Original Article

Novel surgical technique for female distal urethral stricture disease: an evaluation of efficacy and safety compared with urethral dilatation

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Abstract: Objective: The aim of this study was to review the efficacy and safety of the use of a dorsal-onlay pedicled labium flap for urethroplasty and urethral dilatation in the treatment of female urethral strictures (FUS). Patients and methods: A retrospective review of 22 women with FUS was conducted. Ten of these patients received urethral dilatation while the other twelve patients were treated with dorsal-onlay pedicled labium flap urethroplasty. All patients underwent pre-treatment and post-treatment evaluation. Results: One patient receiving urethral dilatation was lost to follow up 7 months after treatment. Others were evaluated at 12th months. Range of the follow-up period was 7-12 months. Range of follow-ups in the surgical group was 6-15 months. According to statistical analysis, quality of life (QOL), American Urological Association (AUA) symptom scores, urination symptom scores, and post-void residual (PVR) and maximum flow rates (MFR) were all obviously improved in both two groups (P<0.05). Comparing the two forms of therapy, there were no significant changes in terms of AUA symptom scores, urination symptom scores, and PVR (P>0.05), although post-surgical median QOL and MFR were significantly better than urethral dilatation at the last follow-up (P<0.05). No complications were observed during or after urethroplasty and no recurrence or recurrent urinary tract infections were reported during follow-up. Conclusion: Urethral dilatation and dorsal-onlay pedicled labium flap urethroplasty can be used in the treatment of FUS. However, urethroplasty can resolve FUS in one application without complications, with greater advantages in terms of patient satisfaction and MFR.

Keywords: Female urethral stricture, urethral dilatation, urethroplasty

Introduction

Female urethral stricture (FUS) is very rare and is almost always neglected by both patients and doctors. Main symptoms of FUS include frequent micturition, urgent urination, dysuria, micturition waiting, urinary stream thinning, a sense of incomplete emptying, and repeated urinary tract infections. Incidence of bladder outlet obstruction (BOO) in female patients with lower urinary tract symptoms ranges from 2.7% to 22.4% [1-5]. In 2.7% to 8% of these patients, symptoms are caused by urethral stricture [6-8]. FUS occurs most often in the distal urethra and is far less common in the proximal urethra [9].

The pathogenesis of FUS involves trauma, iatrogenic injury, infections, radiation damage, and idiopathic stricture [3, 10-12]. The most common factors are iatrogenic injury and trauma, accounting for 42% and 15% of morbidity, respectively [8].

At present, the most common therapies for urethrostenois include urethral dilatation, transurethral urethrotomy, and urethroplasty. Of these, urethral dilatation represents the first-line therapy for urethrostenois, although over 50% of patients receiving this technique might need further intervention. The proportion of recurrence in urethrostenois patients can reach as high as 73% [13]. Repeated urethral dilatation
Treatment of female urethral stricture

In an earlier review of the literature, Osman [13] suggested that urethroplasty might represent a superior therapy for urethrosteno-

**Patients and methods**

The present study retrospectively reviewed and prospectively collected data from a total of 22 women diagnosed with FUS, between February 2012 and May 2017. The median age of these patients was 54 years (range: 37-83 years). Of these, two cases were caused by trauma, five cases were caused by iatrogenic injuries, nine cases were caused by recurrent urinary tract infections (UTI), and six cases were caused by unknown factors. Ten patients were treated with long-term urethral dilatation, while the other twelve patients underwent dorsal-onlay pedicled labium flap urethroplasty augmentation.

Patient investigation strategies included history and subjective assessment of symptoms, using quality of life (QOL) scores, American Urological Association (AUA) symptom scores, routine urine tests, urodynamics, cystourethroscopies, and voiding cystourethrographies (VCUG). Some of the patients could not accommodate a 14-Fr catheter. VCUG confirmed distal urethrosteno-

**Urethral dilatation**

Ten patients were treated with progressive urethral dilatation using a 30-Fr urethreurynter, with intervals extending from once a week to once every 3 months.

