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Original Article

Antegrade Urethral Approach for Urethral Stricture in Patients with Previous Failed Retrograde Intervention

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HIGHLIGHTS

- A novel technique can be done on the patients as a daycare procedure in Patients with Previous Failed Retrograde Intervention.
- Antegrade Urethral Approach is easy, cost-effective, and can be tolerated well.

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ABSTRACT

Introduction
Urethral stricture has challenging difficulties in its treatment. Various treatment modalities had been used e.g.; urethral dilatation is one of the oldest methods. Severe bleeding and several false passages may end to failure, which may make retrograde access impossible. The purpose of this study was to describe safety in antegrade accessing followed by retrograde dilatation with am Platz renal dilator.

Methods
The total number of 15 patients with difficult urethral stricture and failed retrograde approaches were entered into the study. Guidewire was passed through the cystostomy for proper retrograde accessing which was delivered through external urethral meatus followed by retrograde dilation. Patient parameters were analysis, all patients had retrograde urethrography (RUG) pre-and post-operative, max flow rate (Qmax) on uroflowmetry (UF) in addition to post voiding residual urine (PVR). Patients were followed at 2, 6, and 12 months. The technique described was enabling us to get safe antegrade urethral access followed by stepwise retrograde am Platz renal dilation.

Results
The mean age of patients was 39.2 ± 16.7 years. Preoperative uroflowmetry demonstrate Qmax 2ml/sec and ultrasonography showed PVR of 315ml ranging from 35 to1000ml. In post-operation uroflowmetry Qmax was raised to 19ml/sec (p-value<0.001), 18 ml/sec (p-value<0.001) and 15ml/sec (p-value<0.001) respectively. PVR values were 9ml with (p-value<0.001), 11ml (p-value<0.001) and 13ml (p-value<0.001) respectively. Operation time was 10 minutes for antegrade passage of a guidewire, followed by 25 minutes for retrograde dilatation. In patients who had was no cystostomy, an average of 32 minutes was required. Two patients had recurrence during a 12 months follow-up.

Conclusions
The antegrade approach is a safe applicable approach for the treatment of difficult urethral stricture, followed by retrograde stepwise dilatation. This technique can be tolerated well and cost-effective for patients in whom getting retrograde access was not possible and may avoid these patients to go under urethroplasty.

Keywords: Antegrade; Dilatation; Urethral Stricture; Am Platz Dilators; Cystostomy

Introduction

One of the common diseases in the field of urology is urethral stricture which is having complex issues due to difficulty in diagnoses, treatment, and high recurrent rate. External trauma is considered as a major cause of partial or complete urethral injuries but still, the pathology of the disease is poorly understood (1).

The mechanism by which the urethral stricture had been formed in patients without trauma is unclear and it may be consequences of the changes in structure and function of the urethral epithelium in addition to

fibrosis of sub-epithelial spongy tissue which may lead to urethral narrowing (2). In the past few years, there have been various improvements in the treatment of urethral stricture. Yet there is no golden technique for the treatment of this problem. Urethral dilatation and internal urethrotomy are the most commonly performed procedure for the treatment of urethral stricture.

The first line surgical treatment for urethral strictures is internal urethrotomy with a cold knife or Laser (3, 4) but these techniques have high rate of recurrences and may need additional surgery. Some authors advised temporary dilators after internal urethrotomy to prevent strictures recurrence (5, 6).

Nowadays the preferred technique is internal urethrotomy followed by intermittent self-urethral dilatation. The surgeon who tries to perform urethral dilatation may not be able to have a successful outcome due to the presence of several false passages and severe bleeding leading to the inability to find the correct urethral pathway. These patients are a candidate for open reconstruction (7).Using the cut to the light technique which has been done by Leonard (8) may have a high complication rate as is it done blindly (9, 10).

Traditionally urethral dilation had been performed by rigid dilators e.g., Beniquet and Van Buren dilator or other metal and filiform devices (11), which are effective in the treatment of post urethroplasty and focal urethral stricture. It is performed as an outpatient procedure modality in patients who are not willing to go under urethroplasty or not stable for anesthesia. The traditional methods for dilation were perfumed blindly and the risk of complications such as urethral perforation, severe bleeding with urine extravasations and false passage, even rectal injury had also been reported (11).

