

# The use of Amplatz renal dilators in the minimally invasive management of complex urethral strictures

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**Introduction** To present the outcomes of using Amplatz renal dilators in the management of complex urethral strictures.

**Material and methods** From September 2011 to August 2015, 34 patients with complex urethral strictures were treated with Amplatz renal dilators assisted with internal urethrotomy. Evaluation included uroflowmetry, IPSS and post-void residual volume measurement. Under spinal anesthesia, sequential dilatations were performed with Amplatz renal dilators measuring from 8 Fr up to 24 Fr. Urethrotomy was sequentially performed.

**Results** The mean stricture length was 2.6 (1.5–3.5) cm. Preoperative mean Qmax was 4.4 (3.2–9.6) ml/sec. From September 2011 to August 2015, 34 patients with complex urethral strictures were treated with Amplatz renal dilators assisted with internal urethrotomy. Evaluation included uroflowmetry, IPSS and post-void residual volume measurement. Under spinal anesthesia, sequential dilatations with Amplatz renal dilators over an 8 Fr stylet were performed up to 24 Fr. Urethrotomy was sequentially performed. PVR was 155 (75–380) ml. Postoperative mean Qmax at 1 month was 18.4 (14.6–21.8) ml/sec,  $p < 0.001$ , at 6 months was 16.6 (9.8–18.2) ml/sec,  $p < 0.003$  and at 12 months was 12.7 (7.4–17.3) ml/sec,  $p < 0.005$ . Accordingly, mean PVR was significantly improved postoperatively, at 32 (12–88) ml in 1 month,  $p < 0.001$ , while at 6 months was 34 (28–101) ml,  $p < 0.005$  and at 12 months was 62 (38–115) ml,  $p < 0.005$ . Only 8 patients (23.5%) had a stricture recurrence in the first nine months and were treated with Amplatz dilatations alone.

**Conclusions** The use of Amplatz renal dilators in combination with internal urethrotomy is a safe and effective technique for the endoscopic treatment of complex urethral strictures in patients unfit for reconstructive surgery

**Key Words:** Amplatz dilators ↔ complex urethral strictures

## INTRODUCTION

Urethral stricture is a relatively common cause of bladder outlet obstruction in males. The most common etiology is iatrogenic injury due to urologic instrumentation. A single treatment strategy is not appropriate for all types of urethral strictures. The current first-line surgical treatment includes direct vision internal urethrotomy (DVIU) by cold knife or holmium-Yag laser and urethral dilatations

alone [1]. There are no significant differences in the terms of recurrence rates between DVIU and urethral dilatations, although blind urethral dilatations have been associated with higher complication rates. Temporary dilatation after internal urethrotomy was also described for the prevention of stricture recurrence [2]. The choice of one technique over another depends on stricture length and location, as well as, history of previous treatments. Long or refractory to endoscopic treatment of urethral strictures are

difficult to treat and are associated with significant morbidity. Urethroplasty is the treatment of choice for long or recurrent strictures after failed internal urethrotomy [3]. There are no reports in the literature regarding the use of Amplatz renal dilators in combination with DVIU for the management of urethral strictures. We present the outcomes of using Amplatz renal dilatation techniques in the management of complex urethral strictures.

## MATERIAL AND METHODS

From September 2011 to August 2015, 34 patients with complex urethral strictures were treated with Amplatz renal dilators with assisted urethrotomy. Complex strictures were regarded as those longer than 2cm, or those with failed previous simple urethral dilatation or internal urethrotomy. Patients with primary strictures shorter than 2.0 cm, pediatric patients and malignant strictures were excluded from the study. All patients provided informed consent for the procedure.

