TÜBİTAK

Turkish Journal of Medical Sciences

http://journals.tubitak.gov.tr/medical/

Research Article

Turk J Med Sci
(2017) 47: 1543-1548
© TÜBİTAK
doi:10.3906/sag-1701-36

Analysis of recurrent urethral strictures due to iatrogenic urethral trauma

Fuat KIZILAY*, Adnan ŞİMŞİR, Ceyhun ÖZYURT
Department of Urology, Faculty of Medicine, Ege University, İzmir, Turkey

Received: 06.01.2017 • **Accepted/Published Online:** 12.06.2017 • **Final Version:** 13.11.2017

Background/aim: We aimed to analyze the effects of stricture location, etiology, age, and catheterization time on recurrence rate and recurrence time in patients who underwent direct vision internal urethrotomy (DVIU) for urethral strictures.

Materials and methods: Patients were divided into three groups according to the location of the stricture: penile urethra, membranous urethra, and prostatic urethra strictures. Patients were also divided into three groups according to etiologic factors: strictures secondary to endoscopic procedures, urethral catheterization, and open or radical prostatectomy (anastomotic strictures were included in this group). Patients were also divided into three groups according to catheterization time: <2, 2–5, and >5–7 days. Recurrence rate and time data were analyzed according to stricture location, etiology, age, and catheterization time.

Results: The recurrence rate was significantly higher in endoscopic procedures. Recurrence rate was significantly lower and recurrence time was significantly earlier in penile urethral strictures. Recurrence rate was significantly lower and recurrence time was significantly longer in short catheterized group than in the other two groups. However, first recurrence time was not different between the groups, while second and multiple recurrence times were significantly earlier in patients <60 years old.

Conclusion: Patients are exposed to multiple operations as a result of frequently recurring urethral strictures. Although DVIU is an important first-line treatment method for strictures, alternative methods should be considered for frequently recurring cases.

Key words: Male, urethra, urethral stricture

1. Introduction

In males, urethral stricture disease is the most common cause of obstructed voiding symptoms (1). Iatrogenic injury due to urological instrumentation is the most common etiology for urethral stricture (e.g., oversized resectoscope for transurethral resection or indwelling catheters) (2). The length, location, and severity of the stricture are identified by pretreatment evaluation and available treatment options include urethral dilation, direct vision internal urethrotomy (DVIU), urethral stent placement, open urethroplasty, and urinary diversion (1). One single treatment option is not appropriate for all stricture types.

Treatment indications for urethral stricture are severe voiding symptoms, acute urinary retention, bladder stones, recurrent urinary tract infection, or high postvoid residual urine volume. The treatment approach to urethral strictures depends upon the etiology, location, and length of the strictures. It is well known that the most commonly used methods for the treatment of urethral stricture are urethral dilation and DVIU (3). In this retrospective study we aimed to analyze the effects of stricture location, etiology, age, and catheterization time on recurrence rate and time in patients who underwent DVIU for urethral strictures shorter than 2 cm due to iatrogenic causes.

2. Materials and methods

This retrospective study was conducted in the urology clinic of a tertiary university hospital with a yearly admission of 120,000 patients. Patients included within the scope of this study were admitted to the hospital between January 2011 and December 2015. The study was performed in compliance with the Declaration of Helsinki.

2.1. Patient selection

A total of 224 patients were included in the study; patients were admitted to the urology outpatient with urethral stricture disease diagnosed with uroflowmetry and retrograde urethrography. Thirty-nine patients had no recurrence, 98 had only one recurrence, 74 had two recurrences, and 13 had more than two recurrences. Patients with urethral stricture due to infection or accidental urethral trauma were excluded from the study.

* Correspondence: fuatkizilay@gmail.com

Patients were divided into three groups according to the location of the stricture: penile urethra (L1) (n = 109), membranous urethra (L2) (n = 70), and prostatic urethra (L3) (n = 45). Patients were also divided into three groups according to etiologic causes: strictures secondary to endoscopic procedures (E1) (n = 122), strictures due to urethral catheterization (E2) (n = 71), and strictures after open and radical prostatectomy (E3) (n = 31). Those with anastomotic stenosis were added to the third group (E3). Age groups were formed as patients younger than 60 years (A1) (n = 22), patients between 60–69 years (A2) (n = 38), and patients older than 69 years (A3) (n = 164). Patients were divided into three groups according to catheterization time as <2 (C1, n = 80), 2–5 (C2, n = 91), and >5–7 (C3, n = 53) days. Patients were analyzed in terms of recurrence rate and time according to stricture location, etiology, age, and catheterization time.

