ICUD on Urethral Strictures

SIU/ICUD Consultation on Urethral Strictures: Dilation, Internal Urethrotomy, and Stenting of Male Anterior Urethral Strictures

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Male urethral stricture is one of the oldest known urologic diseases, and continues to be a common and challenging urologic condition. The oldest and simplest form of management is urethral dilation, which can be performed with a number of different devices and is generally considered a palliative maneuver. In 1974, Sachse introduced direct vision internal urethrotomy (DVIU) to treat urethral strictures by cold-knife incision. Optical urethrotomy by either incision or ablation has been considered standard therapy for anterior urethral strictures and is regarded, along with dilation, as the initial treatment of choice for most urethral strictures. In general, open urethral reconstruction is the most successful management option for urethral strictures, but it requires surgical expertise, adequate operating room facilities, and has a longer recovery period.

A number of large series from the late 1990s have well characterized the success of incision or dilation of the urethra and delineated predictive factors of outcomes. Various modifications of the single cold-knife incision have been suggested, including a variety of different laser wavelengths and the introduction of anterior urethral stenting. However, there are no prospective, randomized studies to prove their claims of greater efficacy.

The long-term success rate of urethrotomy has continued on a steady downward trend from the results of 20 years ago, which suggested a cure rate of over 90%. The reported success rates of urethral stricture treatment are critically dependent on the criteria used for stricture diagnosis before and after treatment, and on the definition of success (in some studies this includes eventual outcome, despite multiple treatments).

Modalities used in determining the success of treatment include symptoms, uroflowmetry, urethral catheterization or calibration, urethrocystoscopy, urethrography (radiological or sonographic), post-void residual urine volume, absence of urinary tract infection, and requirement for subsequent treatment. Clearly, the success rates reported in various studies depend not only on the type of treatment given, but on the criteria used for stricture diagnosis before treatment, the type and duration of follow-up, and the modalities and criteria used to determine stricture recurrence and to define success.

METHODS

An extensive review of the scientific literature concerning anterior urethral urethrotomy/dilation/stenting was performed. Articles were included that met the criteria set by the International Consultation on Urological Diseases (ICUD) urethral strictures committee and were classified by level of evidence using the Oxford Centre for Evidence-Based Medicine criteria adapted from the work of the Agency for Health Care Policy and Research as modified for use in previous ICUD projects. Using criteria set forth by the ICUD, a committee of international experts in urethral stricture disease reviewed the literature and created a consensus statement incorporating levels of evidence and expert opinion in regard to dilation, internal urethrotomy, and stenting of male anterior urethral strictures. UROLOGY 83: S18–S22, 2014. © 2014 Elsevier Inc.
Review of the Literature on Incision and Dilation

Outcomes

One randomized study performed in 1997 by Steenkamp et al sought to determine whether DVIU and dilation were equally efficacious, which had been reported in prior level 3 studies (level 1). Two well-matched groups of 104 and 106 patients were randomized to either incision or dilation, respectively. Although there was a higher reported success rate with DVIU, this was not statistically significant and the effectiveness of the 2 procedures was considered equivalent. This study also found that incremental increases in length resulted in higher failure rates and recommended initial dilation for strictures <2 cm, urethroplasty for strictures >4 cm, and a trial of DVIU or dilation for strictures 2-4 cm in length. The same group of patients was analyzed for time to recurrence, outcomes of repeat incision/dilation, and long-term SFRs using Kaplan-Meier curves out to 48 months. Investigators found that early recurrence (<3 months) and repeat incision/dilation were poor prognostic factors. Urethral strictures that recurred at <3 months and underwent repeat incision or dilation had an SFR of 30% at 24 months and 0% at 48 months. If a stricture recurred at >6 months, then a second DVIU could achieve an SFR of up to 40%. Urethral strictures undergoing a third incision or dilation had a 100% recurrence rate.

A number of level 3 studies on DVIU with short duration of follow-up have been published over the past 10-20 years. The mean follow-up in these case series was commonly <12 months (range 3-30 months), with a variety of endpoints, stricture locations, and success rates (46%-84%) being reported. Two of the better level 3 series were published in the late 1990s.