During the past 20 years, we had patients in which we could not treat their urethral stricture retrogradely because of several false passages in the urethra or severe bleeding. In the present study, we describe the possible technique for the treatment of urethral stricture by approaching urethra antegrade via cystostomy to pass guidewire followed by retrograde dilatation. We present the outcome of our patients; also, we discuss the data with the related literature review.

Methods

The study was performed prospectively under the Shahed university ethical committee (*IR.SHAHED.RECC.1399.027*). All patients signed informed consent before enrolling. A total of 15 male patients with difficult urethral stricture was enrolled in the study. Inclusion criteria were patients with urethral stricture diagnosed by retrograde urethrography and failed the previous try for treatment, the exclusion criteria were patients with successful retrograde accessing for dilatation of urethra, malignant stricture, obliterated urethral stricture, and history of lower abdominal surgery (which makes it difficult to accessing bladder safely for obtaining percutaneous cystostomy). All patients provided informed consent. Laboratory evaluation: complete blood count (CBC), blood urea nitrogen (BUN), Creatinine, urine analysis (U/A), and urine culture (U/C) were performed in all patients. Diagnosis of urethral stricture was based on history, uroflowmetry, ultrasonography for assessing residual urine (which was estimated only with an empty bladder). RUG was performed to assess the site and length of urethral stricture. Before the surgery, the first-generation cephalosporin was advised prophylactically for all patients and was kept as maintenance until the patient was catheter free (10 days after surgery). All patients were evaluated by history, U/A, U/C, uroflowmetry, PVR by sonography, at 2, 6, and 12 months after surgery. RUG was done 6 months after surgery. They were advised to visit the clinic at any time they have any complain and have yearly visits as well.

The criteria for success in surgery were Qmax more than 15ml/sec on uroflowmetry and ability to pass 18fr catheter at 2, 6, and 12 months postoperatively. Criteria of recurrent stricture were Qmax<10ml/s on uroflowmetry and inability to pass 18fr catheter. Patients were advised to do sonography only with an empty bladder without filling the bladder to estimate residual volume. Because filling the bladder, till the max capacity will cause difficulty in normal emptying so the patient will have a wrong residual volume. The relapse was identified as a need for reoperation due to recurrent stricture. All patients were placed in lithotomy position the procedure was performed under General anesthesia, Regional anesthesia, or IV sedation. In all patients retrograde try was done to get through the stricture and if it was failed patient was entered into the study. In patients who had cystostomy, the procedure was performed through the same track and if the patients were not having cystostomy he was given one liter of IV normal saline plus furosemide 20mg. Patients' hemodynamics was controlling not to induced Hypertension or Hypotension. After waiting to get the bladder filled with urine, the Chiba needle was inserted 5cm at midline above the pubic symphysis, the urine withdrawal was followed by passing guidewire into the bladder and Stepwise dilatation perform by allek dilator till 22fr Amplatz shield was inserted into the bladder. Then cystoscopy was performed through cystostomy bypassing 17fr cystoscope into the Amplatz sheet and internal urethral orifice was identified antegrade, a guidewire was inserted into urethral antegrade, an assistant was pulling the patients' penis up and dorsally to make easy passage of a guidewire. The guidewire is being pushed antegrade into the urethral orifice. The guidewire is retried at the external urinary meatus (Figure 1). The surgeon will change his position to the cystoscopy side and stepwise