2.2. Operative technique

Urethrotomy was performed under regional or general anesthesia. Sterile urine was obtained from all patients preoperatively and intravenous infusion of 1 g of cefazolin was given both prior to the induction of anesthesia and 12 h after the operation. A 21-Fr urethrotome (Karl Storz, Germany) was inserted through the external meatus and a 3-Fr ureteral stent was passed through the narrowed stricture area. The stricture site was incised at the 12 o'clock position by a cold-knife urethrotome. An indwelling urethral catheter with a diameter of 16, 18, or 20 Fr was inserted after the procedure. The catheterization duration was 1–7 days (mean: 2.28). An informed consent form was requested from patients prior to the operation. Catheter diameter and catheterization time were determined according to the surgeon's foresight. The use of thick catheters and long catheterization period were avoided, but catheterization time was extended if the surgeon predicted the stricture to recur in a short time.

2.3. Data collection

Medical histories of patients, symptoms, and demographics were accessed through the patient files. Recurrence rates and times stored in the patient files were collected.

2.4. Outcome measures

The primary outcome of the study is the recurrence rates and recurrence times of patients who underwent DVIU. The secondary outcome is the relationship between recurrence rate and time and the stricture location, etiology, age, and catheterization time.

2.5. Statistical analysis

Pearson correlation analysis, Shapiro–Wilk tests, Kruskal–Wallis tests, and Kolmogorov–Smirnov tests were used for the analysis of variables. Variables that had P-values of less than 0.05 in correlation analyses was included in the multivariate analysis. A two-tailed P-value of less than 0.05 was considered to be statistically significant. All analyses were performed using SPSS 21.0 for Macintosh IBM Corp., Armonk, NY, USA).

3. Results

DVIU was performed in 224 male patients for urethral strictures caused by iatrogenic reasons in the past five years. The ages of the patients ranged from 17 to 95 years (mean: 68.21). Demographic data of the patients are shown in Table 1, and comorbidities and medications of patients according to age groups are shown in Table 2. Strictures occurred secondary to endoscopic procedures in 122 patients, urethral catheterization in 71 patients, and open or radical prostatectomy in 31 patients. Strictures were located in the penile urethra in 109 patients, in membranous urethra in 70 patients, and in prostatic urethra in 45 patients. Fourteen patients were ≤59, 38 patients were between 60 and 69, and 164 patients were ≥70 years old. Catheterization times were <2 days for 80 patients, 2–5 days for 91 patients, and >5–7 days for 53 patients.

Stricture did not recur in 39 patients, while it recurred once in 98 patients, twice in 74 patients, and more than twice in 13 patients after DVIU. First recurrence time ranged between 14 and 1030 days (mean: 233.4). First recurrence occurred within 120 days in 22 patients (9.82%); 33.03% of the patients (n = 74) had a second recurrence in 1155 days of follow-up period and 5.80% of patients (n = 13) had more than two recurrences (mean: 3.46). Stricture was most frequently detected 120 days after the operation in the second recurrence, as in the first recurrence. Mean recurrence time was 48.74 days for more than two recurrences. It was significantly earlier than first and second recurrence times (P = 0.0023).

Recurrence rate was significantly higher in group E1 (P = 0.0013). Although first and second recurrence times were found to be 224 and 218 days for E1, 196 and 203 days for E2, and 233 and 221 days for E3, there was no significant difference between these intervals (P = 0.428). More than two recurrence times were significantly earlier in group E1 than in the other two groups (P = 0.0018). Table 3 shows recurrence details according to etiologic factors.

Table 1. Demographic data of patients.

Characteristics	Mean	Min–max
Age	68.213	17–95
Weight (kg)	78.235	56.8–96.5
Height (cm)	172.8	145.2–198
BMI	26.64	22.53–31.86

Table 2. Comorbidities and medications of the patients according to age groups.

