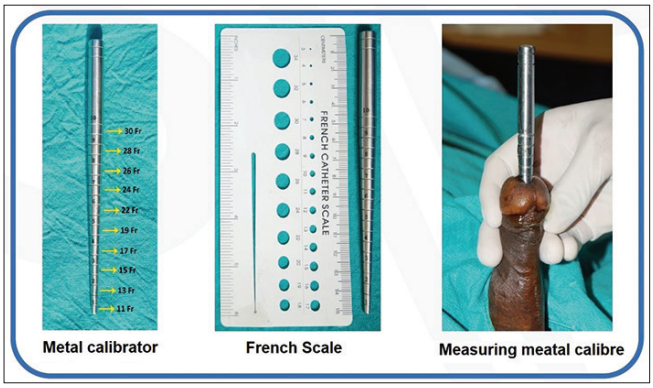

Figure 1: Technique for meatal calibration

Follow-up

Patients with a minimum follow-up period of 6 months were included in the study. Patients were followed up at 3 months, 6 months, and 1 year. Postoperative outcome measures, including IPSS, Q-max, and PVR, were recorded at each follow-up visit. Patients with obstructive voiding symptoms (IPSS >19) and poor flow rate (Q-max <12 mL/sec) underwent retrograde urethrography (RGU) and/or cystourethroscopy to diagnose the urethral stricture. Urethral stricture was defined as narrowing of the urethral lumen requiring instrumentation to improve the urinary flow rate.

Statistical analysis

Data that followed a normal distribution are presented as mean and standard deviation, while those that did not are presented as median; some categorical data are presented as percentages. The Chi-square and student *t*-tests were used to compare the categorical data and group means. Statistical significance was set at a $P < 0.05$. All calculations were performed using IBM SPSS Statistics (IBM Co., Armonk, NY, USA).

RESULTS

A total of 514 patients underwent B-TURP at our institute during the study period. Of these, 352 were included in the study and 162 were excluded [Figure 2]. The patient demographics are shown in Table 1. The mean preoperative IPSS score and Q-max were 21 ± 4 and 8 ± 3 mL/min, respectively. The mean total prostate volume was 58.8 ± 31.7 cm^3.

All the patients underwent B-TURP, and there were no conversions to open surgery. Perioperative parameters

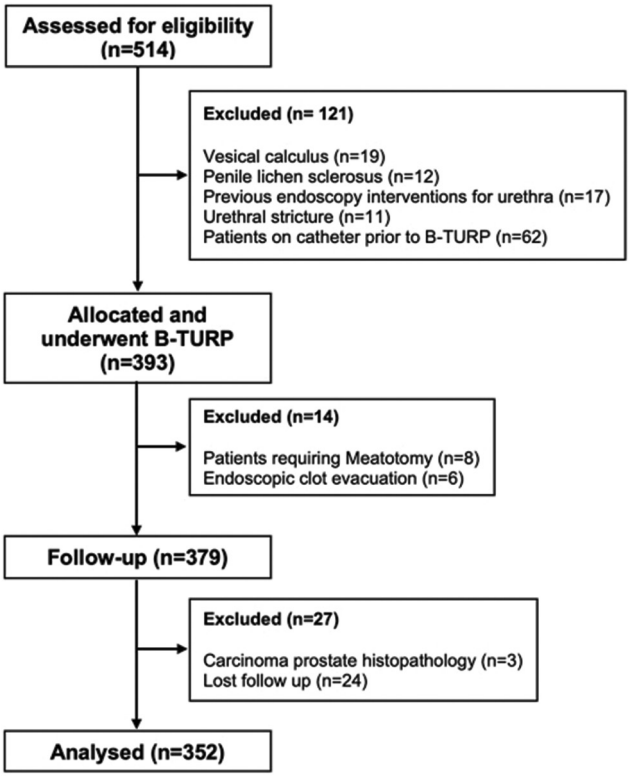

Figure 2: Enrolment, follow-up and analysis of study cohort

and complications are summarized in Table 2. The mean meatal caliber was 28 ± 2 Fr. In all the patients (n-106) with a prostate volume of ≤40 cm^3, a 24 Fr resectoscope was used. For the 246 patients with a prostate volume ≥40 cm^3, a 26-Fr resectoscope sheath was used in 143 patients and in the remaining 103 patients, a 24-Fr resectoscope sheath was used as the meatal caliber was <26 Fr. The mean prostate volumes resected with a 24Fr sheath was 44.3 ± 22 cm^3 and that with a 26Fr sheath was 80.2 ± 32 cm^3.

