JOURNAL OF CLINICAL MEDICINE OF KAZAKHSTAN (E-ISSN 2313-1519)
Original Article DOI: https://doi.org/10.23950/jcmk/12690

The factors affecting occurrence of urethral stricture after transurethral resection of the prostate

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Received: 2022-10-11.
Accepted: 2022-11-18

J Clin Med Kaz 2022; 19(6):68-72

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Abstract

Objectives: Urethral stricture is one of the complex subjects of urology in terms of high recurrence rates, patient care, treatment difficulties and follow-up. We aimed to evaluate factors associated with the occurrence of urethral stricture after TUR-P (Transurethral resection of the prostate) surgery.

Material and methods: In our clinic, 301 patients who underwent TUR-P surgery for benign prostatic hyperplasia (BPH) were analyzed retrospectively. The patients who developed urethral stricture after TUR-P were named Group-1, did not develop were named Group-2. In addition, the patients were compared in terms of demographic and perioperative data.

Results: Urethral stricture was observed in 21 (6.97%) of the patients and not in 280 (93.03%) of them. There was no significant difference between the two groups in terms of age (p=0.913), resectoscope size (p=0.932), energy source type (p=0.932), energy source power (p=0.838), urethral catheter type (p=0.776), urethral catheter size (p=0.973), urethral catheter duration (p=0.797) and urethral catheter traction (p=0.887). Resection time was significantly higher in patients with urethral stricture (53.1±10.8 min vs. 42.2±9.7 min, p<0.001). The preoperative urinary tract infection (UTI) rate was significantly higher in patients with urethral stricture. (76.2% vs 40.0%, p=0.001). The optimum cut-off value for resection time associated with the risk of urethral stricture after TUR-P was 38.5 minutes, with an AUC of 0.812 (95% CI 0.738–0.885).

Conclusion: Prolonged resection time and even if treated, preoperative UTI increases the risk of urethral stricture after TUR-P surgery. However, if the resection time is not long, patients are more protected from developing urethral stricture.

Key words: TUR-P, urethral stricture, internal urethrotomy, prostate

Introduction

Guthrie first used transurethral resection (TUR) in urological surgeries in 1834. It has been developed and applied since the 1930s [1]. Currently, it is the gold standard method in staging and treatment of bladder tumors, treating benign prostatic hyperplasia (BPH), and relieving obstruction in advanced prostate cancer [2].

Urethral stricture is one of the complicated subjects of urology in terms of high recurrence rates, patient care, treatment difficulties and follow-up. Its etiology mainly includes iatrogenic causes and external traumas. The incidence of urethral stricture as a late complication of TUR is up to 9.8 % in studies [3]. Some studies have examined the factors that may cause urethral stricture after TUR [4]. However, the pathogenesis of stricture has not been clearly clarified.

In the current study, we aimed to investigate the urethral stricture seen after TUR-P surgeries performed in our clinic and the factors that may cause it.

Material and methods

Totally 301 patients who underwent TUR-P operation for BPH were analyzed. The patients were divided into two groups according to the occurrence of urethral stricture after TUR-P. The patients with urethral strictures were determined as Group 1, and those without urethral strictures were determined as Group 2. In addition, the patients were analyzed in terms of age, location of the stricture, the diameter of the resectoscope used during TUR-P, resection time, power and type of energy source used, urethral catheter duration, whether or not catheter traction was performed at the end of the operation and preoperative urinary tract infection (UTI).

TUR-P procedure was performed with 24 fr (Karl Storz) and 26 fr (Gyrus Acme) resectoscope sheaths. The conventional energy source was used in patients with 24 fr resectoscope sheath, and the plasmakinetic energy source was used in patients with 26 fr resectoscope sheath. Patients who were found to have urethral stricture during TUR-P were excluded from the study. Therefore, urethral dilatation was not performed in any patients before the procedure. Cathegell (12.5 g 2% lidocaine hydrochloride and 0.05 g chlorhexidine hydrochloride) was applied transurethrally before the resectoscope sheath was advanced from the penis. During the TUR-P procedure, 5% mannitol (resectisol) was used in patients who used a 24fr resectoscope as irrigation fluid, and saline (0.9% sodium chloride) was used in those who used a 26fr resectoscope sheath. After the procedure, an 18,20,22 fr latex or silicone Foley catheter was used. The TUR-P procedure was performed after the patients with preoperative UTI were treated with the appropriate antibiotic according to the urine culture.