**Surgical technique**

All operations were performed by the same surgeon. Following epidural anesthesia or general anesthesia, patients were placed in a dor-

may be more likely to cause urethral injuries and scarring, clearly increasing occurrence of urethrosteno-

Transurethral urethrotomy management, using a cold knife or laser incision, has been associated with risk of recurrence and urinary inconti-
Treatments of female urethral stricture

Figure 3. The urethra was carved at point 12 of the dorsal urethra and the tongue-shaped pedicel flap of the labia was selected. (1 urethral incision, 2 pedicel flap, 3 orificum vaginae).

Figure 4. The flap was rotated and sutured to the urethra defect. (3 orificum vaginae, 4 pedical flap was embedded into the urethral incision).

Figure 5. Post-operative image. (3 orificum vaginae, 5 and 6 reconstructed meatus urinarius, 7 suture of incision).

of the stricture (Figure 3). The flap was then sutured to the margins of the urethrotomy defect with an interrupted 4-0 polyglactin absorbable suture (Figure 4). The flap was rotated and sutured to the near end of the urethra defect and the near-end of flap was sutured to the orificium urethrae externum to reduce flap torsion, as much as possible (post-operative image is shown in Figure 5). A 22-Fr catheter was retained after the operation and the cut was covered by oily yarn. Broad-spectrum antibiotic therapy was administered for one week after the operation and the catheter was removed one week later.

Follow-up

During the last post-operative review (patients receiving the regular urethral dilatation were seen after one year), QOL, AUA symptom scores, maximum flow rates (MFR), and post-void residual (PVR) were assessed. Complications, such as urinary incontinence and recurrence of urethrosthenosis, were also evaluated.

Statistical analysis

A descriptive statistical assay was performed using SPSS for Mac 24 (International Business Machines Corporation, New York, USA). Data from each group were measured by the median (range). A non-parametric test was used to make comparisons between each group, with P<0.05 indicating statistical significance.

Results

Operations were performed successfully in all twelve patients. Surgery lasted between 35-65 minutes. On average, flap length was 1.0-1.5 cm with a width of 0.7-1.0 cm. The catheter was removed one week after surgery and all patients were able to urinate voluntarily. The range of follow-up was 6-15 months. No immediate or delayed complications or lasting side effects
were noted after surgery. At the last follow-up, median QOL was 2 (range: 1-3), median AUA symptom score was 16 (range: 12-21), and median urination symptom score was 9 (range: 7-12). Uroflowmetry showed that the median PVR was 35.5 mL (range: 0.0-89.0 mL) and that the Qmax was 17.9 mL/s (range: 11.3-22.4 mL/s). Each of these parameters were significantly improved following surgery (P<0.05).

One patient given urethral dilatation was lost to follow up seven months after treatment. Of patients receiving regular urethral dilatation, range of the follow-up period was 7-12 months. Three patients had recurrent urinary tract infections and pain, requiring long-term urethral dilatation. At follow-up, median QOL, AUA symptom score, and urination symptom score was 3 (range: 2-4), 16.5 (range: 14-25), and 9.5 (range: 7-15) respectively, indicating a significant reduction. Furthermore, median PVR was 57.0 mL (range: 21.0-330.0 mL) and median MFR was 8.7 mL/s (range: 5.4-11.6 mL/s) before the regular urethral dilatation and 33.5 mL (range: 0.0-46.0 mL) and 12.0 mL/s (range: 9.5-15.0 mL/s) at the last follow-up.

There were no significant changes in AUA symptom scores, urination symptom scores, and PVR (P>0.05) comparing the two treatments, while postoperative median QOL and MFR were superior to urethral dilatation at the last follow-up (P<0.05) (Table 1). Furthermore, there were no recurrent urinary tract infections after the operation.

