

# The current role of direct vision internal urethrotomy and self-catheterization for anterior urethral strictures

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## ABSTRACT

**Introduction:** Direct visual internal urethrotomy (DVIU) followed by intermittent self-dilatation (ISD) is the most commonly performed intervention for urethral stricture disease. The objective of this paper is to outline the current scientific evidence supporting this approach for its use in the management of anterior urethral strictures.

**Materials and Methods:** A Pubmed database search was performed with the words “internal urethrotomy” and “internal urethrotomy self-catheterization.” All papers dealing with this subject were scrutinized. Cross-references from the retrieved articles were also viewed. Only English language articles were included in the analyses. Studies were analyzed to identify predictors for success for DVIU.

**Results:** Initial studies showed excellent outcomes with DVIU with success rates ranging from 50% to 85%. However, these studies reported only short-term results. Recent studies with longer followup have shown a poor success rate ranging from 6% to 28%. Stricture length and degree of fibrosis (luminal narrowing) were found to be predictors of response. Repeated urethrotomies were associated with poor results. Studies involving intermittent self-catheterization following DVIU have shown no role in short-term ISD with one study reporting beneficial effects if continued for more than a year. A significant number of studies have shown long-term complications with SC and high dropout rates.

**Conclusions:** DVIU is associated with poor long-term cure rates. It remains as a treatment of first choice for bulbar urethral strictures <1 cm with minimal spongiositis. There is no role for repeated urethrotomy as outcomes are uniformly poor. ISD, when used for more than a year on a weekly or biweekly basis may delay the onset of stricture recurrence.

Key words: Internal urethrotomy, urethral stricture

## INTRODUCTION

Direct visual internal urethrotomy (DVIU) and urethral dilatation are the most commonly performed procedures for urethral stricture disease. This approach is appealing both for urologists and patients as it is minimally invasive. The original description of urethral dilatation was outlined by the great Indian sage-surgeon of premedieval times in his seminal work *The Susruta Samahita* where he mentioned

the procedure in detail “In a case of Niruddhaprakasha (stricture of the urethra), a tube open at both ends made of iron, wood or shellac should be lubricated with clarified butter and gently introduced into the urethra. Thicker and thicker tubes should be duly introduced every 3<sup>rd</sup> day. The urethra passage should be made to dilate in this manner and emollient food should be given to the patient.”<sup>[1]</sup> Since then, the practice of dilatation has not changed significantly. DVIU was popularized after the initial report of Sachse in 1972. In the 1980s, the concept of intermittent self-catheterization (SC) following DVIU took shape in order to decrease stricture recurrence. This paper analyses the developments in DVIU that have occurred subsequently and attempts to outline its role in the current management of urethral stricture disease.

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## TECHNIQUE

The classical VIU as described by Sachse includes a single cut made at 12 o'clock position in the scar tissue, till the scar is incised completely. Concerns have been raised about the correct position of the incision: some authors advocate multiple radial incisions on the premise that it would allow better incision of the scar. However, there

is no reported difference in the outcome of single versus multiple incisions.<sup>[2,3]</sup>

Laser urethrotomy using different lasers has been attempted to improve outcomes. In a prospective randomized study, Jablowski *et al.*<sup>[4]</sup> demonstrated superior outcomes using a neodymium-doped yttrium aluminum garnet laser. In this study, recurrence rates following laser urethrotomy were 30% compared to 65% with DVIU over a 12-month followup. However other studies have reported similar success rates after laser and cold knife incision.<sup>[2,5-7]</sup>

Intralesional injection of medications like corticosteroids<sup>[6,8]</sup> and mitomycin<sup>[9]</sup> and intraurethral captopril gel<sup>[10]</sup> have been used in an attempt to decrease the fibrotic response after DVIU; however, no long-term followup data are available to determine the true benefit of such strategies.