Perioperative complications were classified using the CCS. The most common intraoperative complication was capsular perforation and was recorded in 14 patients (3.9%). Most postoperative complications were classified as Grade 1 (30 out of 56; 53.6%) or Grade 2 (19 out of 56; 33.9%). Nine patients had catheter blockage (Grade 1) and required bedside catheter change/catheter flush [Table 2].

Traction was maintained for 6 h in the immediate postoperative period in 161 patients (45.7%). The catheter was removed after a median duration of 3 days in 201 patients (57.1%). Eight patients (2.3%) who failed to void on the day of the catheter removal were recatheterized. They were given repeat voiding trial later (mean duration of catheter removal 6.2 ± 1.7 days) and none of them developed strictures at the follow-up.

Table 1: Demographics and preoperative parameters of patients

Demographics	Values
Age (years), mean±SD	67±8.6
IPSS, mean±SD	21±4
Total prostate volume (cm^3), mean±SD	58.8±31.7
PVR (mL), mean±SD	62.4±50.7
Q-max (mL/s), mean±SD	8±3
Physical status: (ASA-classification), *n* (%)	
ASA I (no comorbidities)	127 (36)
ASA II (diabetes/hypertension/others)	195 (55.4)
ASA III (CVA/CAD/others)	30 (7.4)
Antiplatelets, *n* (%)	94 (26.7)
Serum creatinine, mean±SD	1±0.5
Haemoglobin (g/dL), mean±SD	13±1.6
Packed cell volume, mean±SD	38.7±3.5

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

Table 2: Perioperative parameters and complications following bipolar transurethral resection of the prostate

Parameters	Values
Meatal caliber (Fr), mean±SD	28±2
Resectoscope sheath (Fr), *n* (%)	
24-Fr	209 (59.4)
26-Fr	143 (40.6)
Mean resection time with resectoscope sheaths (min), mean±SD	
Resection time with 24-Fr sheath	36.5±19.8
Resection time with 26-Fr sheath	63.5±30
Catheter traction, *n* (%)	161 (45.7)
Duration of catheter placement (days), mean±SD	2.6±0.5
Complications, *n* (%)	
Grade 1	
Haematuria (managed with saline irrigation)	13 (3.7)
Catheter block-required bedside catheter change/flush	9 (2.5)
Failure to void after catheter removal	8 (2.3)
Grade 2	
Urinary tract infection	12 (3.4)
Blood transfusion	7 (1.9)

SD=Standard deviation, Fr=French Scale, CCS=Clavien classification system

The follow-up parameters, mean IPSS, mean Q-max, and mean ultrasonography PVR performed at 3 months were 8 ± 4, 20 ± 2 mL/min, and 24.9 ± 7.3 mL, respectively; at 6 months, the parameters were 8 ± 3.8, 20 ± 2.2 mL/min, and 19.2 ± 3.3 mL, respectively. These parameters correlated significantly with the baseline values ($P < 0.01$).

Urethral stricture was diagnosed in 15 patients (4.3%) with cystourethroscopy or RGU. Of these 15 patients, five (1.4%) had sub-meatal stenosis, four (1.1%) had penile urethral stricture, and six (1.7%) developed bulbar urethral strictures. The mean meatal caliber in 15 patients who developed stricture was 26 ± 2 Fr, whereas, in patients without stricture, the mean meatal caliber was 28 ± 2 Fr ($P = 0.001$).

A significant correlation between the development of urethral stricture following B-TURP and diabetes mellitus ($P = 0.36$),

prostate volume ($P = 0.77$), resectoscope sheath ($P = 1.26$), resection time ($P = 0.74$), capsular perforation ($P = 0.11$), postoperative haematuria ($P = 0.55$), catheter block-manged with flush/exchange ($P = 0.32$), catheter traction ($P = 0.36$), duration of catheter removal ($P = 0.50$), and post-operative urinary tract infections ($P = 0.46$) [Table 3] was not found.

