Urethral stricture: etiology and treatment. Experience at the Centro Médico ISSEMYM

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Abstract

Background: Urethral stricture develops due to the process of cicatrization and fibrosis of the urethral mucosa and/or its surrounding tissues. The etiology described for this pathology includes: prostatectomy (radical and simple), urethral catheterization, transurethral resection (TUR), and cystoscopy, among others. Therapeutic options for this pathology are: internal urethrotomy (IUT), end-to-end urethroplasty, buccal flap urethroplasty, and scrotal flap urethroplasty.

Aims: To present our experience in relation to etiology and the surgical approach offered, as well as to provide a review of the literature.

Methods: Eighty case records of patients diagnosed with urethral stricture within the time frame of January 2005 and July 2012 were reviewed. The evaluated variables were: etiology, length, anatomic location, the surgical technique employed, recurrence, and complications.

Results: Of 110 case records, only 80 were included. Of those patients, 59 underwent internal IUT and 19 had urethroplasty. One patient underwent both procedures and therefore was not included in the present study. The mean length was shorter in the patients that underwent IUT compared with those that had urethroplasty. Eight end-to-end urethroplasties in the bulbous urethra were performed: 8 urethroplasties were carried out using the prepuce and 7 were done with scrotal skin flaps. The success rate was 94.74%.
Introduction

Currently, urethral strictures are considered to develop secondarily to a process of cicatrization or fibrosis of the urethral mucosa and/or of the periurethral tissues, thus any process that conditions trauma may also condition a urethral stricture. However, there are also references sustaining the existence of congenital strictures of the bulbous urethra in which a substantial quantity of smooth muscle is present and they are believed to originate from an alteration in urethral canalization.

Etiology

The etiology of this pathology has been modified over the years; in the 1980s, urethritis was thought to be the main cause in up to 40% of the cases; today, however, it is associated with 3.7%. The decrease in post-inflammatory stricture was associated with the prevention of sexually transmitted diseases (STDs) and to good adherence to their antibiotic management. Currently, the following are among the main etiologies: prostatectomy (radical and simple), urethral catheterization, transurethral resection (TUR) of the prostate, bladder, and urethral valves, cystoscopies, brachytherapy, hypospadias surgery, lichen sclerosus, urethral tumor, corpora cavernosa fracture, perineal trauma, pelvic fracture, and idiopathy.

Some authors have divided the etiologies into 2 groups in relation to patient age at the time of presentation: under and over 45 years of age. From the age of 45, patients have a higher incidence of certain pathologies, such as benign prostatic growth, prostate cancer, and bladder cancer, and are more susceptible to iatrogenic urethral manipulation of which TUR and prostatectomy are described as the main causes. In the patients under 45 years of age, idiopathic strictures—which have been associated with a past history of trauma during infancy or a congenital alteration, without yet being clarified—and hypospadias surgery and cases of pelvic fracture—with motorcyclists and bicyclists being at greater risk—are the most frequent.

The anatomic site at which the urethra is most affected can orient us towards a probable etiology. In 2009, Lumen et al. reported on a case series of 286 patients diagnosed with urethral stricture and described the most frequent etiologies according to the portion involved. This case series showed that the bulbous urethra was the most affected urethral portion, corresponding to 48.1%; among the etiologies associated with this portion are idiopathic etiology, followed by TUR (this procedure has been associated with traumatic introduction of the resectoscope, or friction caused by it at this level, due to the urethral diameter, as well as with insufficient isolation of the monopolar resectoscope; in other words, to poor instrumentation, although this has not been proved). Then follow strictures at the level of the penile urethra (22.8%), the principal causes of which are: hypospadias surgery, idiopathy, urethral catheterization, and lichen sclerosus (associated with stricture at the distal portion of the penile...
urethra in 43.75%). The main condition at the level of the posterior urethra was shown to be pelvic fracture, in 14.9% of the cases. Panurethral or multifocal stricture in the anterior urethra was reported in 13.6% of the patients and was associated with a past history of internal urethrotomy (IUT) (on more than 2 occasions) or periodic dilations.6