### DURATION OF CATHETERIZATION AFTER DVIU

The reported duration of catheterization following urethrotomy ranges from 1 day to 3 months. As yet there is no convincing evidence that extending the duration of catheterization<sup>[11]</sup> has an impact on the outcome. Contrary to the popularly held belief, Albers *et al.*<sup>[12]</sup> reported that leaving the urethral catheter in place for 3 days or less is associated with lower recurrence rates (34%), compared to leaving it for 4-7 days or >7 days (recurrence rates of 43% and 65%, respectively). Most studies have reported catheterization duration of 1-4 days.<sup>[13-15]</sup>

### DVIU: RESULTS

Following the introduction of optical visual internal urethrotomy, there were numerous reports in 1970s and 1980s highlighting the efficacy of DVIU with reported success rates ranging from 50% to 80% [Table 1].<sup>[16-20]</sup> Smith *et al.*<sup>[21]</sup> reported on 39 patients who underwent DVIU with a success rate of 82% over a mean followup of 1 year. A multicenter survey involving 177 patients<sup>[22]</sup> managed in five urological departments in the UK demonstrated an 81% success rate over a followup of 4 years. The authors of this paper concluded with the statement “The procedure of selective internal urethrotomy is, in our opinion, the best primary method for the treatment of urethral stricture, and it is hoped this will reduce the indications for anastomotic or substitution urethroplasty.” This enthusiasm was coupled with poor outcomes of urethroplasty in contemporary series.<sup>[18,23]</sup> However, most of these studies were uncontrolled and did not specify details of stricture characteristics, e.g., location, degree of spongiositis, and etiology. Outcomes criteria were also not standardized as some authors reported on subjective criteria, whereas others reported on variable uroflowmetry data. Also, very few studies reported on long-term followup of more than 1 year.

### LONG-TERM EFFICACY OF DVIU

Despite the initial enthusiasm and good results reported by earlier studies, more recent articles have demonstrated a poor long-term success rate for urethrotomy.

Albers *et al.*<sup>[12]</sup> reported on 937 patients managed with primary visual internal urethrotomy at two centers (Group 1, managed at The Mainz University and Group 2 managed at Bonn University in Germany). The mean followups in these two groups were 4.6 years and 3.2 years, respectively. The stricture recurrence rate in Group 1 was 26.9%, whereas in Group 2 it was 44.6%. Subgroup analysis revealed a higher preponderance of idiopathic strictures in Group 1 and iatrogenic strictures in Group 2. These authors concluded that idiopathic strictures have a more favorable prognosis. Pansodoro *et al.*<sup>[24]</sup> reported on 224 patients with a mixed pattern of urethral stricture disease managed by internal urethrotomy. The overall recurrence rate in this study was 68% over a median followup of 98 months. The recurrence rate was 54%, 84%, and 89% for bulbar, penile, and bulbopenile strictures, respectively. Prognostic characteristics of bulbar urethral strictures associated with good results included single or primary strictures, length shorter than 10mm and caliber wider than 15F. In this series 44% and 18% of the recurrent strictures were noted after more than 12 and 24 months of followup, respectively. A few strictures recurred 7–8 years after urethrotomy. This clearly signifies the importance of extended followup in order to establish the success of any technique for the management of urethral strictures. In a more recent study, Santucci and Eisenberg<sup>[2]</sup> followed up 76 patients who underwent urethrotomy between 1994-2010. In this series the long-term success rate was only 8% over a mean followup of 5 years. This is the only study that has reported an extremely poor success rate. Stricture etiology was available in only 50% patients and the mean stricture length was 1.5 cm. Most strictures involved the bulbar urethra. However this study was retrospective and uncontrolled in nature, with details of stricture characteristics not outlined in a significant number of patients.

### FACTORS ASSOCIATED WITH STRICTURE RECURRENCE

#### Stricture length

Stricture recurrence has been shown to be directly proportional to stricture length. Pansodoro *et al.*<sup>[24]</sup> demonstrated high recurrence rate for strictures greater than 1 cm. In their study, the success rate was 71% for strictures shorter than 1 cm compared to 18% for longer strictures. In the study by Albers *et al.*<sup>[23]</sup> the recurrence rate was 28% for strictures lesser than 1 cm and 51% for those greater than 1 cm. Steenkamp *et al.*<sup>[14]</sup> showed that strictures <1 cm and 1-2 cm in length have similar recurrence rates, approximately

40% at 24 months. Many other studies have confirmed that with increasing stricture length, the recurrence rates for DVIU are higher.<sup>[15,25,26]</sup> Rourke and Jordan constructed a decision analysis model to determine the cost-minimized treatment of short segment (2 cm) bulbar urethral strictures. They demonstrated that management of such strictures is less costly using open urethral reconstruction as compared to DVIU.<sup>[27]</sup>

### Stricture diameter and spongiofibrosis, infection, and duration of catheterization

The degree of spongiofibrosis associated with strictures may also predict stricture recurrence. However, spongiofibrosis is difficult to quantify. Mandhani *et al.*<sup>[28]</sup> used percentage narrowing on retrograde urethrography to predict stricture recurrence. Here 75% narrowing on retrograde urethrography predicted stricture recurrence with a probability of 78%. In a study by Merkle and Wagner,<sup>[29]</sup> the presence of periurethral scarring on ultrasound successfully predicted stricture recurrence in three patients, whereas 11 patients without scarring had no stricture recurrence. Pansadoro *et al.*<sup>[24]</sup> found a success rate of 69% for strictures greater than 15F caliber, and 35% for those less than 15 F.