The predominant symptom was a weak urinary stream which occurred in 31 (90.5%) patients. Patient's characteristics, stricture location and etiology are summarized in Table 1. Eleven (32.3%) patients presented with suprapubic catheter. Diagnosis was based on a clinical history, uroflowmetry, ultrasound post-void residual measurement and IPSS. Retrograde urethrogram and urethroscopy were used to locate the site and to measure stricture length. All patients were assessed by whole blood count, urea, serum creatinine, urinalysis and urine culture. The etiology of urethral strictures was iatrogenic in 27 (79.4%) patients, idiopathic in 4 (11.8%) patients, two (5.9%) presented with balanitis xerotica obliterans and one (2.9%) had a history of gonococcal urethritis. The most common cause of iatrogenic urethral stricture was the unsuccessful urethral catheterization in 12 patients (44.5%). Table 2 summarizes the causes of iatrogenic urethral stricture.

The procedures were performed under spinal anesthesia. All patients are placed in the lithotomy position. A stiff nitinol core hydrophilic guide wire was placed under vision in the urinary bladder and checked fluoroscopically. A 6 French open end ureteric catheter was placed over the guide wire. If resistance or force was needed to advance the ureteral catheter, the dilatations did not begin. Proper placement of the guide wire was established by infusing contrast medium through the ureteric catheter. Sequential dilatations were performed with Amplatz renal dilators from 10Ch to 24Ch over the 8F stylet, as in percutaneous renal surgery. Amplatz dilators were advanced by rotation under fluoroscopy towards

the urinary bladder. Cold knife internal urethrotomy was afterwards performed to the whole length of dense stricture at the 10 and 2 o'clock. Care was taken to avoid contrast extravasation. Penile urethral strictures were treated with Amplatz dilators and Otis urethrotomy. At the end of the procedure, a 20Fr silicon Foley catheter was positioned over the guidewire and remained in place from 5 to 15 days. All patients commenced a self-dilatation protocol with 14Fr hydrophilic urethral catheters once a week for the first 6 months and afterwards twice a month up to a year.

Postoperatively, all patients were evaluated with clinical history, urinalysis, urine culture, uroflowmetry and PVR at 1.6 and 12 months. Retrograde urethrography was performed in all patients between 6 to 9 months postoperatively. They were also advised to attend the clinic once a year thereafter with uroflowmetry and PVR measurement. All statistical evaluations were performed by the Statistical Package for Social Sciences (SPSS). Any p-value less than 0.005 was considered as significant.

**Table 1.** Patient demographics and urethral stricture parameters

		Number of patients (n)	Percentage of patients
Etiology	Iatrogenic	27	79.4
	Idiopathic	4	11.8
	Balanitis xerotica obliterans	2	5.9
	Gonococcal urethritis	1	2.9
Patient symptoms	Weak urine stream	28	89.3
	Difficulty initiating urination	4	11.7
	Refractory urinary tract infection	4	11.7
	Interrupted weak stream	3	8.8
	Hematuria	2	5.9
	Stricture location	Bulbar urethra	21
Prostatic urethra		8	23.5
Penile urethra		5	14.7
Comorbidities	Hypertension	25	73.6
	Diabetes mellitus	7	20.5
	Chronic obstructive pulmonary disease	2	5.9

**Table 2.** Iatrogenic causes of complex urethral strictures

Unsuccessful urethral catheterization	12 (35.29%)
Transurethral prostatectomy	9 (26.4%)
Radical retropubic prostatectomy	6 (22.2%)
Transurethral resection of bladder tumour	3 (11.1%)
Open prostatectomy	4 (14.8%)

## RESULTS

A total of 34 male patients with complex urethral strictures was analyzed. These patients either declined or were not eligible for reconstructive urethral surgery. Twenty-three (67.6%) patients had strictures longer than 2 cm and 11 (33.4%) patients had strictures refractory to endoscopic treatment. Six patients had received internal urethrotomy and 5 patients had blind urethral dilatations alone. Patients with recurrent strictures had an average of 2.5 procedures per patient (range 1 to 4 procedures).

