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Predictors of Urethral Stricture After Transurethral Resection of the Prostate Procedure

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Abstract

Transurethral resection of the prostate (TURP) is the most frequently used urology surgical method to manage benign prostate hyperplasia (BPH). Despite the relatively efficacious treatment, urethral stricture (US) may form after TURP. The prevalence of the urethral strictures (US) following TURP ranges from 2.2% to 9.8%. The study aimed to identify the predictors of urethral strictures in patients receiving TURP. This study was a retrospective cohort study on patients underwent TURP in Dr. Hasan Sadikin General Hospital Bandung, Indonesia, between 2015 and 2019. Data were obtained from medical records and urology registry of a minimum 12-month follow-up period. Data on patient demographics, estimated volume of the prostate, total resected prostate, and operating time were extracted. Multiple logistic regression was utilized to determine the odds ratio difference between groups. A total of 451 TURP cases were performed between 2015 and 2019, with 22 (4.87%) cases of post TURP US identified. The mean estimated prostate weight was 45.6 g and resected prostate weight was 20.4 g, with a 0.37 g/min resection rate. Prostate weight, operating time, and duration of catheterization after surgery were not significantly different statistically. Slower resection rate and smaller resected volume are the statistically significant predictors of increased occurrence of urethral stricture ($p<0.05$). Lower resection rate is also a predictor for urethral stricture after TURP procedure.

Keywords: Predictor factor, TURP, urethral stricture

Introduction

Over the years, transurethral resection of the prostate (TURP) has been the most common urology surgical technique to manage benign prostate hyperplasia (BPH). Monopolar transurethral resection of the prostate (M-TURP) is the gold standard for lower urinary tract symptoms due to benign prostatic obstruction (BPO). The TURP procedure is considered adequate, clinically and economically.[1] Tao H. et al. found that the earliest known case series in 1962 consisted of 2,015 patients receiving TURP and had a mortality rate of 2.5% compared to recent case series in the 2000s having 0.25% mortality rate with a similar number of patients.[2] Monopolar (M-TURP) and bipolar TURP (B-TURP) methods for the resections are available for use, with the latter was thought to have better safety profile compared to the former.[3] In the last decade, using normal saline irrigation, B-TURP emerged as an alternative to M-TURP with less perioperative morbidity.[1] TURP is still the primary choice due to its evident efficacy and persistent outcome in the long term.[3]

Despite being safe and effective in managing urological conditions, patients undergoing the TURP procedure were at risk of intraoperative and postoperativecomplications. Bleeding, transurethral resection syndrome, infection of the urinary tract/sepsis are the common early complications. Later, complications such as urethral stricture (US), bladder neck contracture, urinary incontinence, and retrograde ejaculation may occur. Urethral stricture reports incidence after M-TURP widely varies.[1,4-7] Rassweiler et al.[8] discovered that more extensive randomized clinical trial studies reported as many as 2.2–9.8% urethral stricture cases and 0.3–9.2% bladder neck contracture cases. A systematic review and meta-analysis by Tang and colleagues found 36 and 38 incidences of urethral strictures reported after M-TURP and B-TURP for BPH, respectively. These data resulted from eleven RCT studies or subgroups and eleven RCT researches or subgroups for the B-TURP group (948 subjects). Between M-TURP and B-TURP, no significant difference was shown from the pooled analysis in urethral stricture and contracture of bladder neck incidence.[9]

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The definitive cause of TURP related urethral stricture remains controversial. Some etiology factors include infection, mechanical trauma, extended catheter use, local anesthetic use, and electrical injury.[10] The meatus and fossa navicularis, penoscrotal junction, mid-bulbar region, and below urethral sphincter are the most prevalent location of urethral strictures related to TURP.[15] Surprisingly, the membranous urethra stricture is common after TURis.[11] Meatal stenosis in TURP usually occurs due to the unmatching size of the instrument and the urethral meatus diameter. Bulbar strictures arise because the lubricant lacks isolation, causing the monopolar current to leak.[5,6] The incidence of urethral strictures following TURP represents severe and late complications. It is also reported as the main etiology of iatrogenic urethral strictures.[1] Another factor is the lower resection speed. It has been correlated with undesirable procedure processes, including bleeding, poor vision, prolonged surgical duration, more fluid leakage/absorption, and impaired urethral mucosal; those are potential reasons for urethral stricture.[5,6] Investigation should be taken to identify various risk factors of scar formation in the urethra to decrease the occurrence of urethral stricture elicited by TURP.[12]

This study aims to identify predictor factors in developing urethral strictures in patients receiving TURP in Dr. Hasan Sadikin General Hospital Bandung, a tertiary hospital.