Untreated perioperative urinary infection increases the recurrence rate significantly, from 28% if uninfected to 72% if infected, and the use of prophylactic antibiotics might reduce recurrence rates.

**Table 1: Success rates of DVIU**

Author	Year	No patients	Followup	Success rate (%)
Smith <i>et al.</i> <sup>[21]</sup>	1979	39	1 yr (mean)	82
Gaches <i>et al.</i> <sup>[22]</sup>	1979	177	4 yr (mean)	81
Chilton <i>et al.</i> <sup>[23]</sup>	1983	151	5 yr (mean)	50
Holm Nielsen <i>et al.</i> <sup>[20]</sup>	1984	225	Not specified	77
Steenkamp <i>et al.</i> <sup>[14]</sup>	1997	101	14.4 mo (mean)	77
Albers <i>et al.</i> <sup>[12]</sup>	1992	937	3.9 yr (mean)	62
Pansadoro <i>et al.</i> <sup>[24]</sup>	1996	224	8 yr (median)	32
Santucci <i>et al.</i> <sup>[2]</sup>	2010	74	14 mo (median)	8

**Table 2: Results of comparative studies of CIC versus no CIC following DVIU**

Author	Type of study	Stricture recurrence (%) (CIC)	Stricture recurrence (%) (No CIC)	Frequency and duration of CIC
Harris <i>et al.</i> <sup>[35]</sup>	Prospective randomized	40 (CIC 6 mo) 16 (CIC > 1 yr)	-	Biweekly
Kjaergard <i>et al.</i> <sup>[34]</sup>	Prospective randomized	19	68	Weekly for 1 yr
Bodker <i>et al.</i> <sup>[40]</sup>	Prospective	78	82	Bi weekly for 3 mo
Matanhelia <i>et al.</i> <sup>[41]</sup>	Prospective randomized	24	20	Bi weekly 4 mo
Lauritzen <i>et al.</i> <sup>[42]</sup>	Retrospective	9	31	Variable (biweekly most common)

CIC - Clean intermittent catheterization

### Stricture site

The Bulbar urethra has better vascularity than the pendulous urethra and many studies have reported lower recurrence rates for bulbar urethral strictures in comparison to more distal ones.<sup>[12,13,15,24]</sup>

### DOES STRICTURE ETIOLOGY IMPACT THE OUTCOME OF DVIU

Nielsen *et al.*<sup>[20]</sup> found that iatrogenic strictures had higher recurrence rates than inflammatory or traumatic strictures, whereas another study<sup>[30]</sup> showed better results for iatrogenic strictures. Two studies<sup>[15,24]</sup> found inflammatory strictures occurring after long-term catheterization or genital infection to be associated with higher chance of recurrence. Others have found no relationship between stricture etiology and risk of recurrence.<sup>[14,24]</sup>

There is no consensus on whether stricture etiology predicts recurrence, as different studies have proposed different etiologies as poor responders to DVIU.

### THE ROLE OF REPEAT URETHROTOMY

Heyns *et al.*<sup>[13]</sup> analyzed the role of repeated urethrotomies in patients who had a stricture recurrence after the first urethrotomy. They showed that after a single dilatation or a DVIU, not followed by restricting at 3 months, the stricture recurrence rate was 55-60% at 24 months and 50-60% at 48 months. After a second DVIU for stricture recurrence at 3 months, the stricture-free rate was 30-50% at 24 months and 0-40% at 48 months. After a third dilatation or DVIU for stricture recurrence at 3 or 6 months, the stricture-free rate at 24 months was 0. These authors feel that repeat urethrotomy has no role when stricture recurrence occurs within 3 months of the DVIU or recurs after a second urethrotomy. In the series by Pansadoro *et al.*<sup>[24]</sup> only 2 of the 47 patients treated with multiple urethrotomies achieved a good result and a third or fourth urethrotomy always failed. In a study involving 126 patients who underwent internal urethrotomy, Greenwell *et al.*<sup>[31]</sup> compared outcomes of patients who underwent either a subsequent urethrotomy or urethroplasty following a failed urethrotomy (51%). These authors demonstrated that repeat urethrotomy was neither cost-effective nor clinically effective.