**Treatment**

- **Urethral dilations**
  The first treatment described for this pathology is periodic urethral dilation, which is recommended in cases of strictures under 2 cm; a complication rate or treatment failure has been reported for this procedure in 32% of the patients with 16% more recurrence than in the patients that underwent IUT at 36 months (with no statistically significant difference).11 Some authors regard urethral dilation as a non-curative therapy, substituting it with balloon dilation, stents, and IUT.12,13

- **Internal urethrotomy**
  Since the first report of IUT in 1974, this procedure has become the most widely used technique, compared with urethroplasties, because it is considered to be simple, safe, with a short period of convalescence, and easy to perform, despite the risk for recurrence during the first 6 months of up to 50%.14,15

  The aim of this technique is to enable re-epithelialization before there is new scarring, remodeling the urethral scar into an open position. By not completely removing the scar tissue, the procedure is only potentially curative in those strictures under 1 cm in which there is a minimum of spongiosfibrosis.16

  A success rate of 60% has been reported for the small bulbous urethral strictures treated through IUT17 and the outcome factors that have been described for increasing this success rate are: single primary lesion, < 1 cm (increasing the success rate by up to 71%), and a urethral caliber > 15Fr (French).16

  The complications associated with an IUT commonly involve the risk for bleeding (hematoma or hematuria) and urinary tract infection.11,18,19

  In a randomized, prospective study comparing IUT and urethral dilations in 210 men, Steenkamp et al. reported that there was no significant difference in urethral stricture recurrence between the 2 methods.11

- **Urethroplasties**
  The first urethroplasty was described by Russell in 1914,20 and since then numerous surgical procedures and technical advances have been reported on. Nevertheless, since 1974, the number of urethroplasties has decreased considerably, despite the many studies that have shown its long-term effectiveness. For example, in the majority of bulbous urethral strictures with a length of 1 to 3 cm, tissue resection and primary anastomosis can be performed, resulting in a 93% success rate at the 5 and 10-year follow-up.11,21,22

  These are some of the reasons why certain groups have argued in favor of anastomotic urethroplasty as first-line treatment in short, recurrent urethral stricture after endoscopic management.23 Nevertheless, it should not be performed in the case of penile urethral stricture since it could condition a curving of the urethra.24

  On the other hand, in those cases in which there is not enough tissue or there is a lack of adequate irrigation, such as in congenital defects or fibrosis from previous surgeries, the most recommendable procedure is a flap or tissue transplant for restoring the length of the urethra.25

  Over the years, different tissues have been used to repair urethral stenoses. In 1941, Humby published the first study using a buccal mucosa flap from the lip. It did not have very good results, given that after 6 days, the graft presented with necrosis.26 A few years later, in 1947, the use of bladder mucosa became popular at clinics, but within a short period of time it was regarded as a complex and not very esthetic technique and fell into disuse. Nothing was published until 5 decades later when Burger et al. once again took up the buccal mucosa flap for urethral repair, obtaining satisfactory results in 5 out of 6 patients.27

  The buccal mucosa flap consists of performing an autologous transplant of the non-keratinized buccal mucosa for repairing urologic defects secondary to stricture, hypospadias, or epispadias. The 2 most common sites for taking the flap are: the internal surface of the cheek and the labial alveolar region (inferior maxillary area). Among the advantages of the buccal mucosa for carrying out urethral grafts are: easy access, availability, resistance to infection, and tissue characteristics (thick epithelium, high content of elastic fibers, and a thin lamina propria).28

  Currently, the majority of urethroplasties are performed in a single surgery and the 2-stage procedures are reserved for those cases presenting with refractory strictures, multiple stricture sites, or panurethral strictures.11,22

  The complications that are reported change according to the technique of urethroplasty employed; in anastomotic urethroplasty the main complication is urethral re-stricture, which has occurred in 10.9% of the cases.29

  In relation to preputial or scrotal flaps, stricture recurrence, flap necrosis, urinomas, retraction, penile curvature, and erectile dysfunction have been reported in 4% of the cases. Nevertheless, other complications have been documented that commonly incur in the characteristic lithotomy risks16,17,30 (deep vein thrombosis and transient neurapraxia) and surgical wound complications. Any other adverse event occurs in less than 1% of the patients.31,34

  The aim of this study was to describe the incidence of urethral stricture, analyzing the main etiologies and the type of treatment carried out in the Mexican population. In addition, it attempted to evaluate the difference in urethral stricture recurrence between the endoscopic and the open approaches.