Mean age was 66 (54–88) years. The median stricture length was 2.6 (1.5–3.6) cm. Preoperative uroflowmetry showed mean Qmax 4.4 (3.2–9.6) ml/sec and mean ultrasound measured post void residual volume (PVR) was 155 (75–380) ml. Mean preoperative IPSS score was 19 (14–22). Postoperative mean Qmax was 18, 4 (14.6–21.8) ml/sec at one month  $p < 0.001$ , 16.6 (9.8–18.2) ml/sec at 6 months,  $p < 0.003$  and 12.7 (7.4–17.3) ml/sec at 12 months  $p < 0.005$ . Accordingly, mean PVR was significantly improved postoperatively, at 32 (12–88) ml in a month,  $p < 0.001$ , at 6 months was 34 (28–101) ml,  $p < 0.005$  and at 12 months was 62 (38–115) ml,  $p < 0.005$ . Mean postoperative IPSS score was significantly improved and remained relatively steady at 1 month (9), at 6 months was 11 and at 12 months was 12, respectively (Table 3). Mean operative time was 32 (22–46) minutes and mean hospital stay was 2.8 [2–5] days. Complications included 3 postoperative febrile urinary tract infections treated with antibiotics. One macroscopic hematuria and 2 periurethral contrast extravasations were treated conservatively with longer stay of the urinary catheter. Eight patients (23.5%) had a recurrence in the first 9 months postoperatively. These patients had longer than 2.5 cm iatrogenic strictures preoperatively. All of them reported deterioration in the urinary flow between 4 to 9 months during follow-up. Recurrences were immediately diagnosed with a retrograde urethrogram and a subsequent urethroscopy. Three were located in penile urethra, 3 in bulbar and 2 in prostatic urethra with stricture length of less than 2 cm. All of them were treated with Amplatz renal dilatations alone.

## DISCUSSION

Urethral stricture is a chronic fibrosis and narrowing of the urethral lumen caused by an acute injury, inflammatory conditions, and/or iatrogenic interventions [4]. Although the success rates of internal urethrotomy are inferior to urethroplasty (50% compared to 83%), the ease and safety of internal

**Table 3.** Preoperative and postoperative parameters in patients with complex urethral strictures treated with Amplatz dilators assisted urethrotomy

Parameters		Mean	Min-Max
Pre-operative		4.4 ml/sec	3.2–9.6 ml/sec
Post-operative	1 month	18.4 ml/sec	14.6–21.8 ml/sec
Qmax (range)	6 months	16.6 ml/sec	9.8–18.2 ml/sec
	12 months	12.7 ml/sec	7.4–17.3 ml/sec
Pre-operative		155 ml	75–380 ml
Post-operative	1 month	32 ml	12–88 ml
PVR (range)	6 months	34 ml	28–101 ml
	12 months	62 ml	38–115 ml
Pre-operative		19	13–23
Post-operative	1 month	9	3–11
IPSS	6 months	11	3–14
	12 months	12	5–15

urethrotomy make it the procedure of first choice for the treatment of male urethral strictures. The success of endoscopic treatment either cold knife or laser, depends on the location and length of the stricture, with the highest success rates found in those with bulbar strictures less than 1 cm. Studies have shown that success rates are 32–90% and the recurrence rates are 38–75% after internal urethrotomy [5, 6, 7]. There have been some attempts to establish which surgical method is the most efficient and cost-effective, but clinical data is insufficient. Wong et al. compared the outcomes of urethral dilatation and optical urethrotomy in 210 adult men with urethral stricture disease. No significant difference was found in the proportion of men being stricture free at three years or in the median time to recurrence [8]. Steenkamp, and coworkers [9] made a prospective randomized trial between dilatation and internal urethrotomy with a group of 100 patients in each treatment. After 4 years, the trend for urethrotomy was better, but statistical significance was not reached. Most of the refractory strictures appeared within the first 12 months after surgery. Longer strictures are less responsive to the endoscopic treatment, with success rates of only 20% for strictures longer than 4 cm in the bulbar urethra [10]. Additionally, urethral strictures that have been previously endoscopically treated are unlikely to be successfully treated with another endoscopic procedure, with high failure rates. Repeated endoscopic treatment may cause longer strictures, and may increase the complexity of subsequent urethroplasty [11]. Santucci et al., demonstrated that a third direct vision internal urethrotomy (DVIU) results in 100% failure for the procedure [12]. Therefore, repeated

internal urethrotomies or dilations are neither curative or cost-effective.