dilatation is being performed retrograde till 14fr. Each dilator from 6, 8, 10, 12, 14fr was left in the urethral for 3 minutes. Then cystoscopy was performed by 17fr cystoscope. Cystoscopy is performed retrogradely through natural urinary meatus by the following guidewire under direct vision. The lens of the cystoscope is withdrawn and the 8fr stylet of Percutaneous nephrolithotomy (PCNL) is inserted into the bladder through the sheet of the cystoscope followed by stepwise dilatation, as it is done in percutaneous surgery until 30fr. Dilators from 16, 18, 20, 22, 24, 26, 28, and 30fr were left inside the urethral tract for 5 minutes each, not only to induce the dilatation but also to help hemostasis which is done by side pressure of dilator on the urethral wall to reduce the bleeding. If the bleeding was observed after dilator withdrawal, it was reinserted again for an additional five minutes to get better hemostasis. The duration may vary according to length, the hardness of fibrosis at the stricture site, and the severity of bleeding. During each step in between inserting next the dilator, 10ml of lidocaine gel 2% was inserted into the urethral for easy passage of dilators, and the length of inserted dilator was measured on every step of dilatation; care is taken not to over insert the dilator. It should pass the bladder neck but not so deep to perforate the bladder. The felling of the fibrotic tissue consistency and its length was always memorized in the mind to do dilatation precisely and avoid any possibility of bladder or rectal perforation. Also, after each step of dilatation, a 17fr cystoscopy was performed to evaluate the urethral and readjust 8fr stylet length in the bladder. The dilation is done till 30fr (Figure 1).

Then a 24fr silicon catheter is placed in the urethral. The proper placement of the catheter was confirmed via antegrade cystoscopy. Cystostomy is removed at the end of surgery. The urethral catheter will be maintained for 10 days.

Statistics data were evaluated by social sciences (SPSS) and p-values less than 0.05 were considered as significant. Test Shapiro-wilk was used to analyzing the result.

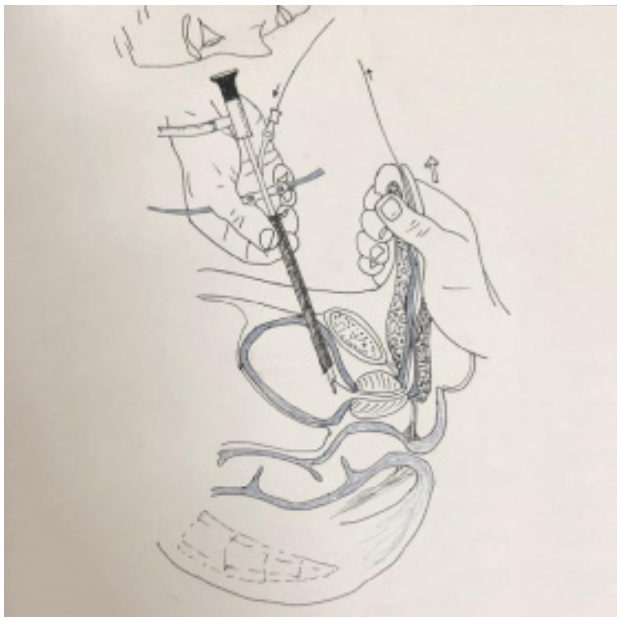

Figure 1. Schematic presentation of the procedure.

Results

A total of 15 male patients who had a difficult urethral stricture and retrograde access was failed were analyzed, getting antegrade access was successful in all patients. The reasons for failure during the initial retrograde approach were false passages in 13 patients and severe bleeding in two patients.

The main age of patients was 39.2 ± 16.7 (17- 83) years, the median stricture length was 1.1 (0.2- 3.5) cm. The main symptoms were urine retention in 10 (66.6%) patients, In rest 5 (33.3%) patients without retention, the main symptoms were weak urine stream in 5 patients, painful urination in 3 patients, difficulty in urination in 5 patients, interrupted micturition in 5 patients, hematuria 1 patient, and incontinency 2 patients. History of refractory lower urinary tract infection (UTI) 3 patients. All patients were given a history of unsuccessful previous intervention for the treatment of their urethral stricture, in 3 patients three times, in 9 patients two times, and one time in 3 patients.

Etiology of urethral stricture was iatrogenic in 4 patients (3 patients give the history of transurethral resection of the prostate (TURP) and 1 patient catheterization respectively), idiopathic in 7 patients, urethral trauma in 2 patients, and sexually transmitted disease (STD) in 2 patients (Figure 2). 13 patients were having urethral stricture in the bulbourethral, 1 in the prostatic urethra, and 1 patient in the penile urethra (Figure 3). All patients either refused or not fit for reconstructive urethral surgery. Uroflowmetry before the surgery showed a mean Qmax of 2 (0-9) ml/sec. In 5 patients who were not having cystostomy ultrasonography showed a mean PVR of 62 ml (40-400) ml (the sonography was done only without filling phase and the patient was told to empty the bladder before sonography).

