0022-5347/96/1565-1611$03.00/0
THE JOURNAL OF UROLOGY
Copyright © 1996 by AMERICAN UROLOGICAL ASSOCIATION, INC.

Vol. 156, 1611–1614, November 1996
Printed in U.S.A.

LONG-TERM RESULTS OF INTERNAL URETHROTOMY

PETER ALBERS, JAN FICHTNER, PETER BRÜHL AND STEFAN C. MÜLLER

From the Departments of Urology, Bonn University Medical Center, Bonn, and Mainz University Medical Center, Mainz, Germany

ABSTRACT

Purpose: A retrospective analysis was done of long-term results of internal urethrotomy to evaluate risk factors of stricture recurrence.

Materials and Methods: Followup studies were performed of 937 patients with urethral strictures treated with internal urethrotomy. Of the patients 357 were treated at Mainz University between 1977 and 1989 (mean followup 4.6 years) and 580 were treated at Bonn University between 1974 and 1986 (mean followup 3.2 years).

Results: Strictures recurred in 96 of 357 (26.9%) and 260 of 580 (44.8%) patients, respectively. Risk factors for recurrence were etiology (post-transurethral resection and inflammation), stricture longer than 1 cm. and postoperative catheter drainage for longer than 3 days.

Conclusions: Urethroplasty should be considered in patients at high risk for stricture recurrence and with more than 1 treatment failure after urethrotomy.

KEY WORDS: urethra, risk factors, urethral stricture, follow-up studies

The natural history of urethral stricture usually begins with a lesion of the urethral mucosa and infection followed by a scar. Iatrogenic (so-called post-transurethral resection), inflammatory (particularly from long-term use of transurethral catheters) and traumatic strictures, and those without a known etiology (so-called idiopathic) are the main types of urethral strictures in men. In contrast to the well-known pathogenesis, the indications for various treatments are not precisely defined possibly due to the lack of studies on long-term followup of different operations. We report the long-term results of internal urethrotomy for urethral strictures with respect to location, etiology, length and other stricture parameters to identify risk factors for an unfavorable outcome. Our findings should help physicians to tailor treatment options individually according to the stricture characteristics, and define the role of internal urethrotomy in the treatment of urethral strictures.

PATIENTS AND METHODS

Of our patients with urethral strictures primary internal urethrotomy was performed in 512 at Mainz University between 1977 and 1989 (group 1) and 696 at Bonn University between 1974 and 1986 (group 2). In 357 (73%) and 580 (83%) patients, respectively, data on primary stricture characteristics, treatment and followup visits were available by reviewing the local computer data base and patient charts. Mean followup was 4.6 years (range 9 months to 16 years) in group 1 and 3.2 years (range 4 to 42 months) in group 2. Mean patient age was 58 (range 14 to 84) and 55 (range 25 to 74) years, respectively. Primary as well as recurrent strictures were defined by urinary flow rates (peak flow less than 15 ml. per second) and clinical symptoms. In group 2 data were available on retrograde urethrography, which was performed in all patients to determine location and length of the stricture preoperatively and at the time of stricture recurrence, defined as the need for re-treatment because of low urinary flow rates (peak flow less than 15 ml. per second) and clinical symptoms.

Therapeutically, all patients underwent an identical endoscopic procedure.[1] The urethral stricture was incised under vision to a urethral lumen of at least 24F at the 12 o'clock position using a sharp cold knife attached to an endoscope (outer diameter 20F). After urethrotomy an indwelling catheter was left in place. Of 357 patients in group 1, 66 performed clean intermittent catheterization as adjuvant treatment for an average of 17 months.

The study combined 2 different patient cohorts at different institutions using the same technique to compare treatment regarding stricture recurrence rates in patients with identical etiologies, treatment complications and duration of postoperative catheter drainage. Furthermore, diagnostic evaluation during followup differed, and data on recurrence rates regarding stricture length, location and followup interval were available only for group 2. However, data on postoperative adjuvant clean intermittent catheterization were available only in group 1. Thus, combination of the groups made it possible to analyze treatment results retrospectively and identify etiological risk factors for stricture recurrence in a significant number of patients. Statements concerning the influence of certain stricture characteristics, such as length, location and adjuvant treatment, on stricture recurrence were available by subgroup analysis.