Uroflowmetry was performed on patients who had complaints about postoperative urine flow rates. The patients with a curved pattern of stricture were evaluated with a 16 fr cystoscope under anesthesia. The patients with urethral stricture performed the Sachse model cold incision optic internal urethrotome developed by Karl Storz. 12 o'clock was chosen as the primary incision direction to avoid corpus cavernosum injury. All scar tissue visible to the proximal part of the stricture was excised entirely to the free connective tissue. Internal urethrotomy was performed under the guidance of a 3 fr ureteral catheter in cases with severe narrowness and multiple lumens.

Statistical analysis

Statistical analyzes were performed using SPSS Statistics software version 26.0 (IBM, Armonk, NY, USA). Categorical variables were stated as numbers and percentages. Continuous variables were expressed as means, standard deviations, medians and interquartile ranges according to the normality of the distribution. Comparison of continuous variables was done with Student's T-test/Mann-Whitney U tests. Categorical variables were compared with Chi-square and Fisher's exact tests. Spearman correlation analysis was used to define the association between urethral stricture and perioperative parameters. Receiver operator characteristics (ROC) curve analysis was applied to define optimum thresholds via area under the curve (AUC). The optimum threshold value for the resection time for urethral stricture was determined by the Youden Index on the ROC curves. P-value <0.05 was defined as statistical significance.

Results

The urethral stricture was observed in 21 (6.97%) patients who underwent TUR-P, and it was not observed in 280 (93.03%) of them. The mean age were 70.9±7.8 years in Group 1 and 70.6±7.4 years in Group 2 (p=0.913). There was no significant difference between the two groups in terms of resectoscope size (p=0.932), energy source type (p=0.932), energy source power (p=0.838), urethral catheter type (p=0.776), urethral catheter size (p=0.973), urethral catheter duration (p=0.797) and urethral catheter traction (p=0.887) (Table 1).

Table 1 Demographic and per-operative data of patients according to urethral stricture status

	Group 1 (n=21)	Group 2 (n=280)	P value
Age (years), mean±SD	70.9±7.8	70.6±7.4	0.913
Resection time (minutes), mean±SD	53.1±10.8	42.2±9.7	**<0.001**
Resectoscope size, n (%) 24F 26F	5 (23.8) 16 (76.2)	69 (24.6) 211 (75.4)	0.932
Energy source type, n (%) Conventional Plasmakinetics	5 (23.8) 16 (76.2)	69 (24.6) 211 (75.4)	0.932
Energy source power, n (%) <150 watt >150 watt	8 (38.1) 13 (61.9)	113 (40.4) 167 (59.6)	0.838
Urethral catheter type, n (%) Latex Silicon	16 (76.2) 5 (23.8)	205 (73.2) 75 (26.8)	0.776
Urethral catheter size, n (%) 18F 20F 22F	5 (23.8) 13 (61.9) 3 (14.3)	64 (22.9) 180 (64.3) 36 (12.9)	0.973
Urethral catheter duration (days), mean±SD	4.6±1.6	4.4±1.6	0.797
Urethral catheter traction, n (%)	15 (71.4)	204 (72.9)	0.887
Preoperative UTI, n (%)	16 (76.2)	112 (40.0)	**0.001**