Methods

This study was a retrospective cohort of urethral stricture occurrence in a patient who had undergone TURP procedure in Dr. Hasan Sadikin General Hospital Bandung between 2015 and 2019. The procedure was performed in a Monopolar system with a 26 Fr continuous-flow resectoscope. The coagulation power was 80 W and the cutting power was 120 W. The irrigation fluid used was sterile water. All patients were given a lubricant gel (Cathejell) before the TURP procedure. Data of patients who had received TURP procedure in Hasan Sadikin General Hospital with 12 months follow-up period minimum were collected from the urology unit's (department) database and medical records. Incomplete or insufficient data and coexisting urethral stricture prior to surgery were excluded from the study. All of cases of urethral stricture cases were included. The presence of stricture was defined as narrowed segment of the anterior urethra (membranous or bulbosa) with urethral lumen less than 16 Fr which confirmed during urethrography or endoscopic examination.[12] Patient demographics, the estimation volume of the prostate, the total of resected prostate, operating time, resection rate, and catheter use duration following surgery were collected. The amount of prostate resected divided by the operating time was used to calculate the resection rate for each patient. The ethical clearance for this study was not required. All patients attended to Dr. Hasan Sadikin General Hospital Bandung already sign medical record disclosure consent form research purposes.

This study used IBM SPSS Statistics version 23.0 for data analysis. Data with abnormal distribution were reported as medians (interquartile range). Data comparison were carried out with the Mann-Whitney U-test. Multiple logistic regressions were carried out to determine factors associated with urethral stricture after TURP, comparing the groups. For analytical purposes, we randomly selected non-US patient as comparison with ratio 1:1 using simple random sampling method. A statistically significant result was considered in a p-value of <0.05.

Results

There were 451 patients who received TURP between 2015 and 2019 were documented. All data was taken from medical record and our Urology department patient records. No patient was considered loss to follow-up. The patient's characteristics are presented in Table 1. The mean age of these patients was 65 years old, ranging from 52 to 77 years. These subjects estimated prostate volume was varied, ranging from 30–69 g (mean volume was 46.86 g). As many as 378 patients had a history of urinary retention before undergoing surgery. The range of operation time was from 30 to 60 minutes (mean 55 minutes).

This cohort study revealed 22 cases of US after TURP procedure, therefore the rate of US incidence was 4.87%. The complication of these cases was acknowledged as Clavien- Dindo grade III. All of them had symptoms requiring management with surgery or endoscopic. Most of these patients (15 of 22, 68.2%) developed the US within 12 months after receiving the TURP, while 7 patients (31.8%) developed the US in the second year of the follow-up period. The most common sites of TURP-related urethral strictures

Table 1 Patient's Characteristics

Variables	Mean (Range)	n (%)
Age	65 (52–77)	
Estimated prostate volume (g)	46.86 (30–69)	
Operative time (min)	55 (30–60)	
Time of Development US		
12 months		15
2nd Year		7
Urethral Stricture		
Yes		22 (4.88%)
No		429 (95.12%)
Urethral stricture location		
Pendulous		2
Pendulobulbous		4
Bulbous		14
Membranous		2

Table 2 Univariate Analysis of Factors Affecting Urethral Stricture Occurrence

Variables	Stricture n = 22	No Stricture n = 22	P-value
Duration of catheterization after surgery (day)	3.00 (2.5–4.00)	2.5 (2.00–4.00)	0.523
Estimated prostate weight (g)	45.6 (35–65)	54.3 (42–69)	0.521
Operative time (min)	55 (30–60)	58 (40–60)	0.485
Prostate weight resected (g)	20.4 (12.2–30.5)	36.2 (28–40)	0.001*
Resection rate (g/min)	0.37 (0.40–0.50)	0.53 (0.46–0.56)	0.001*

*p<0.05, statistically significant difference; Data present as mean (range)

were bulbous urethra (63.6%), followed by pendulobulbous urethra, pendulous urethra, and membranous urethra (18.1%, 9.09% and 9.09%, respectively).

On univariate analysis (Table 2), resected prostate weight and resection rate were found to be significantly related to the occurrence of urethral stricture (p<0.05). In contrast, the occurrence of urethral stricture was not greatly influenced by the duration of catheterization after surgery, operative time and estimated prostate weight (p>0.05).

Multiple logistic regression analyses result shown in table 3 and discovered that resected volume weight and resection rate were associated significantly with US occurrence (p-value 0.022 and 0.042, respectively). Other variables such as duration of catheterization after surgery and estimated prostate weight volume were not significantly associated with US development (p-values>0.05).