**Methods**

A retrospective study was conducted through a review of the case records from the clinical archive of the Centro Médico ISSEMYM of patients that were diagnosed with narrowing of the urethra within the time frame of January 2005 to July 2012. This diagnosis is the one that is used in the SAAM electronic system of our hospital to refer to this pathology. Those patients that did not have adequate
postoperative follow-up of at least 3 months and any patient that had undergone both procedures were excluded from the study.

Results

A total of 110 case records were reviewed, 30 of which were excluded due to incomplete records. One patient was excluded for having undergone both procedures. Finally, only 78 case records were included that were complete and had adequate outpatient follow-up. Fifty-nine patients were treated endoscopically through an IUT and 19 underwent urethroplasty.

The mean age of the patients was 51 years, and the range was 22 to 80 years. In relation to urethral stricture location, the mean age of patients presenting with bulbous urethral stricture was 52 years; at the posterior urethral level the mean age was 26 years and a motorcycle accident was the principal factor. Regarding urethral stricture etiology, the iatrogenic ones were the most frequent, especially after transurethral catheter placement for different pathologies or surgical operations (n=26), representing 33.33% of the patients. A past history of previous TUR (prostate or bladder) was also a cause of urethral stricture in 32.01% (n=25), 7.69% (n=6) developed stricture after cystoscopy, and in 14.10% (n=11) of the patients stricture was secondary to trauma from cuts or contusions, and only 3.75% (n=3) of the cases were associated with multiple symptoms of urethritis; nevertheless, 8.97% (n=7) were regarded as idiopathic (table 1) (fig. 1).

Concerning the involved portion of the urethra, the bulbous urethra was the most affected, representing 51.28% (n=40) of the patients, and was associated with instrumentation or catheterization. A total of 19.23% (n=15) of the patients presented with fibrosis of the neck after TURP. Involvement at the level of the membranous urethra was found in 14.10% (n=11) of the population and was associated with urethral instrumentation, urethral catheterization, and pelvic fracture (3 patients) secondary to a motorcycle accident. The penile urethra was affected in 10.26% (n=8) of the patients and was associated with urethritis, catheterization, hypospadias, and corpora cavernosa fracture. There were multiple urethral stricture sites found in 4 patients (5.13%) that were associated with urethral dilatation and/or urethral instrumentation in 2 or more occasions (fig. 2).

Once the surgery was carried out, a control urethrocystogram was done at 3, 6, and 12 months during the first year, and then every 6 months until completing 3
years. Stricture recurrence was considered in those patients that complained of the recurrence of obstructive urinary symptomology (or of emptying) and/or in whom there was a reduced urethral caliber shown in the urethrocystogram, compared with the previous ones. Flowmetry was not done due to lack of equipment, which only became available this year.

Of the patients treated through IUT the mean stricture length was 1.2 cm, with an interval of 0.8 to 1.6 cm; 33 patients (55.93%) presented with recurrence within the first semester of follow-up; 25 of them (66.67%) presented with recurrence after a second IUT, and 12% of them (n=3) came to the Emergency Department with symptoms of acute urine retention that required emergency cystotomy (fig. 3).

Among the patients that underwent urethroplasty, the mean stricture length was 2.20 cm, with a range of 0.5 to 4 cm (fig. 4). Eight end-to-end urethroplasties in the bulbous urethra have been performed and the mean stricture length was 1 cm (range: 0.5-1.5 cm). Urethroplasties using the prepuce were performed on 7 patients, with a mean stricture length of 2.5 cm (range: 2 and 3 cm) - 3 in the penile urethra, 3 in the membranous urethra, and one in the bulbous urethra - and the 7 were performed in 2 stages; in 2 urethroplasties with a scrotal skin flap the mean stricture length was 3.5 cm (range: 3-4 cm) and in 2 urethroplasties with buccal mucosa in the bulbous urethra the mean stricture length was 2.2 cm (range: 2 and 2.4 cm). Of the 19 patients that underwent urethroplasty, only one patient (with a past history of end-to-end reconstruction) required a second 2-stage operation. The remaining patients have had no recurrence data up to the present, representing a 94.74% success rate (fig. 5).