Age groups	≤59 (A1)	60–69 (A2)	≥70 (A3)
Diabetes mellitus	2	9	26
CAD	1	7	18
COPD	1	6	18
Rheumatic diseases	-	3	14
Hypertension	8	16	41
Medication			
Insulin	1	6	11
Oral antidiabetic	1	5	16
Steroids	-	2	11
Erectile dysfunction	4	17	43
Chronic constipation	4	8	24
Radiotherapy	-	3	15
Pelvic surgery	-	3	11

CAD, Coronary artery disease; COPD, chronic obstructive pulmonary disease.

Recurrence rate was significantly lower for L1 strictures (24.35%) (P = 0.0039). The rate was 57.85% for L2 strictures and 62.33% for L3 strictures. Recurrence time was earliest for penile urethral strictures for first, second, and multiple recurrences (P = 0.026). Recurrence details in terms of stricture location are summarized in Table 4.

There was no significant difference in recurrence rates between the age groups. However, while first recurrence time was not different between groups, second and multiple recurrence times were significantly earlier in groups A1 and A2 than in A3 (P = 0.012 and P = 0.026, respectively). Table 5 summarizes recurrence details in terms of age groups.

Recurrence rate was significantly lower (P = 0.0043) and recurrence time was longer in the short catheterized group (C1) (P = 0.0027) than in the other two groups (C2 and C3). Recurrence details in terms of catheterization time are detailed in Table 6.

4. Discussion

Male urethral stricture is a challenge for urologists from time immemorial (4). There is no single procedure for all strictures and multiple techniques may be used in the same patient for recurrent strictures.

DVIU is widely available, safe, and quick. It can be performed safely in a single-day setting using a penile block or with local, spinal, or general anesthesia in an ambulatory setting. However, long-term success rates are poor, but better for strictures <1 cm, midbulbar-located strictures, and those with at least 5 mm of preserved lumen. Commonly, the results are not permanent and the stricture may recur in a short time, and many patients will progress to surgical repair (5). DVIU was first performed in 1974 to treat urethral strictures by cold-knife incision (6). Urethral dilation and DVIU are regarded as initial treatment options for most urethral strictures (4). Recurrence rates following endoscopic treatment of urethral strictures range from 30% to 80% (7,8). The variability of reported recurrence rates is wide due to the patient population's heterogeneity. There is no minimally invasive technique proven superior to any other.

In their study, Steenkamp et al. found that urethral dilation demonstrated equivalent long-term success rates for short (<2 cm) urethral strictures with urethrotomy (9). We treated urethral strictures using urethrotomy only, and all strictures were shorter than 2 cm. Although recurrence rates are high with endoscopic methods, they are widely available, quick, and safe. Pansadoro et al. suggested that the success of initial treatment of urethral strictures using endoscopic treatment (urethrotomy) depends upon stricture length, degree, and location (8). Minimally invasive therapies were more successful in strictures of <1 cm in length (7,10). Strictures of <1 cm had a recurrence rate of 27% compared with 50% for those ≥1 cm in length in one study (7).

Urethral anatomy in the male is important because stricture location designates the management. Patients suffering from urethral stricture consult a urologist for a variety of reasons that include acute urinary retention, obstructive voiding symptoms, recurrent urinary tract

Table 3. Recurrence details according to etiologic factors.

Etiology	N	Recurrence rate (%)	P-value[a]	First recurrence time (days)	Second recurrence time (days)	P-value[a]	Third recurrence time (days)	P-value[a]
Endoscopic procedure (E1)	122	54.21		224	218		319	
Urethral catheterization (E2)	71	26.46	0.0013	196	203	0.428	421	0.0018
Open or radical prostatectomy (E3)	31	11.78		233	221		462	

[a] Independent samples Kruskal–Wallis test. P < 0.05 is statistically significant.

Table 4. Recurrence details according to stricture location.

Location	N	Recurrence rate (%)	P-value[a]	Overall recurrence time (day)	P-value[a]
Penile urethra (L1)	109	24.35	0.0039	187	0.0026
Membranous urethra (L2)	70	57.85		283	
Prostatic urethra (L3)	45	62.33		315	

[a]Independent samples Kruskal–Wallis test. P < 0.05 is statistically significant.

Table 5. Recurrence details in age groups.