**Discussion**

Morbidity associated with FUS is very low but is often harmful. Therefore, it has attracted more interest from urologists. Currently, there are no uniform standards for diagnosis of FUS. Urethral diameter has been accepted as the most common standard. The urethra of normal adult females should be able to accommodate at least a 30-Fr catheter [9]. Branner et al. [15] reported that a urethral diameter smaller than 20-Fr should be diagnosed as being in a pathological state, requiring treatment. However, Goel et al. [16] [Goel, 2014 #28] pointed out that the standard for FUS diagnosis should be a urethral diameter smaller than 14-Fr. These differences might have been caused by subjective evaluations of urethral diameter measurements. Defreitas [17] found that a maximum flow rate smaller than 12 mL/s when the detrusor pressure is higher than 25 cmH₂O should be diagnosed as urethremphraxis. The present study applied a 14-Fr caliber or urethral sound as diagnostic criteria.

Urethral dilatation is typically the first intervention for FUS, although the majority of published reports have suggested that urethral dilatation is only effective for a short period of time [3, 16, 18, 19]. The present study found that, although urethral dilatation can improve the voiding condition and increase maximum urine flow rates, it is not as good as urethroplasty in terms of improvements to the QOL and MFR. Furthermore, long-term urethral dilatation has been associated with pain, urethral scar formation, and poor patient satisfaction, restricting the clinical application of long-term urethral dilatation.

Increasing evidence has suggested that urethroplasty may represent the “gold standard” for achieving a long-term stricture-free outcomes without the need for clean intermittent catheterization (CIC) life [8, 20]. Grafts and flaps are two major methods of urethrosteno- sis. At present, grafts for urethroplasty include free vaginal wall [21], buccal mucosa [22], lingual mucosal [23], and labia minora [24]. Flaps can be created from the vestibular mucosa [25], pedicled vaginal wall [11], and pedicled labia minora [26].
Treatment of female urethral stricture

In the present study, a pedicel labium flap was used for the surgical group. Since the labium flap is a form of hairless elastic wet skin and is close to the urethra, the skin area is large and convenient for sampling. Furthermore, the flap is well supplied by the arteriae perinealis and has a high rate of survival. This is beneficial for union of the anastomotic stoma.

The flap can be laid onto the urethra using a dorsal or ventral approach [11, 22, 27]. Dorsal free graft urethroplasty was first proposed by Barbagli in 1996 [28]. This author placed the free graft on the back of the urethra for treatment of male urethral strictures. With reference to this operation method, Tsivian et al. [29] cured 3 cases of FUS with dorsal urethroplasty using a vaginal graft. The present study found that dorsal-onlay pedicled labium flap urethroplasty augmentation could effectively improve patient voiding symptoms, significantly increase patient satisfaction, and reduce PVR. Furthermore, there were no complications, including bleeding, infections, and necrosis of the skin flap during the perioperative period. No incontinence or recurrence of urethstenosis was observed at the final follow-up. Therefore, the present study suggests that using a dorsal approach can reduce the risk of urethral vaginal fistula and urethrocele, maintain the integrity of the urethral sphincter maximally, and reduce incidence of incontinence. Consequently, this method can solve the problems of urination once and for all, relieving patients of the pain of repeated urethral dilatation. This method is, therefore, a safe and effective technique for FUS.

However, surgical therapy of FUS has not yet reached a consensus. Due to the rarity of this condition, the present study was performed for a small number of patients. The final target is to create a new urethra allowing painless smooth micturition and continence. In clinic, more attention should be paid to FUS. Larger studies, with long-term results, are necessary to determine the most important methods in treating this condition.

Conclusion

Urethral dilatation and dorsal-onlay pedicled labium flap urethroplasty can both be used for the treatment of FUS. However, dorsal graft urethroplasty with a pedicled labium flap can resolve FUS in one application. It has not been associated with complications and has a greater advantage in terms of patient satisfaction and MFR.

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Disclosure of conflict of interest

None.

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References

Treatment of female urethral stricture