Figure 1 - Number of urethral strictures according to preoperative UTI

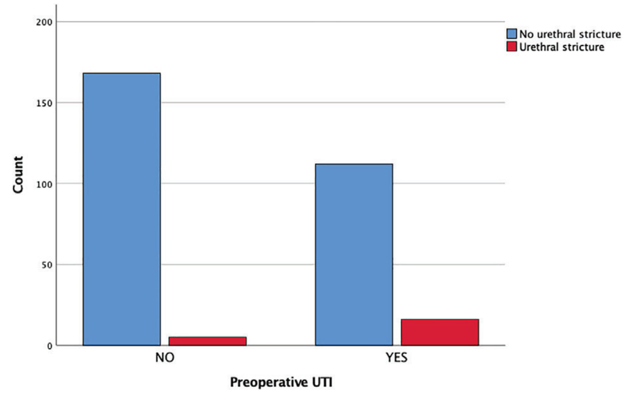

Table 2 Spearman correlation analysis between the urethral stricture and per-operative parameters

Characteristics	Urethral stricture	
	rho value	P value
Age	0.001	0.987
Resection time	0.297	**<0.001**
Resectoscope size	0.005	0.932
Energy source type	0.005	0.932
Energy source power	0.012	0.839
Urethral catheter type	-0.017	0.767
Urethral catheter size	0.001	0.981
Urethral catheter time	0.045	0.434
Urethral catheter traction	-0.008	0.888
Preoperative UTI	0.186	**0.001**

The resection time were significantly higher in patients with urethral stricture (53.1±10.8 min vs. 42.2±9.7 min, p<0.001). Similarly, the preoperative UTI rate was significantly higher in patients with urethral stricture. (76.2% vs 40.0%, p=0.001) (Figure 1). In Spearman correlation analysis, both resection time (rho: 0.297, p<0.001) and preoperative UTI (rho: 0.186, p=0.001) had a positive and significant relationship with the urethral stricture occurrence (Table 2). ROC curve analysis was performed to determine the optimum cut-off value for resection time associated with the risk of urethral stricture after TUR-P. It was assigned 38.5 minutes, with an AUC of 0.812 (95% CI 0.738–0.885). The highest sensitivity and specificity were 0.857 and 0.626, p<0.001 (Figure 2).

Figure 2 - Receiver operating characteristic (ROC) curve analysis of the resection time for urethral stricture

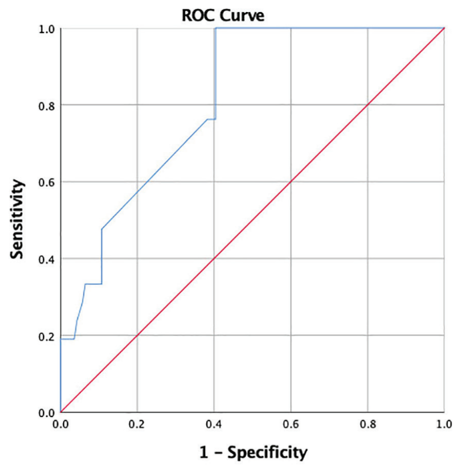

Table 3 Number of patients according to urethral stricture localization

Urethral stricture localisation	N (%)
Bulbous	12 (57.1)
Membranous	6 (28.5)
Penile	3 (14.2)

The urethral stricture was observed in the bulbar, membranous and penile urethra in 12 (57.1%), 6 (28.5%) and 3 (14.2%) patients, respectively (Table 3).

Discussion

The incidence of urethral stricture after TUR-P is similar to previous years, despite improvements in surgical techniques, technology, and lubricants. For example, Tan GH et al. found a urethral stricture rate of 3.5% in long-term follow-up of 373 patients who underwent TUR-P surgery [5]. Similarly, Afandiyev F. et al. found the rate of urethral stricures after TURP as 10.5% in their study of 124 patients who were followed up [6]. In addition to these two previous studies, Grechenkov A. et al. reported the rate of urethral stricture as 8.6% in their current study with 402 patients who underwent bipolar TUR-P [7]. In our research, the urethral stricture rate after TUR-P was 6.9 %, consistent with the literature.

Previously, the most common cause of urethral stricture was urethritis caused by sexually transmitted diseases [8]. In contrast, nowadays, reasons such as TUR, cystoscopy, urethral catheterization, prostatectomy, brachytherapy and hypospadias surgery come to the fore [9].