Age	N	Recurrence rate (%)	P-value[a]	First recurrence time (days)	P-value[a]	Second recurrence time (days)	P-value[b]	Third recurrence time (days)	P-value[b]
≤59 (A1)	22	24.35	0.0039	211	0.648	12	0.012	53	0.026
60–69 (A2)	38	57.85		189		32		87	
≥70 (A3)	164	62.33		226		43		102	

[a] Spearman's rho. P < 0.05 is statistically significant.
[b] Independent samples Kruskal–Wallis test. P < 0.05 is statistically significant.

Table 6. Recurrence details according to catheterization time.

Catheterization time (days)	N	Recurrence rate (%)	P-value[a]	Overall recurrence time (days)	P-value[a]
<2	80	12.85	0.0043	386	0.0027
2–5	91	34.25		217	
>5–7	53	58.75		149	

[a] Independent samples Kruskal–Wallis test. P < 0.05 is statistically significant.

infection, or, more rarely, hydronephrosis, urethral fistula, or periurethral abscess. In a study, 214 men were queried and the most common complaints were obstructive symptoms (49%) and incomplete bladder emptying (27%) (11). In a retrospective review of 224 patients who underwent DVIU, patients had the best outcomes with bulbar strictures with a luminal diameter of >5 mm (8). Midbulbar urethral strictures present the best outcomes when treated with dilation, incision, or ablation with laser. The corpus spongiosum is voluminous in the bulbar urethra, which decreases scarring. The outcome of DVIU is most likely to be successful in this segment of the urethra. Strictures of the pendulous urethra or strictures associated with spongiofibrosis recur more frequently (12). In our study patients were divided into three groups according to stricture location in the penile urethra, membranous urethra, or prostatic urethra. The lowest recurrence rate was seen in penile urethra strictures; on the other hand, recurrence time was earliest for penile urethral strictures.

The effect of etiologic factors on recurrence rates has not been investigated in previous studies. Recurrence rate was significantly higher in patients who underwent endoscopic procedures. In addition, more than two recurrence times were significantly earlier in the same group of patients than in the other two groups. The effect of age on recurrence rates of urethral strictures also has not been investigated previously. We found that urethral strictures tend to recur earlier in patients <60 years.

Our findings show that stricture is a very frequently recurring condition no matter in which location. Recurrences usually occur within the first 120 days after DVIU. There is no difference between the time of the first and second recurrence; it is not possible to say that a second DVIU protects the patient from recurrence for a longer time. The time to second recurrence after DVIU is earlier in patients under the age of 60. Time to recurrence

is longer in patients over the age of 60. Penile urethral strictures recur less, but time to recurrence is shorter.

We did not come across a study that revealed a relationship between the duration of catheterization and stricture recurrence after urethrotomy. In our study, the recurrence rate was significantly lower and recurrence time was significantly longer in the short catheterized group.

Some urologists argue that an initial urethrotomy is not cost-effective or beneficial in the long-term care of these patients due to high recurrence rates (10,13,14). Urethrotomy is beneficial, especially in select patients (short, midbulbar strictures), and there is a general consensus that only one endoscopic procedure should be utilized prior to open surgical repair (15). An initial urethrotomy is feasible and cost-effective and should be utilized in the initial treatment algorithm for urethral stricture disease (16–18). Self-catheterization may be used after urethrotomy by providing urethral lumen patency. However, it should be kept in mind that the stricture may recur after ending the catheterization (9). Some patients may be treated with periodic Benique bougie dilations. It may be curative for patients with isolated epithelial stricture (without the corpus spongiosum). In a recent study, 31 patients with anterior urethral strictures underwent high-pressure balloon dilation; the authors concluded that it was safe and effective and can be considered as an alternative treatment for anterior urethral strictures (19). It should be considered that multiple endoscopic treatments may reduce success rates of open surgery and cause a more difficult surgical repair (20–22).

In conclusion, DVIU is the most commonly used treatment alternative for urethral strictures worldwide. Despite frequent recurrences, the easiness to perform it and the inexpensiveness of this method make it useful for the treatment of uncomplicated strictures. Catheter diameter and catheterization length should be kept to a minimum to prevent or reduce the risk of recurrence.