Three patients had positive U/C yield to the growth of susceptible E.Coli which were treated according to antibiotic sensitivity. Total 10 patients were having cystostomy at the time of presentation, in 5 patients' cystostomy was perform at time of failed retrograde accessing. Preoperative uroflowmetry demonstrate Qmax 2 (0-9) ml/sec and ultrasonography showed PVR of 315ml ranging from 35- 1000ml. In post operation uroflowmetry Qmax was raised to 19ml/sec (p-value<0.001) at 2 month,

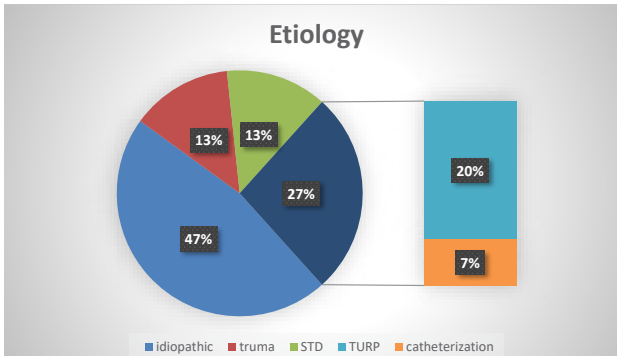

Figure 2. The etiology of urethral stricture was iatrogenic in 4 patients.

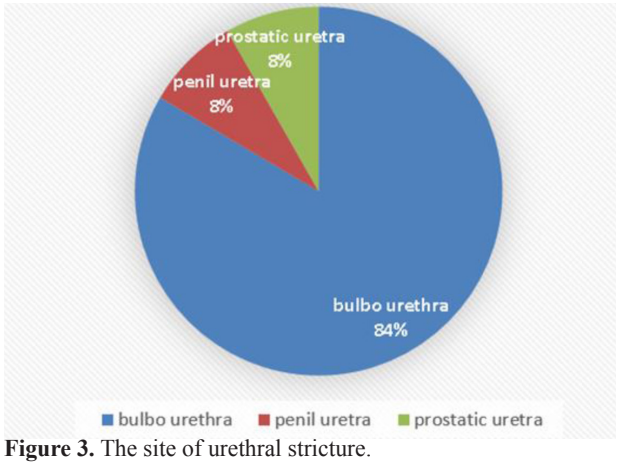

Figure 3. The site of urethral stricture.

18ml/sec (p-value<0.001) at 6 month and 15(12-17) ml/sec (p-value<0.001) at 12 month. PVR values were 9ml ranging from 5 to 31ml with p-value<0.001 at 2 months, 11ml (p-value<0.001) 6 months and 13ml (p-value<0.001) 12 months (Table 1). The procedure was performed by general anesthesia in 4 patients, spinal anesthesia in 3 patients, and IV sedation in 8 patients respectively.

The mean procedure time was 10 (8-15) minutes in patients who had cystostomy to pass the guidewire antegrade and getting it delivered at external urinary meatus. The duration of the dilatation was about 60 minutes. In patients without cystostomy, an additional average of 50 (30-90) minutes was required to get the bladder full of urine and have safe suprapubic access to the bladder. All patients were discharged on the same day. All procedure was performed in a highly accurate manner, there was no complication. One patient in the cystostomy group and one patient in the non-cystostomy group had severe bleeding during the initial try for a retrograde approach. The bleeding was scant after gaining proper dilatation by the guidance of antegrade pass guidewire. There was no need for blood transfusions in any of the patients.

Table 1. Comparison of baseline clinical characteristics before and after treatment.

	PVR	Qmax
Preoperative	315 (35-1000) cc	2 (0-9) ml/sec
2 months	9 (5-31) cc	19 (15-22) ml/sec
6 months	11 (7-37) cc	18 (15-22) ml/sec
12 months	13 (9-21) cc	15 (12-17) ml/sec

Data are presented as a number. PVR: Post Voiding Residual; Qmax: Max Flow Rate

There was no sign of rapid recurrent in 13 patients and only two patients required re-dilatation at 2 and 3month months follow-up. Recurrences were diagnosis with retrograde urethrogram and inability to pass 18fr foley catheter. Patients with recurrent were dilated in a routine retrograde fashion through the urethral. Patients who had recurrent are on monthly self-catheter dilatation with 20fr silicon catheter. No patients needed urethroplasty. No major problem was noted during follow-up.