The 2-tailed Student t test was used to compare different patient cohorts. Differences were significant at $p < 0.05$.

RESULTS

Recurrence rate and number of repeat procedures. Of 357 patients in group 1, 96 (26.9%) had a recurrent stricture after primary urethrotomy: 57 (16.0%) underwent a second urethrotomy and 39 (10.9%) required more than 2 urethrotomies or open reconstructive urethroplasty for cure. The recurrence rate in group 2 was 44.8% (260 of 580 patients): 201 (34.6%) needed a second urethrotomy and 59 (10.2%) required more than 2 urethrotomies or urethroplasty. In both series approximately 90% of patients were cured with up to 2 urethrotomies and followup of longer than 3 years (table 1).

Stricture length and location. Data on location and length of strictures with regard to recurrence rates were available only in group 2. Stricture length was analyzed by retrograde

Accepted for publication May 17, 1996.

TABLE 1. *Recurrences after internal urethrotomy*

	No. Pts. (%)	
	Group 1 (357 pts.)	Group 2 (580 pts.)
No. recurrences (No. urethrotomies):		
None (1)	261 (73.1)	320 (55.2)
1 (2)	57 (16.0)	201 (34.6)
More than 2 (more than 2)	39 (10.9)	59 (10.2)
Success with up to 2 urethrotomies	318 (89.0)	521 (89.8)

Mean followup was 4.6 years (range 9 months to 16 years) in group 1 and 3.2 years (range 6 to 72 months) in group 2.

urethrography. The recurrence rate was less (27.8%) for strictures less than 1 cm. compared to long (50.5%) or multiple (50.6%) strictures (table 2). Strictures were in the bulbar urethra in 52.6% of the cases and multiple in 21.9%. Penile strictures (28.6%) had the highest recurrence rates (42.5%). Location did not significantly influence recurrence rate. Bulbar strictures had the lowest recurrence rate (34.3%) but this group also had the highest rate of short strictures (62%).

Etiology. Data on etiology were available related to the total number of patients in group 1 and to the total number of strictures only in group 2. Strictures without a known cause (so-called idiopathic) were found in 51% of patients (group 1) and comprised 19% of strictures (group 2, table 3). Post-transurethral resection strictures occurred in 23 and 43%, inflammatory strictures (genital infection) in 8 and 22%, and strictures after long-term use of catheters in 11 and 13% of the cases, respectively. The rate of traumatic strictures in each series was low (7 and 3%, respectively). Thus, the patient groups differed in etiology concerning the high rates of post-transurethral resection and inflammatory strictures in group 2 and the high rate of so-called idiopathic strictures in group 1. Group 2 allowed for subdivision of the idiopathic cases into those with congenital (1.5% of all strictures) and idiopathic (17.5%) strictures.

Of the patients (group 1) and strictures (group 2) without known cause 80 and 81%, respectively, were cured by a single internal urethrotomy. However, post-transurethral resection and post-catheter strictures had recurrence rates of 36 and 44, and 35 and 44%, respectively, in groups 1 and 2 (table 3). The time to recurrence was analyzed in subgroups of group 1, and was longest in 36 patients with idiopathic strictures (mean 35 months to recurrence) and 30 with post-transurethral resection strictures (mean 18 months to recurrence).

Length of followup was the most important parameter for recurrence. A preliminary analysis in group 2 after 6 months showed that only 5% of patients (29 of 580) had symptoms of recurrence, compared to 44.8% (260) after a mean followup of 38 months. The complication rate was low in both groups (6.7 and 6.6% in groups 1 and 2, respectively), and complications mainly were minor, such as bleeding and temporary fever

TABLE 2. *Recurrence rate with respect to stricture length and location in group 2 (798 strictures)*