## OUTCOMES ASSESSMENT AFTER VISUAL INTERNAL URETHROTOMY

Various techniques have been employed to follow up patients following visual internal urethrotomy. These include urethral calibration with a catheter, uroflowmetry, flexible cystourethroscopy, AUA symptom index and urethrographic studies, and the need for a repeat procedure. There is no uniformly accepted method of followup. Using a peak flow rate of <15 ml/sec, Pansadoro *et al.*<sup>[24]</sup> showed that stricture recurrence could be diagnosed in 84% patients who had stricture recurrence in their series. Heyns and Marais<sup>[32]</sup> showed that an American Urological Association symptom index score of >10 combined with a urine flow rate of <15 ml/sec would save 34% of patients from further invasive testing such as urethrography.

## INTERMITTENT SELF DILATATION AFTER DVIU: IS THERE A ROLE?

In 1988, Lawrence and McDonagh<sup>[33]</sup> demonstrated the feasibility of SC in patients following visual internal urethrotomy. They subjected 42 patients to this technique for 3 months and demonstrated an excellent success rate. They theorized that following DVIU, the process of SC prevents the scar from contracting while it matures. Kjaergard *et al.*<sup>[34]</sup> randomized 43 patients to either weekly ISD for 1 year or no ISD. The stricture recurrence was 68% in those who did not perform ISD versus 19% in those who did, clearly demonstrating the beneficial effects for ISD. Of note, there were 10 “drop-outs” in the treatment group and some patients discontinued ISD due to pain or intermittent UTI. In another randomized study, Harris *et al.*<sup>[35]</sup> showed that biweekly ISD, when continued for longer than 12 months, had a much lower rate of stricture recurrence (16%) when compared with the group that performed CIC for 6 months (40%). Numerous other uncontrolled studies<sup>[36-39]</sup> demonstrated the advantage of clean intermittent catheterization for the prevention of recurrence following DVIU. Two studies<sup>[40,41]</sup> that included shorter periods of intermittent SC (3-4 months) failed to demonstrate any benefit of ISD. More recently in a nonrandomized retrospective study, Lauritzen and colleagues<sup>[42]</sup> reported on outcomes of 214 patients managed with observation only or ISD after urethrotomy. The study involved patients managed in 15 different urological centers in Scandinavian countries. This was a heterogeneous group, with patients being managed differently in the participating centers. Duration of catheterization following DVIU varied significantly and the frequency of self-dilatation also varied widely from once daily to once in 30 days with the most common protocol being once weekly. Stricture characteristics at presentation, e.g., site, duration, and degree of spongiofibrosis were also lacking. The study demonstrated a significantly improved stricture recurrence rate in the SC group (9%) versus the observation group (30%) [Table 2].

There is no level I evidence to support the use of clean intermittent catheterization following DVIU. Based on the existing literature, which consists of predominantly individual case series, it is reasonable to recommend a trial of ISD, not more than once weekly to be continued at least for a year. There is no role for short-term ISD following urethrotomy.

## CONCLUSIONS

Since the introduction of DVIU by Sachse in 1972, the wheel has come a full circle. Earlier studies demonstrated excellent outcomes following DVIU and poor success of urethroplasty techniques. However the last two decades have witnessed a revolution in techniques of urethroplasty and many state-of-art centers have reported excellent long-term outcomes.<sup>[43-45]</sup> Coupled with the expansion of urethroplasty techniques, studies have highlighted extremely poor long-term outcomes for DVIU.<sup>[2,46]</sup>

In contemporary practice, DVIU is indicated for bulbar urethral strictures of less than 1 cm and minimal spongiofibrosis. A second urethrotomy may be indicated in patients who have a recurrence after 6 months or depending on patient preference. For strictures that are longer than 1 cm, multiple strictures, pendulous urethral strictures, and bulbar strictures with significant spongiofibrosis, and those that recur within the first 3 months, DVIU is associated with extremely poor long-term outcomes. ISD, weekly/biweekly for at least a year, could be attempted by patients willing to do so.

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