Discussions

Urethral stricture is one of the common urologic problems and had been mentioned in very old publications (12). Its treatments are varies according to the location and length of the stricture. The density of fibrotic tissue of the affected area is also an important parameter affecting the outcome of treatment (7). Internal urethrotomy is the first option for the majority of the cases (13), it has various success rates from 32-92% and recurrent rates of 38-77% (14, 15). The previous success rate in the use of dilatation and laser urethrotomy is 60% and 70% respectively (16, 17). In the experience mentioned by Ali akkoc et al., they found the treatment of urethral stricture by Ampltz renal dilator is highly successful and they had no recurrence 1 year after surgery (11). Various techniques have been introduced for male urethral stricture but clinical data are limited (18). Comparing the efficacy in using dilator vs. internal urethrotomy for treatment of urethral stricture the data are limited and in most of the studies if they fail during retrograde accessing to get into the bladder the patient was advised to go under urethroplasty (19).

Dilatation and urethrotomy seem to have an equal effect but treatment efficacy is reduced when stricture length is longer, so this technique is usually advised for patients with short stricture (less than 2cm). Patients with long stricture (>4cm) should be treated with primary urethroplasty (16). There is no evidence to prove that internal urethrotomy is better than urethral dilatation but it seems urologists are more in favor of urethrotomy.

Since the sixth century, Urethral dilatation has been used for the management of urethral stricture (11, 20). There was no need for any anesthesia or IV sedation. It requires less surgical experience and equipment. It is simple, less invasive, and can be done in the office (21, 22). The use of the blind technique for dilatation is still being practice widely and has a high complication rate which includes severe bleeding, false passages, rectal perforation, and fistula. Guidewire assisted urethral dilatation under direct vision by cystoscope decrease the risk of complication. The use of guidewire and Alken dilator has been used for percutaneous access in renal surgery and their use is not common in urethral stricture (23). The use of Alken dilator has been using by Ali Akkoc et al., and we also have been using it for the last 15 years in our practice (7). Patients with a flow rate less than 5ml/sec, overflow incontinency, and high residual volume on sonography show a higher chance of recurrent. These patients are potentially at risk of acute retention (24), most of our patients had cystostomy, only 5 patients did not have cystostomy which was able to urinate with difficulty.

In our study, no patient needed a blood transfusion as it was needed by Tawfik H Al-Ba'adani (25). We performed the procedure on the outpatients' basis and all of them were discharged on the same day. Comparing it with a cut to light technique, our technique needs only one surgeon and assistance but to perform the cut to light technique two surgeons are needed (25). Some of the authors advised temporary dilatation after urethrotomy to decrease the chance of recurrence (5, 6). Two of our patients had recurrent and they are on monthly self-dilation with a 20fr silicon catheter.

We have dilated the stricture tract with help of guidewire and periodic monitoring of it by direct vision during surgery, so we felt more confident than blind dilatation. A complication of blind dilatation for treatment of urethral stricture could cause false passages, rectal performance, and injury to other nearby organs (26-28). In the review published in 2012 comparing complications of internal urethrotomy and urethral dilation, the finding was comparable. In both groups, the rate of false passage is the same (dilation 0.94% vs. urethrotomy 0.96%) (18). We had under-mining of dilator behind the bladder only one patient which did not develop any consequences. No major hematuria was observed postoperatively. Generous use of lubricant could ease the procedure providing effective and easy dilatation by dilators. We inserted the dilator by yo-yo rotation which made them pass easier. Usually, surgeons maintain urethral catheters for the various duration from 1 day to 3 months, but yet there is no proper advice on the duration of catheterization and its impact on the rate of recurrence. Albert et al., (26) stated less urethral catheter duration in place will have a lower rate of recurrent as compare to leaving it for long period. He reported recurrent rates of 34%, 43%, and 65% for less than 3 days, 4-7 days, and >7 days respectively. The usual duration of catheterization is 1-4 days (16, 27). Catheter size does not affect the rate of recurrent (28).