Urethral Stricture	No. Strictures (%)	No. Recurrences (%)	% Strictures Longer than 1 Cm.
Length (cm.):			
Less than 1	418 (52.3)	116 (27.8)	
More than 1	206 (25.8)	104 (50.5)	
Multiple	174 (21.9)	88 (50.6)	
Total No. cases	798	308	
Location:			
Prostatic	45 (5.6)	(46.6)	49
Membranous	105 (13.2)	(39.0)	56
Bulbar	420 (52.6)	(34.3)	62
Penile	228 (28.6)	(42.5)	33

TABLE 3. *Etiology and recurrence rates of urethral strictures treated with internal urethrotomy in groups 1 (357 patients) and 2 (580)*

Etiology	No. (%)	No. Without Recurrence (%)	No. With Recurrence (%)
Group 1:			
Idiopathic	183 (51)	147 (80)	36 (20)
Post-transurethral resection	83 (23)	53 (64)	30 (36)
Inflammatory	28 (8)	18 (64)	10 (36)
Post-catheter	40 (11)	26 (65)	14 (35)
Trauma	23 (7)	17 (74)	6 (26)
Totals	357 (100)	261 (73)	96 (27)
Group 2:			
Idiopathic	154 (19)	125 (81)	29 (19)
Post-transurethral resection	342 (43)	192 (56)	150 (44)
Inflammatory	179 (22)	121 (68)	58 (32)
Post-catheter	102 (13)	57 (56)	45 (44)
Trauma	21 (3)	7 (33)	14 (67)
Totals	798 (100)	502 (63)	296 (37)

Data are reported based on number (percent) of patients in group 1 and strictures in group 2.

(table 4). Patient age did not influence the stricture recurrence rate.

Adjuvant treatment. Mean duration of postoperative transurethral catheter drainage in group 1 was 3.2 days, compared to 5.5 days in group 2. Detailed analysis in group 2 showed the lowest recurrence rates, with a postoperative catheter drainage period of less than 3 days (table 5). A silicone Foley catheter was used for 89.7% of the strictures. Clean intermittent catheterization for dilation after primary internal urethrotomy was recommended in 84 unselected patients in group 1. Of the 84 patients 66 performed clean intermittent catheterization twice a month for a mean of 17 months (range 1 to 61), with a 12% recurrence rate (6 patients) compared to 27% for the entire group. However, the minor complication rate (mainly bleeding) was 50% (33 of 66 patients).

DISCUSSION

We analyzed patients with urethral stricture primarily treated with internal urethrotomy to evaluate risk factors for recurrence depending on stricture characteristics. In the literature most studies of urethral stricture treatment only inconsistently reported stricture characteristics, such as length, location and etiology, and few presented long-term results.[2,3] Two groups of patients were analyzed in combination to compare treatment results among those with identical etiologies who underwent identical procedures at different institutions. The subgroup analysis of both groups made it possible to report on various stricture and treatment characteristics with regard to recurrence rates. Followup in both groups was sufficient (mean 4.6 and 3.2 years in groups 1 and 2, respectively). Mean patient age was comparable, and all strictures had not been treated previously. The primary investigations (urinary flow rate and retrograde urethrography) were comparable in both groups, with defined treatment success (no clinical symptoms and peak flow rate greater than 15 ml. per second).

The overall recurrence rate differed remarkably in both

TABLE 4. *Complications of internal urethrotomy*

	No. Pts. (%)	
	Group 1 (357 pts.)	Group 2 (580 pts.)
Bleeding	12 (3.4)	23 (4.0)
Fever	8 (2.2)	6 (1.0)
Epididymitis	3 (0.8)	6 (1.0)
Incontinence	1 (0.4)	3 (0.5)
Totals	24 (6.7)	38 (6.6)

TABLE 5. *Recurrence rate with respect to postoperative catheter drainage in group 2 (798 strictures)*

Days Postop. Catheter Drainage	No. Strictures	% Recurrence Rate (No. cases/total)
1–3	255	34 (87/255)
4–7	479	43 (205/479)
More than 7	64	65 (42/64)

Mean duration of postoperative catheter drainage was 5.5 days. A silicone catheter was used in 89.7% of cases.

groups (26.9% in group 1 versus 44.8% in group 2) due to the differences in etiology. In group 1 more than half of the patients had so-called idiopathic strictures, whereas post-transurethral resection strictures dominated in group 2. Idiopathic strictures are a separate entity in which there is no history of instrumentation or urethral disease.[4–6] Whether there are pathogenetic associations with idiopathic urethrorrhagia in boys (posterior urethritis)[7,8] or congenital strictures[9] remains unknown.