References

1. Wong SS, Aboumarzouk OM, Narahari R, O'Riordan A, Pickard R. Simple urethral dilatation, endoscopic urethrotomy, and urethroplasty for urethral stricture disease in adult men. Cochrane Db Syst Rev 2012; 12: CD006934.
2. Lumen N, Hoebeke P, Willemsen P, De Troyer B, Pieters R, Oosterlinck W. Etiology of urethral stricture disease in the 21st century. J Urology 2009; 182: 983-987.
3. Bullock TL, Brandes SB. Adult anterior urethral strictures: a national practice patterns survey of board certified urologists in the United States. J Urology 2007; 177: 685-690.
4. Buckley JC, Heyns C, Gilling P, Carney J. SIU/ICUD Consultation on Urethral Strictures: dilation, internal urethrotomy, and stenting of male anterior urethral strictures. Urology 2014; 83: 18-22.
5. Barbagli G, Palminteri E, Lazzeri M, Guazzoni G, Turini D. Long-term outcome of urethroplasty after failed urethrotomy versus primary repair. J Urology 2001; 165: 1918-1919.
6. Sachse H. Treatment of urethral stricture: transurethral slit in view using sharp section. Fortschr Med 1974; 92: 12-15.
7. Albers P, Fichtner J, Bruhl P, Muller SC. Long-term results of internal urethrotomy. J Urology 1996; 156: 1611-1614.
8. Pansadoro V, Emiliozzi P. Internal urethrotomy in the management of anterior urethral strictures: long-term followup. J Urology 1996; 156: 73-75.
9. Steenkamp J, Heyns C, De Kock M. Internal urethrotomy versus dilation as treatment for male urethral strictures: a prospective, randomized comparison. J Urology 1997; 157: 98-101.
10. Rourke KF, Jordan GH. Primary urethral reconstruction: the cost minimized approach to the bulbous urethral stricture. J Urology 2005; 173: 1206-1210.
11. Nuss GR, Granieri MA, Zhao LC, Thum DJ, Gonzalez CM. Presenting symptoms of anterior urethral stricture disease: a disease specific, patient reported questionnaire to measure outcomes. J Urology 2012; 187: 559-562.
12. Stone AR, Randall J, Shorrock K, Peeling W, Rose M, Stephenson T. Optical urethrotomy — a 3–year experience. Brit J Urol 1983; 55: 701-704.
13. Anger JT, Buckley JC, Santucci RA, Elliott SP, Saigal CS, Urologic Diseases in America Project. Trends in stricture management among male Medicare beneficiaries: underuse of urethroplasty? Urology 2011; 77: 481-485.
14. Morey A. Urethral stricture is now an open surgical disease. J Urology 2009; 181: 953-954.
15. Heyns C, Steenkamp J, De Kock M, Whitaker P. Treatment of male urethral strictures: is repeated dilation or internal urethrotomy useful? J Urology 1998; 160: 356-358.
16. Wright JL, Wessells H, Nathens AB, Hollingworth W. What is the most cost-effective treatment for 1 to 2-cm bulbar urethral strictures: societal approach using decision analysis. Urology 2006; 67: 889-893.
17. Greenwell T, Castle C, Andrich D, MacDonald J, Nicol D, Mundy A. Repeat urethrotomy and dilation for the treatment of urethral stricture are neither clinically effective nor cost-effective. J Urology 2004; 172: 275-277.
18. Wessells H. Cost-effective approach to short bulbar urethral strictures supports single internal urethrotomy before urethroplasty. J Urology 2009; 181: 954-955.
19. Yu SC, Wu HY, Wang W, Xu LW, Ding GQ, Zhang ZG, Li GH. High-pressure balloon dilation for male anterior urethral stricture: single-center experience. J Zhejiang Univ-Sc B 2016; 17: 722-727.

20. Roehrborn CG, McConnell JD. Analysis of factors contributing to success or failure of 1-stage urethroplasty for urethral stricture disease. J Urology 1994; 151: 869-874.

21. Singh BP, Andankar MG, Swain SK, Das K, Dassi V, Kaswan HK, Agrawal V, Pathak HR. Impact of prior urethral manipulation on outcome of anastomotic urethroplasty for post-traumatic urethral stricture. Urology 2010; 75: 179-182.

22. Breyer BN, McAninch JW, Whitson JM, Eisenberg ML, Mehdizadeh JF, Myers JB, Voelzke BB. Multivariate analysis of risk factors for long-term urethroplasty outcome. J Urology 2010; 183: 613-617.