**Discussion**

Some authors consider that repeat transurethral manipulation converts a discreet or simple problem that is easily manageable, into a chronic disease requiring continuous maintenance treatment after the IUT in order to reduce the repeated incidence of urethral obstruction symptoms with each stricture recurrence;\textsuperscript{35} autocatheterization is regarded as part of this maintenance, and is well tolerated in patients diagnosed with neurogenic bladder and a urethra that is within normal parameters.
However, the usual clinical course of these patients is the presentation of bleeding, false pathway, or new symptoms of stricture, leading to emergency surgery due to acute urine retention.

Our results corroborated those reported in the literature on this pathology. The most frequent associated factors were urethral instrumentation and urethral catheterization. The bulbous urethra was also the most affected urethral portion, observed in 51.2% of our total population.

A recurrence rate of 50% to 68% during the first 6 months has been reported in patients that have undergone iUT;15,16 we observed a recurrence rate of slightly more than half (55%) in our population during the first semester of follow-up. This could be associated with the fact that the good outcome factors were not met: stricture that was short (<1 cm), non-traumatic, and located in the bulbous urethra,13,14,17 and so when the recurrence rate was compared in the patients that underwent iUT (p1) vs. those that underwent urethroplasty (p2) (0.533 vs. 0.0526), there was significant difference in recurrence with each procedure, leading us to carry out a statistical analysis between these 2 populations.

The Z test analysis=3.6582 was extrapolated to a normal distribution curve (Z<3.65=0.9987 and the probability that Z=3.65=[1-0.9987]=0.0013), and to avoid bias between the procedures, the p value was multiplied by 2 (0.0013x2) = 0.0026. The p value was < alpha (0.0026<0.05), implying that the null hypothesis could be rejected in favor of the alternative.

Once these results were obtained and compared with previously published ones, it was inferred that this was the reason for questioning the use of iUT as treatment for small strictures in the bulbous urethra,14,18 and the reason why the perineal approach with stricture resection and end-to-end urethral anastomosis should be evaluated as a therapeutic option in these patients.14 It should be mentioned that this is a questionable procedure in the hands of the inexperienced surgeon since it is technically much more complex than the iUT. However, numerous reports have shown it to be very effective when performed by an experienced urologist,16,39,40 even though it is initially more expensive because it requires a special surgical team and a urologic surgical table.23,36,37

On the other hand, it has recently been demonstrated that the iUT is characterized by poor durability and little effectiveness when it is carried out under different circumstances. Pansadoro and Emiliozzi19 reported a case series of 224 patients treated with iUT in which the general recurrence rate was 68% at the 5-year follow-up; it was 58% at the bulbous urethra level, and 84% at the penile urethra level. They also reported that the effectiveness percentage of a second urethrotomy was from 0% to 4%, and in those patients that underwent a 3rd or 4th urethrotomy, recurrence was 100%.16-17 Thus it is necessary to evaluate the long-term cost-benefit for the patients.

Despite the high success rate and low morbidity of urethroplasty, it is still used less frequently than iUT and dilations. In an analysis of patients with urologic diseases (Project America), Anger et al.18 reported in 2001 that only 0.7% of 895 patients with urethral strictures underwent urethroplasty, whereas 57.7% were treated with iUT, 34.5% with urethral dilation, and 1.9% with stent/injection. Moreover, urethroplasty was only performed on those patients with 3 or more failed endoscopic procedures,4 and its success was restricted by the presence of spongiosis fibrosis, which limits tissue elasticity. Something very similar occurs in patients that have undergone multiple dilations; in these patients there is a 14.3% to 27.6% increased risk for urethroplasty failure.14,39-41