The idiopathic stricture rate usually ranges from 20 to 40%, and the 51% rate in group 1 certainly was high. However, the recurrence rate in this subgroup was low in both groups (20 and 19% in groups 1 and 2, respectively), compared to that for post-transurethral resection strictures (36 and 44%, respectively). Thus, the difference in patients with idiopathic strictures explains the overall difference in recurrence rates between the 2 groups.

In both groups approximately 10% of cases were not treated successfully with repeated urethrotomies (table 1). A second urethrotomy may be advisable because another 70% of patients may be cured in the long term.[10] However, it is agreed that every procedure causes a new scar,[2] and progressive scarring in 10% of patients necessitates reconstructive urethroplasty with excision of the lesion.

Our overall primary recurrence rate compares to those of previous reports on internal urethrotomy, with success rates of 66 to 90%.[2,3,11,12] Reports with a high success rate often did not give sufficient followup data.[12] Analysis in our group 2 after 6 and 38 months demonstrated the importance of longer followup.

Several characteristics seem to be correlated with recurrence after primary urethrotomy, including post-transurethral resection or inflammatory (after long-term catheterization or genital infection), multiple and long strictures, with recurrence rates of up to 50% (tables 2 and 3). The high recurrence rate in these subgroups was correlated with a short interval to re-treatment (average 18 months), whereas for example idiopathic strictures showed low recurrence rates (20 and 19% in groups 1 and 2, respectively), with a long interval to re-treatment (average 35 months). The location of the stricture did not influence outcome, since the differences in recurrence rates are explained by the different percentages of short strictures within the subgroups (table 2). Among short strictures those in the bulbar urethra showed lower recurrence rates than, for example, those in the penile urethra, which may be explained by the better vascularization of the proximal urethra.[10] Nonetheless, the process and length of scarring certainly depend more on etiology than stricture location.

Stormont et al compared internal urethrotomy with urethral dilation by clean intermittent catheterization in 151 patients with bulbar strictures and they noted no differences in treatment outcome depending on stricture characteristics.[3] They reported an approximately 18% complication rate for internal urethrotomy (bleeding, urinary tract infection and epididymitis), which was greater than that in our series (6.7 and 6.6% in groups 1 and 2, respectively, table 4) but the reported complications were minor and the differences were explained by different group sizes. Generally, internal urethrotomy is a safe procedure with only minor complications, usually in less than 10% of cases.[2,3,11–13] The external diameter of the cystoscope sheath should not exceed 21F.

Postoperative catheter drainage seems to influence recurrence rate. Catheterization for less than 3 days postoperatively may lead to lower recurrence rates (table 5). Hammarsten et al reported a decreased stricture rate from 17 to 4% when a suprapubic tube was used instead of a transurethral catheter.[14] In a subgroup of nonselected patients (66 of 357 in group 1) clean intermittent catheterization was performed to prevent recurrence as adjuvant treatment for an average of 17 months. Only 12% of this small group required re-treatment compared to 27% of the entire group. Harriss et al reported an approximately 14% recurrence rate in patients who performed intermittent self-catheterization for longer than 12 months, compared to 40% in those with only 6 months of catheterization.[15] Others also found long-term improvements in urinary flow rates with clean intermittent catheterization performed for longer than 1 year postoperatively.[16] In a controlled study clean intermittent catheterization again was superior to no adjuvant treatment.[17]

CONCLUSIONS

Internal urethrotomy is a safe first line treatment for urethral strictures independent of etiology and location, with an overall primary success rate of 60 to 70%. Depending on etiology, repeat internal urethrotomy will cure another 50 to 70% of the primary failures in the long term. More idiopathic strictures are treated successfully than post-transurethral resection or inflammatory strictures. Generally, it is advisable to avoid more than 2 internal urethrotomies in the primary treatment of urethral strictures. Postoperative catheter drainage for less than 3 days and clean intermittent catheterization for longer than 1 year postoperatively seem to result in a decreased recurrence rate. For patients with more than 1 recurrence or strictures longer than 1 cm., who are at high risk for recurrence after internal urethrotomy, surgical repair remains the treatment of choice. Clean intermittent catheterization (dilation) should be considered in older patients to avoid multiple operations.