DISCUSSION

B-TURP is an increasingly common procedure performed for the treatment of BPE as it has lower complication rates as compared to the M-TURP[1]. The reported incidence of complications in the patients undergoing B-TURP ranges from 0.5% to 11%.[7-10] The long-term postoperative complications following TURP include urethral stricture and bladder neck contracture. Our study highlighted and evaluated the incidence and the contributing factors of urethral strictures following B-TURP.

Urethral strictures are known to occur following TURP and are most commonly located in the bulbomembranous urethra, followed by the fossa navicularis and the penile urethra.[11] Over the past three decades, the risk of urethral stricture has remained stable, mostly because the TURP is performed with a large-caliber sheath which results in pressure ischemia of the bulbomembranous urethra and the narrow fossa navicularis, increasing the risk of stricture in these regions.[11]

The present study included 352 patients who underwent B-TURP and were followed up for at least 6 months. At the end of 6 months, urethral stricture was identified in 15 patients, with an incidence of 4.3%. With regards to the location of stricture in these 15 patients, five had sub-meatal stenosis, four had penile urethral stricture, and six had bulbar urethral stricture. Ho *et al*. reported a 6.3% urethral stricture rate with the TURis system.[12] Our findings correlated with those of Issa, who found a 4.7% overall risk of urethral stricture.[3]

Table 3: Correlation of various parameters with stricture

Parameters	Stricture		*P*
	Yes (*n*=15)	No (*n*=337)	
Total volume of prostate (cm^3), *n* (%)			0.77*
<40	5 (33.0)	101 (30.0)	
>40	10 (67.0)	236 (70.0)	
Diabetes mellitus, *n* (%)	5 (33.0)	140 (42.0)	0.36*
Meatal caliber, mean±SD	26±2	28±2	0.001†
Resectoscope sheath, *n* (%)			1.26*
24-Fr	11 (73)	198 (59)	
26-Fr	4 (27)	139 (41)	
Resection time (min), mean±SD	45.2±20.6	47.6±28	0.74†
Capsular perforation, *n* (%)	2 (13.0)	12 (3.5)	0.11*
Postoperative haematuria, *n* (%)	1 (6.6)	17 (5.0)	0.55*
Catheter block - flush/changed, *n* (%)	1 (6.6)	8 (2.4)	0.32
Catheter traction, *n* (%)	8 (53.3)	153 (45.4)	0.36*
Duration of catheter removal, mean±SD	2.7±0.8	2.6±0.5	0.50†
Postoperative urinary tract infections, *n* (%)	1 (6.6)	13 (3.8)	0.46*

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

We next assessed the factors associated with urethral stricture, such as prostate volume, meatal caliber, resectoscope sheath size, resection time, catheter traction time, and the duration of catheterization.

Among the patients who underwent B-TURP, Tefekli *et al*.[13] found a higher incidence of urethral stricture if a larger diameter resectoscope sheath was used. Also, a study by Komura *et al*.[14] found that longer operating times and larger prostate volumes were associated with a higher urethral stricture rate in the TURis group. However, in the present study, the urethral stricture rates did not significantly correlate with the prostate volume, resectoscope sheath size, resection time, catheter traction, or the duration of catheter placement. Several of the possible confounding factors were taken care by the well selected exclusion criteria, such as the preoperative catheterization for acute urinary retention, lichen sclerosis of the glans, prior history of urethral instrumentation, and the requirement for ventral meatotomy.

None of the previously reported studies have described a correlation between the meatal caliber and the incidence of the stricture. We found a significant correlation between the rate of urethral stricture and small meatal caliber ($P = 0.001$). The mean meatal caliber in patients who developed a stricture was smaller (26 ± 2 Fr) than in those without it (28 ± 2 Fr). Patients with a narrow meatal caliber had a higher incidence of stricture when a standard resectoscope of either 24 Fr or 26 Fr was used. Meatal caliber estimation before the procedure helps the surgeon to determine the appropriate size of the resectoscope sheath, thus avoiding the use of larger caliber instruments for TURP.

The limitations of our study were its small sample size and the short duration of the follow-up. However, most of the cases of urethral stricture occur within the first 6 months of the transurethral surgery.[15]

CONCLUSIONS

The incidence of urethral stricture after bipolar TURP with the TURis system was 4.3%. We found that small meatal caliber was associated with an increased risk of urethral stricture following B-TURP.

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