While complications such as bleeding, bladder perforation, prostate capsule perforation, TUR syndrome and intraoperative priapism can be seen in the early period after TUR-P, complications such as bladder neck contracture and urethral stricture may occur in the long term [10,11]. Urethral stricture can be defined as scar formation in the urethral mucosa and surrounding tissues. Any procedure that may cause trauma to the urethra can result in urethral stricture. It is thought that the friction of the penoscrotal angle in the bulbous urethra with the resectoscope sheath during the TUR-P procedure, especially at the first entry and during the subsequent operation, causes mucosal damage, urine leakage into the submucosal area, and eventually scar tissue formation and thus urethral stricture formation. Applying sufficient lubricant to the urethra and resectoscope sheath before TUR-P will reduce friction between the urethra and the resectoscope sheath. In the studies conducted by V.Mauermayer, it has been reported that the lubricant used during the TUR procedure makes the electrical leakage from the resectoscope more conductive. If the electrical permeability of the lubricant used is less than the permeability of the urethral tissue around the resectoscope shaft, electricity enters the generator correctly from the neutral plate. Otherwise, an electric current passes through the urethra to the body at the point of electric leakage and causes stricture [12]. When the resectoscope sheath is advanced in the penis, especially during the passage through the bulbous urethra, under direct observation and sufficient lubricant will reduce the development of urethral stricture.

Studies show that the risk of developing urethral stricture increases as the resection time increases during the TUR-P procedure [13,14]. Our research observed that the risk of urethral stricture increased as the resection time increased. Since prolonging the resection time will increase the risk of urethral trauma, not keeping the resection long, especially in patients with large prostate volume, completing the TUR procedure in more than one session, if possible, will protect the patients from the development of urethral stricture.

In the study performed by Balbay et al. on 103 patients in 1992, it was reported that the rate of urethral stricture development after TUR increased as the patient's age increased [15]. However, in our study, no relationship was found between the age of the patient and the development of urethral stricture.

Although it was reported that there is a significant relationship between the diameter of the resectoscope and the development of stricture according to the studies performed by Tefekli et al. [16], no association was found between the diameter of the resectoscope and the development of urethral stricture in our research.

In some studies, it has been reported that the diameter of the catheter used after the operation, the type of catheter and the length of the catheter stay affect the development of stricture [17,18]. However, in our study, no relationship was found between these factors and stricture development.

According to the studies of Zaid UB et al., it was reported that the presence of UTI before TUR increases the risk of developing urethral stricture [19]. Similar results were obtained in a recent study conducted in 2017 [20]. In our study, 128 patients had preoperative UTIs, and 16 of them (12.5%) developed urethral stricture after TUR-P. In our study, the presence of preoperative UTI caused stricture development at a high rate, although it was treated with appropriate antibiotics according to the urine culture. Due to the development of multiple resistance to drugs in diabetic patients, more attention should be paid to UTI [21].

It has been reported that high energy use during TUR increases the risk of urethral stricture [22]. However, in our study, no relationship was found between the power of the energy source and the development of urethral stricture. Likewise, in our study, no association was found between the application of catheter traction at the end of the operation and the development of stricture.

Treatment of urethral stricture varies according to the location, length and shape. The most commonly used technique in surgical treatment today is the cold incision endoscopic internal urethrotomy technique applied by Hans Sachse [23]. In addition, urethral dilatation and Holmium-YAG laser applications are also included [24-26]. Our study treated patients who developed urethral stricture with endoscopic internal urethrotomy.

Study limitations

Our study was limited because it was performed in a single center and retrospectively. Therefore, multicentre, more comprehensive and prospective studies are needed to verify our findings.

In conclusion, despite technological advances, urethral strictures are still high after TUR-P. Therefore, even if preoperative UTI is treated, it should be considered that it increases the risk of stricture formation. However, in the TUR-P procedure, if the resectoscope is made with sufficient lubricant and under direct observation, care is taken to avoid electrical leakage from the resectoscope, and the resection time is not kept too long, patients will be more protected from the risk of developing urethral stricture.

Disclosures: There is no conflict of interest for all authors.

Acknowledgements: None.

Funding: None.

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