REFERENCES

1. Sachse, H.: Zur Behandlung der Harnröhrenstriktur. Fortschr. Med., **92:** 12, 1974.
2. Marberger, M. and Albrecht, W.: Operativ behandelbare Harnröhrenerkrankungen—endoskopische Operationstechniken. Verh. Ber. Dtsch. Ges. Urol., 1989.
3. Stormont, T. J., Suman, V. J. and Oesterling, J. E.: Newly diagnosed bulbar urethral strictures: etiology and outcome of various treatments. J. Urol., part 2, **150:** 1725, 1993.
4. Wilbert, D. M.: Congenital bulbus urethral stricture. Akt. Urol., **16:** 42, 1985.
5. Currarino, G. and Stephens, F. D.: Uncommon type of bulbar urethral stricture, sometimes familial, of unknown cause: congenital versus acquired. J. Urol., **126:** 658, 1981.
6. Field, P. L. and Stephens, F. D.: Congenital urethral membranes causing urethral obstruction. J. Urol., **111:** 250, 1974.
7. Kaplan, G. W. and Brock, W. A.: Idiopathic urethrorrhagia in boys. J. Urol., **128:** 1001, 1982.
8. Müller, S. C. and Jeffs, R. D.: Hämaturie bei Urethritis posterior des Knaben. In: Kinderurologie in Klinik und Praxis. Edited by R. Hohenfellner, J. W. Thüroff and H. Schulte-Wissermann. New York: Georg Thieme Verlag, vol. 1, pp. 151–153, 1986.
9. Moormann, J. G.: Angeborene Enge der bulbären Harnröhre als Ursache der Erkrankungen des urogenitalen Grenzgebiets. Urologe A, **11:** 157, 1972.
10. Bandhauer, K. and Schreiter, F.: Operative Therapie der Harnröhrenstriktur. New York: Georg Thieme Verlag, 1991.
11. Fourcade, R. O., Mathieu, F., Chatelain, C., Jardin, A., Richard, F. and Kuss, R.: Endoscopic internal urethrotomy for treatment of urethral strictures. Midterm survey. Urology, **18:** 33, 1981.
12. Eastham, J., Wilson, T. and Boyd, S.: Surgical management of strictures based on etiology. Urology, **40:** 110, 1992.
13. Gaches, C. G. C., Ashken, M. H., Dunn, M., Hammonds, J. C.,

Jenkins, I. L. and Smith, P. J. B.: The role of selective internal urethrotomy in the management of urethral stricture: a multicentre evaluation. Brit. J. Urol., **51:** 579, 1979.
14. Hammarsten, J., Lindqvist, K. and Sunzel, H.: Urethral strictures following transurethral resection of the prostate. The role of the catheter. Brit. J. Urol., **63:** 397, 1989.
15. Harriss, D. R., Beckingham, I. J., Lemberger, R. J. and Lawrence, W. T.: Long-term results of intermittent low-friction self-catheterization in patients with recurrent urethral strictures. Brit. J. Urol., **74:** 790, 1994.
16. Tammela, T. L., Permi, J., Ruutu, M. and Talja, M.: Clean intermittent self-catheterization after urethrotomy for recurrent urethral strictures. Ann. Chir. Gynaec., suppl., **206:** 80, 1993.
17. Kjaergaard, B., Walter, S., Bartholin, J., Andersen, J. T., Nøhr, S., Beck, H., Jensen, B. N., Lokdam, A. and Glavind, K.: Prevention of urethral stricture recurrence using clean intermittent self-catheterization. Brit. J. Urol., **73:** 692, 1994.