We used a 24fr silicon catheter and it was kept for 10 days in all of our patients. We believe the use of a large-caliber catheter for a reasonable period decreases the rate of recurrence as is stated by Akkoc A et al., as well (7). Larger Catheter size and a reasonable period of catheterization will have better epithelization of urethral mucosa over larger catheter diameter. In various study follow-up time after internal urethrotomy is between 2-96 months with a success rate of 8-100% (5, 29).

There is only a little study comparing internal urethrotomy will urethral dilatation. Mayo clinic reported treatment of 199 patients. Of the 151 patients receiving treatment at the time of initial diagnosis, 101(67%) and 39 (26%) underwent dilatation and direct vision urethrotomy respectively in 11 (7%). A cystotomy tube was placed. The median follow-up was 3.5years during which 65% in the dilatation group and 68% in the urethrotomy group did not require re-treatment in 3 years, which means both procedures are equally effective (22). Steenkamp (16) found no statistical significant after 4 years of follow-up in a group of 100 patients following urethrotomy and dilatation. Usually, refractory stricture appears within 12 months. Santucci reported an average time of 9 months after urethrotomy and 20 (1.1%) of their patients required urethroplasty as a second operation due to recurrence at follow-up on 17 and 21 months (30).

One of the main reasons for the development of longer and more complex urethra stricture is repeated previous endoscopic approach which may increase the chance of unsuccessful treatment. Santucci et al., mentioned 100% Failure in third internal urethrotomy (30) So it is not advised to perform urethrotomy or dilatation in these patients. But using the antegrade approach seems to change this status. One of our patients which was a medical student who was advised to go under urethroplasty refuse to do the surgery and started the surgery will decrease the length of the penis (31)

Our technique seems to be having better results comparing with blind dilatation and it is a potential alternative to internal urethrotomy. Its cost-effective procedure, use of a cold knife is possible for 10-12 operation but then it becomes blunt, instead Allek dilator is disposable and 8- 10 operations can perform by them so it reduced the cost of the procedure (7).

We use lidocaine jelly generously to get ease in performing the procedure. We used a 24fr silicon catheter in all patients to have more fibrous tissue traction and less tension on the stricture site at the time of recovery (due to the larger diameter of the catheter). We think catheter size and diameter of dilation do affect the rate

of recurrence. We think dilatation with Alken dilators over 8fr stylet (used in PCNL) will induce less bleeding eventually decrease the formation of scar tissue due to the mechanism of stretching the fibrotic tissue by dilators but in urethrotomy, the injury to tissue and urethra will be much more as well as it may be associated with severe bleeding and inflammation. The mechanism in dilatation is stretching of scar tissue but in urethrotomy, cutting will induce more inflammatory reaction as compared to stretching, so the low rate of recurrent in our patients could be due to less scar formation. The antegrade approach is being used in our hospital for the last 12 years without any major complication; it is safe in all patients with various length of the stricture. To have better judgment it needs a randomized study with longer follow-up and a larger patient population comparing it with other treatment modalities.

Conclusions

Antegrade approach for performing guidewire assisted urethral dilation with Alken renal dilator is safe. It can be done with a routine urology instrument. The procedure is practical and cost-effective moreover it can be performed as a daycare procedure. It seems that it could decrease the need for urethroplasty in selected patients.

Authors' contributions

SA was the main responsible of study conception and design, FK wrote the manuscript and provided data, SKF supervised the process and edited the manuscript. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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Ethical statement

The study was performed prospectively under the Shahed university ethical committee (IR.SHAHED.RECC.1399.027). All patients signed informed consent before enrolling.

Abbreviations

BUN Blood urea nitrogen
CBC Complete blood count
PCNL Percutaneous nephrolithotomy
PVR Post voiding residual urine
Qmax Max flow rate
RUG Retrograde urethrography
STD Sexual transmitted disease
TURP Transurethral resection of the prostate
UF Uroflowmetry
UTI Urinary tract infection
U/A Urine analysis
U/C Urine culture

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