Discussion

Transurethral resection of the prostate (TURP) is

Table 3 Analysis of the Variables Associated with the Occurrence of Urethral Stricture Using Multiple Logistic Regression

Variables	OR (95%CI)	P-Value
Duration of catheterization after surgery	0.953 (0.9–1)	0.128
Prostate volume	0.075 (0–1)	0.075
Resected volume	1.19 (1.02–1.38)	0.022*
Resection rate	0.420 (0–50.57)	0.042*

OR, odds ratio; CI, confidence interval. *p<0.05, statistically significant difference

the most well-known operative management for symptoms of lower urinary tract with a suspicion of benign prostatic obstruction (LUTS/BPO) since the 1970s.[4] TURP is still the primary treatment due to its evident efficacy and persistent outcomes in long term. TURP procedure also become a gold standard for symptomatic BPO in prostates between 30 and 80 cc.[5,7] Despite the advantages, TURP still has several complications. Complications that occur in patients who undergo TURP are urethral stricture, dysuria, and bladder neck contractures.[1,3] In our study, it was found that most patients who were included in the case group (15 of 22 patients) developed the US within 12 months after receiving the TURP. These findings are in accordance with a study conducted by Tan et al. in 2017, which reported 13 cases of US in patients receiving TURP, 61.5% of which developed within 12 months postoperation.[3]

Data from our study showed that the mean estimated prostate weight was 45,6 g. The mean operative time is 55 minutes. The mean prostate weight resection is 20.4 g, with a 0.37 gr/min resection rate. This result was similar to Tao Huang et al. research, which stated that lower resection speed was correlated with a higher risk of stricture in the urethra. Taking too much time in a resection of a small prostate gland, relatively, would be cautious.[2] Tan et al. revealed that the occurrence of urethral stricture was associated with slow resection rate, significantly. They found that the majority of strictures were at the bulbar urethra.[3] This phenomenon was thought to be caused by the TURP mechanism, which put a concentration of electrical Stream Energy to contact with the bulbar. Slow resection rate will prolong the exposure of a tremendous amount of electrical energy at that part of the urethra, resulting in a more considerable risk of thermal damage and, lastly, urethral stricture.[2,5,6] In this study, the results were in agreement with this research. It was documented that a slower resection rate was statistically significant in increasing the incidence of urethral stricture occurrence.

Aside from operation duration, another well-known risk factor for urethral stricture was the size of the resectoscopes. Previous studies revealed that an inappropriate relationship between the urethral meatus diameter and instrument diameter would cause meatus mucosa damage mechanically and then establish a stricture.[10] In China, several studies reported that many resectoscopes ordered from the West area are not adequately fit the Chinese population patients causing numbers of severe urethral mucosa damage.[1] Mamoulakis *et al*. detected the urethral mucosa was evolved at the end of the TURP Compression from the resectoscope causing the proximal bulbous urethra injury and penile urethra with several narrow rings held responsibility in stricture formation.[13] Other study from Gunes *et al*. compared the rate of urethral strictures after TURP with different resectoscope sizes discovered that a greater bulbar stricture incidence occurred in patients who underwent TURP with a 26F resectoscope than a 24F size (11.4% *vs.* 2.9%, p=0.018). Thus, the noncontinuous resectoscope shaft resulted in higher incidence of meatal stricture associated with the shaft's reciprocation in the axial.[7] According to those postulates, urethral stricture may occur due to inappropriate instrument diameters that would damage the urethral mucosa because of mechanical stress. This resulted in inflammatory and ischemic conditions.[1] In our study, we used a 26 Fr sheath continuous-flow resectoscope and the majority of strictures were located in the bulbar/bulbous urethra.

Electric current leakage can stimulate a stenosis formation. Conventional or B-TURP procedure can cause a formation of a high current urethral density that induced an electrothermal injury in the related urethral mucosa. This incidence occurs due to a short circuit formation between the metal or other parts integrated into the sheath (which is metal) and the active electrode.[1,14] Broken cutting loops, damaged insulation of the sheath, or trapped carbonized resection materials on the loop may induce a current conduction disturbance, causing contact of the resection loop and sheath directly.[14] Other than electrical power, electrothermal injury is also influenced by the lubricant gel quality and its conductivity. Lubricant with a conductivity lower than the mucosa may induce current leaks from the sheath's surface into nearby urethra with the relatively thin or totally displaced lubricant applied.[1,14,15]

It is worth noting that the study conducted by Wang et al.[1] has stated that despite the potential of life-long consequences, patients are mostly unaware of the risk from TURP-related urethral strictures. The meticulous indications of BPH surgery are the obvious and best complications preventive measures. The 20th-century technology depends on the resection or ablation of prostatic tissue using various laser or electric current energy. This usually requires an access sheath with large instrument, which

might lead to urethral trauma and subsequent stricture formation. Recently, more advanced and less invasive device technology innovations are emerged in clinical use purposely to gain smaller sheaths access and cut the procedure time. Hopefully, further functional complications prevent and the rate of urethral stricture decrease.[16] A relatively short follow-up duration limits this study. Another limitation that we recognize was multiple operators who performed the TURP surgeries. Authors also did not possess the exact data of time to stricture since several patient that further analyzed was not possible.