Pansadoro and Emiliozzi analyzed 224 patients who underwent DVIU for short urethral strictures, with a median follow-up of 98 months. The overall SFR was 32%, but varied significantly based on the stricture characteristics of location, length, diameter, primary vs recurrent, and single vs multiple strictures. The bulbar, penile, and penoscrotal locations had SFRs of 42%, 16%, and 11%, respectively. Strictures <1 cm had an SFR of 71% vs 18% for those >1 cm. A lumen diameter >15F had an SFR of 69% vs 34% for those <15F. Primary vs repeat incisions had SFRs of 47% and 0%, respectively, and single strictures vs multiple strictures had SFRs of 50% and 16%, respectively.

A second large series by Albers et al looked at 580 patients with over 3 years’ follow-up. They reported an overall SFR of 55% with the best results again seen in short primary bulbar strictures. Longer strictures (>1 cm) that had failed prior DVIU, multiple strictures, and penile strictures had much higher recurrence rates; therefore, the authors concluded that in these patients, urethroplasty should be performed rather than repeat incision or dilation.

These studies indicated that optimal results for urethroplasty can be achieved in patients with a single primary bulbar stricture that is <1-cm long and >15F in caliber. A single DVIU/dilation or primary urethroplasty could be offered as first-line therapy for penile or penobulbar strictures because of extremely poor SFR with DVIU/dilation, whereas repeated (>2) DVIU/dilation is to be considered only as a palliative maneuver.

Contemporary series have also reported a wide range of SFRs. Case series published during the past decade have included 13 to 733 patients per study with 2 to 90 months’ follow-up and success rates of 22% to 100%, remarkably similar to studies published during the preceding 2 decades (1980 to 1999), which included 15 to 580 patients with 6 to 72 months’ follow-up and success rates varying from 22% to 95% (level 3), respectively.

Santucci and Eisenberg recently stated that internal urethroplasty has a much lower success rate than previously reported. They performed a retrospective medical chart review of 136 patients who underwent internal urethroplasty from 1994 through 2009. They excluded 36 patients with complex strictures and 24 who were lost to follow-up. The SFRs after 1, 2, 3, 4, and 5 internal urethroplasties were 8%, 6%, 9%, 0%, and 0%, respectively, and the median times to recurrence were 7, 9, 3, 20, and 8 months, respectively (level 3).

Because of the various definitions of success, nonmatched patient populations, unknown stricture length or location, and various standards of success and lengths of follow-up, it is impossible to compare 1 series to another. Contemporary series on urethroplasty/dilation add little additional information on the management of anterior urethral strictures.

Repeat Direct Vision Internal Urethrotomy/Dilation

In patients with stricture recurrence but favorable characteristics (single, <1 cm bulbar stricture) and time to recurrence >6 months, a second DVIU achieved an SFR of 9%-53% (level 2/3). Longer, multiple, penile, or distal strictures typically do not respond to repeat incision/dilation.

Repeat DVIU offers no long-term cure after a third incision/ dilation or if the stricture recurs within 3 months of the first incision. Such patients should be offered urethroplasty.
Incision/dilation followed by long-term self- or office dilation is an alternative option for men with severe comorbidities or limited life expectancy, or for those who have failed prior reconstruction with no further available surgical options (level 4).

**Side Effects of Direct Vision Internal Urethrotomy**
A review of the literature showed that the most commonly reported complications of internal urethrotomy are urethral hemorrhage and perineal hematoma (each with a 20% incidence).³ Other complication rates reported in various studies include scrotal edema (13%), creation of a false passage (10%), rectal perforation (10%), epididymo-orchitis, meatal stenosis and incontinence (each 9%), urinary extravasation (3.4%), bacteremia (2.7%), urinary sepsis (2.1%), and scrotal abscess (1.4%). Erectile dysfunction has historically been reported in 2%-10% of cases; however, Schneider et al found that of the 68 patients who did not have erectile problems before the operation, only 1 complained about erectile dysfunction after DVIU. It should be noted that most of these numbers are derived from single studies, and the reported 10% rate of rectal perforation is exceptional (level 3).

**Cost Effectiveness**
Several recent studies have looked at cost-effective management of anterior urethral strictures and have shown that a single urethrotomy is cost-effective when the expected success rate is >35%-50%. Primary urethrotomy becomes more cost effective if a repeat urethrotomy is required. Wright et al found that the most cost-effective strategy for the management of short bulbar urethral strictures is to reserve urethrotomy for patients in whom a single endoscopic attempt fails. For longer strictures, in which the success rate of DVIU is expected to be <35%, urethroplasty as primary therapy is cost effective. Two similar studies confirmed that initial urethrotomy or dilation followed by urethrotomy in patients with recurrent strictures is the most cost effective.