Currently there are numerous case series that report a high urethroplasty success rate; it varies depending on the technique used and the affected portion of the urethra. Markiewicz et al. carried out a review article on buccal graft urethroplasty and reported a success rate of 76.4%, which can vary depending on the anatomic site of the urethra, if a tubularized, dorsal, or ventral flap is used, and if the procedure is one-stage or 2-stage. Nevertheless, a better success rate has been described for tubularized (88.5%) and ventral flaps (87.7%).24 In our case series, the ventral flap was employed in the penile urethra in a one-stage procedure in 2 cases, with good results. However, it should be mentioned that in patients presenting with an added pathology (lichen sclerosus, balanitis xerotica obliterans), some authors recommend urethroplasty with ventral flap in 2 or more stages.24,42

In regard to the end-to-end repair of bulbous urethra stricture, we had a success rate of 87.5%, which was slightly lower than that published by other authors (96%),21 and was probably associated with stricture length or the comorbidities of the patients. This technique should be considered in lesions of 2 to 4 cm in length and good dissection is essential in order to take advantage of the elasticity of the bulbous urethra. During this procedure, it is vitally important to remember that 1 cm is lost through spatulation of the edges. This is indispensable for maintaining good caliber despite the postsurgical tissue contraction.43

Various therapeutic options have been described in patients that have stricture or disruption at the posterior urethra level. Some authors recommend initial management with cystotomy and posterior reconstruction. Webster et al.21 reported an erectile dysfunction rate of 11.6% and a urinary incontinence rate of 1.7%; this type of management has been associated with great difficulties in subsequent urethral stricture repair, due to extensive fibrosis that results in longer stricture.44 On the other hand, some authors have reported on primary urethral realignment, whose implementation involves problems such as great surgical risk (unstable and polytraumatized patients) and large pelvic hematomas, among others. Urethral stricture has been observed in 60% of the patients treated with this type of approach, erectile dysfunction in 44%, and urinary incontinence in 20%. Such results dismiss this therapy as initial treatment for lesions at the posterior urethra level.21

Ennemoser et al.45 described another therapeutic option in these cases that we used in our 3 cases of post-traumatic membranous urethral injury. It combines suprapubic cystotomy, the repositioning of the urethral ends, and adequate drainage of the perivesical and perineal spaces. In this type of intervention, it is essential to stabilize the pelvis in those patients that present with a fracture at this level, thus reducing the risk for prostate displacement, rectoprostatic fistula formation, urethral end displacement, and the formation of extensive retropubic fibrosis. This
results in a small residual stricture that facilitates the conditions for late urethral repair at 6 or 8 months. The complication rate of urethroplasties that have been described vary from 7% to 14%.\textsuperscript{20,45} In our case series we observed a complication rate of 4.97%; it was associated with recurrence symptoms of bulbous urethral stricture and initial treatment was end-to-end anastomosis. However, it should be pointed out that the mechanism of the injury was a bullet fragment from a gunshot wound, which among other things, could condition greater fibrosis and inflammatory response, leading to the clinical progression of the stricture. Urinary tract infections, ecchymosis, and scrotal edema have been described as minor complications in the majority of patients and do not compromise the clinical progression of the patients.\textsuperscript{20,45}

Conclusions

IUT could be considered palliative treatment due to its high recurrence rate, which has been shown to be directly proportional to the number of procedures performed. Nevertheless, further studies are needed in order to define the clinical, etiologic, technical, and anatomic criteria that can either compromise or favor the results of this technique. Moreover, we believe that the cost-benefit to the patient must be evaluated when suggesting some type of intervention as treatment for patients presenting with this pathology, given that open urethroplasty can be a treatment intervention as treatment for patients presenting with this pathology, given that open urethroplasty can be a treatment with permanent results when performed by an experienced surgeon and with adequate selection of the surgical technique.

On the other hand, because urethral stricture is relatively infrequent and the current therapeutic tendency is toward IUT, we feel that greater instruction in the open techniques is required during the academic training of the urologist.

Conflict of interest

The authors declare that there is no conflict of interest.

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References

41. Morey AF, Kizer WS. Proximal bulbar urethroplasty via extended anastomotic approach—what are the limits? J Urol 2006;175:2145.