As conclusion, lower resection rate was the predictor factor associated with urethral stricture occurrence in the post-operative period of the TURP procedure. To reduce the stricture incidence, authors suggest reducing the time of the prostate resection, especially in a small-sized prostate.

References

1. Wang JW, Man LB. Transurethral resection of the prostate stricture management. Asian J Androl. 2020;22(2):140–4.
2. Tao H, Jiang YY, Jun Q, Ding X, Jian DL, Jie D, et al. Analysis of risk factors leading to postoperative urethral stricture and bladder neck contracture following transurethral resection of prostate. Int Braz J Urol. 2016;42(2):302–11.
3. Tan GH, Shah SA, Ali NM, Goh EH, Singam P, Ho CCK, et al. Urethral strictures after bipolar transurethral resection of prostate may be linked to slow resection rate. Investig Clin Urol. 2017;58(3):186–91.
4. Kumar BN, Srivastava A, Sinha T. Urethral stricture after bipolar transurethral resection of prostate - truth vs hype: A randomized controlled trial. Indian J Urol. 2019;35(1):41–7.
5. Chughtai B, Simma-Chiang V, Kaplan SA. Evaluation and management of post-transurethral resection of the prostate lower urinary tract symptoms. Curr Urol Rep. 2014;15(9):1–5.
6. Mayer EK, Kroeze SG, Chopra S, Bottle A, Patel A. Examining the 'gold standard': a comparative critical analysis of three consecutive decades of monopolar transurethral resection of the prostate (TURP) outcomes. BJU Int. 2012;110(11):1595–601.
7. Günes M, Keles MO, Kaya C, Koca O, Sertkaya Z, Akyüz M, et al. Does resectoscope size play a role in formation of urethral stricture following transurethral prostate resection?. International Braz J Urol. 2015;41:744–9.
8. Rassweiler J, Teber D, Kuntz R, Hofmann R. Complications of transurethral resectionof the prostate(TURP) – incidence, management, and prevention. Eur Urol 2006;50:969–79.
9. Tang Y, Li J, Pu C, Bai Y, Yuan H, Wei Q, et al. Bipolar transurethral resection versus monopolar transurethral resection for benign prostatic hypertrophy: a systematic review and meta-analysis. J Endourol. 2014;28(9):1107–14.
10. Tian Y, Wazir R, Yue X, Wang KJ, Li H. Prevention of stricture recurrence following urethral endoscopic management: what do we have?. J Endourol. 2014;28(5):502–8.
11. Komura K, Inamoto T, Takai T, Uchimoto T, Saito K, et al. Incidence of urethral stricture after bipolar transurethral resection of the prostate using TURis: results from a randomized trial. BJU Int. 2015;115:644–52.
12. Adi K, Alhajeri F, Satyagraha P. World changing scenario of urethral stricture management. In: Martins FE, Kulkarni SB, Köhler TS, editors. Textbook of male genitourethral reconstruction. Cham: Springer; 2020. p. 33–43.
13. Mamoulakis C, Skolarikos A, Schulze M, Scoffone CM, Rassweiler JJ, Alivizatos G, et al. Results from an international multicentre double-blind randomized controlled trial on the perioperative efficacy and safety of bipolar vs monopolar transurethral resection of the prostate. BJU Int. 2012;109(2):240–8.
14. Mamoulakis C, Schulze M, Skolarikos A, Alivizatos G, Scarpa RM, Rassweiler JJ, et al. Midterm results from an international multicentre randomised controlled trial comparing bipolar with monopolar transurethral resection of the prostate. Eur Urol. 2013;63(4):667–76.
15. Alhajeri F, Alwaal A, Soebadi MA. Etiology, epidemiology, demographic differences in urethral strictures: a worldwide perspective. In: Martins FE, Kulkarni SB, Köhler TS, editors. Textbook of male genitourethral reconstruction. Cham: Springer; 2020. p. 25–32.
16. Pham H, Sharma P. Emerging, newly-approved treatments for lower urinary tract symptoms secondary to benign prostatic hypertrophy. Can J Urol. 2018;25:9228–37.