These studies only evaluated the financial costs of the procedures and lost productivity during convalescence in developed countries. In regions of the world with constrained resources, the use of limited operating room facilities to perform urethrotomy rather than surgery for life-threatening urologic conditions should be considered. An article from Nigeria reported the treatment problems in a community in which strictures are common and resources are limited. In 134 men treated between 1993 and 1996, the combination of internal urethrotomy plus intermittent self-dilation had a recurrence rate of 17%, compared to 22% after urethrotomy. It was estimated that internal urethrotomy was 10 times cheaper and faster to perform than urethroplasty, and offered the surgeon better protection from infection with human immunodeficiency virus (level 3).

**Laser Urethrotomy**
A variety of different laser wavelengths have been used for the incision, resection, and vaporization of anterior urethral strictures over the last 30 years. Initially argon, excimer, and diode lasers were used, as were low-power potassium-titanyl-phosphate (KTP) and contact-tip neodymium:yttrium-aluminum-garnet lasers. Over the past 10 years, holmium and thulium lasers have been added to the surgeon’s armamentarium. There are no level 2 studies and only a few small level 3 series with short-term follow-up.

The addition of lasers with a variety of different energy sources has not improved success rates, yet adds considerable cost with no proven benefit over cold-knife urethroscopy.

**Direct Vision Internal Urethrotomy Plus Self-dilation**
Historically, many patients were placed on intermittent self-catheterization after DVIU/dilation — in an attempt to prevent stricture recurrence. It is a traumatic procedure that some patients find painful, unpleasant, and burdensome, with risk of false passage, infection, abscess formation, and progression of the extent of urethral scarring potentially compromising future reconstruction.

Culty and Boccon-Gibod retrospectively found that prior urethral dilation was a negative predictor for patients undergoing membranous/bulbar anastomotic urethroplasty. Patients without prior urethral manipulation had a satisfactory result of more than 90%, vs ~60% in patients with previous surgical treatment. Several studies have evaluated a combination of urethroplasty and dilation. The contribution of dilation or clean intermittent self-catheterization to failure rates could not be separated out in several of the series, but it was noted to add to the cost of treatment.

**Direct Vision Internal Urethrotomy With Adjunctive Agents**
In an effort to improve outcomes of DVIU, a few small series have been published on adjunctive agents used in combination with DVIU. A level 2 study randomized 40 patients with short bulbar strictures (mean length 0.75 mm) to DVIU vs DVIU plus mitomycin C (MMC) injection. Recurrence with DVIU alone was 50%, compared to 10% in the DVIU plus MMC group. However, this was a highly selected group of young patients with short bulbar strictures and limited follow-up.

The same authors randomized 50 patients to DVIU vs DVIU plus urethral submucosal injection of triamcinolone, and found a decrease in stricture recurrence from 50% in DVIU alone to 21% in DVIU plus triamcinolone. As in the MMC study, this was a highly selected group of young patients with primary short bulbar strictures (<1.0 cm) and limited follow-up. Additional small level 3 series make reference to the use of adjunctive agents with DVIU, but are inherently limited by incomplete or vague follow-up data and/or definition of success.

**Effect on Future Urethral Reconstruction**
A few level 3 series have shown that prior urethral manipulation was a risk factor for urethroplasty failure. A multivariate analysis looking at long-term outcomes of urethroplasty found that prior failed DVIU was correlated with an increased risk of failure after urethroplasty. Similarly, Roehrborn and McConnell found that the failure rate doubled from 14% to 28% when incision or dilation had been performed before urethroplasty. Successful urethral reconstruction can, however, be achieved after failed DVIU, as shown by Barbagli et al, with equal outcomes in primary urethroplasty vs urethroplasty after DVIU.