Debate still exists regarding the definition of the surgical success rate and standard treatment modalities for complex urethral strictures. Currently, urethroplasty is regarded as the treatment of choice for complex urethral strictures [13]. In patients who are unable to undergo, or who prefer to avoid urethroplasty, repeated endoscopic procedures, with self-catheterization may be considered as an alternative approach [14, 15].

For a long time, Amplatz renal dilators have been used for tract dilatation in percutaneous renal surgery, but these dilators have not been routinely used for the dilatation of urethral strictures. Guidewire-assisted urethral dilatation avoids the risks associated with blind dilatation techniques, such as false path or hematoma [16].

In our cohort of 34 patients with complex strictures who were unwilling or were not eligible for urethroplasty; Amplatz renal dilators were safely used combined with internal urethrotomy. Under fluoroscopic guidance, the same maneuvers with renal percutaneous surgery were employed, with rotation and advancement of the dilators over the 8Fr stylet towards the urinary bladder. The performance of internal urethrotomy with the goal to transect the scar dense tissue in all its thickness is of major importance for the reduction of recurrences. Periurethral contrast agent extravasation after urethrotomy should be avoided, because it promotes fibrosis and subsequently stricture recurrence. To our knowledge this is the first report in the literature of the successive use of Amplatz renal dilators in combination with internal urethrotomy for the management of complex urethral strictures. Akkoc et al., in a cohort of 26 men with primary urethral strictures shorter than 1.5 cm, (median stricture length 0.82 cm), quote that they had no recurrences at 12 months follow-up after using Amplatz renal dilators alone, irrespective of the stricture location [17]. A self-catheterization protocol was commenced in all our patients in order to reduce stricture recurrences. There was not enough evidence to support the routine use of self dilatations after endoscopic

treatment of urethral strictures [18]. Studies using varying self dilatation schedules after DVIU, ranging from daily to weekly, have demonstrated that stricture recurrence rates were significantly lower among patients performing self-dilatations [19]. Although, the optimal protocol remains uncertain, data suggest that performing self-dilatation for greater than four months after DVIU reduced recurrence rates compared to patients performing self-dilatations for less than three months [20, 21]. All our patients used 14Fr hydrophilic urethral catheters once a week for the first 6 months and then twice a month up to a year.

The relatively low 23.5% recurrence rate in our cohort is comparable with the almost 40% of patients requiring auxiliary measures after primary urethroplasty for complex urethral strictures [22]. This was achieved due to our strict follow-up protocol with uroflowmetry and retrograde urethrography in the first 9 months after surgery.

Our study is unique regarding the use of minimally invasive techniques for the management of complex urethral strictures, although still remains a retrospective one. A limited number of patients and a short follow-up time are limitations of this study. Further prospective adequately powered trials with a bigger number of patients and longer follow-up are needed to establish the value of Amplatz renal dilators with assisted DVIU for the management of complex urethral strictures.

## CONCLUSIONS

Urethroplasty is the standard treatment for complex urethral strictures. Guidewire-assisted urethral dilatation with Amplatz renal dilators and subsequent urethrotomy is a safe and cost-effective procedure that avoids the risks associated with blind dilatation techniques. It can be used in patients with complex urethral strictures who are unfit or unwilling to undergo major reconstructive surgery. This technique can be performed in any urological operating center.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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