**Anterior Urethral Stenting**
Although the concept of stenting the urethra dates back to at least 1969, it was propagated by Milroy et al in 1988, when they reported “a new treatment for urethral strictures.” Originally developed for endovascular use, a self-expanding woven tubular mesh stent made from an alloy of stainless steel was implanted in 8 patients with urethral strictures. At a mean of 8-
month follow-up, all had a good caliber urethra. A later series of 10 patients implanted with the same stent for bulbar strictures reported a 30% stricture recurrence rate at 24-month follow-up, with 50% of patients reporting post-void dribbling (level 4).44

Long-term data began to reveal the difficulties and shortcomings of the UroLume stent. De Vocht et al15 evaluated patient satisfaction 10 years after placement of the UroLume stent and found that only 2 of 15 patients were satisfied with their stent. Four patients had their stents removed (2 for stent pain and 2 for stent obstruction), 50% had stent-related incontinence, and others reported discomfort with erection and/or ejaculation.45 Hussain et al46 reported 12-year follow-up on 60 patients and showed that 58% had complications, with a recapture rate of 45% for obstructing stent hyperplasia (32%), stent obstruction or stricture (25%), and stent encrustation or calcification (17%). Additionally, patients experienced postmicturition dribbling (32%) and recurrent urinary tract infections (27%).

The original indication for the UroLume stent was for recurrent short bulbar urethral strictures and the original series placed them in men (average age 52–53 years) who were optimal candidates for bulbar urethroplasty. Long-term follow-up revealed that up to 55% had stent-related complications, 45% requiring surgical intervention for perineal pain, post-voiding dribbling, incontinence, stent migration, stent obstruction, or recurrent strictures proximal or distal to the stent. Patency continued to decline over time, originally reported at 100% in the initial patients with short follow-up and decreasing to 45% at a mean follow-up of 77 months.44,45 Additionally, explanation can result in substantial urethral tissue loss and the need for challenging urethral reconstruction.47-49

The Memokath stent (a removable, densely coiled, thermoplastic stent made of nitinol) has been used to treat prostatic obstruction and detrusor sphincter dysynergia in the posterior urethra and was recently evaluated for use in the anterior urethra. A phase III multicenter trial randomized 92 patients to dilation/incision followed by temporary Foley catheter drainage (n = 29) vs Memokath stenting (n = 63) for recurrent bulbar urethral strictures. The primary endpoint was urethral patency, defined as the ability to pass a 16F flexible cystoscope. Urethral patency was 3.5 times longer in the Memokath-stented group, with all stents successfully removed. Durability effect on the stricture was not assessed. Side effects of the stent included urinary tract infections, hematuria, and penile pain. Stent migration occurred in 22% of patients. The ease of placement and removal of the Memokath stent may prove useful for recurrent bulbar strictures in medically unfit patients or patients unable to undergo formal urethral reconstruction; however, further investigation is needed.50

**Recommendations**

The following recommendations were made based on review of the available literature and expert opinion.

### Primary Direct Vision Internal Urethrotomy and Dilation

1. Urethral dilation and DVIU have equal clinical efficacy and the use of either modality is acceptable, depending on the availability of equipment and resources (B).
2. Primary DVIU/dilation is indicated as first-line therapy for short (<1-2 cm), single, bulbar urethral strictures (A).
3. Primary DVIU/dilation may be used as first-line therapy for urethral strictures with unfavorable characteristics (penile, penobulbar, multiple, >1-2 cm) (C).
4. Urethral reconstruction is recommended as a primary management option for long, multiple, and penile or penobulbar strictures when complete urethral obliteration is present (B).

**Repeat Direct Vision Internal Urethrotomy/Dilation**

1. A second DVIU/dilation can be indicated for recurrent urethral strictures with favorable characteristics (<1-2 cm, single, bulbar stricture) with recurrence >3 months after previous treatment (B).
2. A third DVIU/dilation is not recommended, except if necessitated by patient comorbidities or economic resources (A).
3. Urethral reconstruction over repeat DVIU/dilation should be offered for urethral strictures that recur within 6 months or are refractory to a second DVIU/dilation (A).

**Direct Vision Internal Urethrotomy/Dilation and Intermittent Catheterization**

1. DVIU/dilation combined with intermittent self-dilation may be used as a palliative maneuver for patients unwilling to undergo urethral reconstruction or are medically unfit for surgery (B).

**Laser Urethrotomy**

1. Outcomes of laser urethrotomy suggest that it has no advantage over cold-knife urethrotomy, and because of the additional cost associated with the procedure, its routine use is not recommended (A).

**Anterior Urethral Stenting**

1. Permanent urethral stenting is not recommended for patients with strictures who are considered to be candidates for urethral reconstruction (A).
2. Permanent urethral stenting may be considered in patients with a short, recurrent bulbar stricture who are medically unfit for urethroplasty and cannot tolerate intermittent self-dilation (B).
3. The appropriate circumstances for temporary urethral stenting have not been determined. The procedure is still largely experimental (B).

**References**