Int J Clin Exp Med 2018;11(11):12002-12007
www.ijcem.com /ISSN:1940-5901/IJCEM0080490

Original Article

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

Ting-Ting Tao[1,2*], Qing-Kang Xu[3*], Qing Hu[1,2], Xiao-Jun Huang[1,2], Jun Chen[1,2], Wen-Zhi Wang[1,2], Bo-Dong Lv[1,2], Yue Duan[1,2]

[1]Department of Urology, The Second Affiliated Hospital of Zhejiang Chinese Medicine University, Hangzhou, Zhejiang, China; [2]Zhejiang Provincial Key Laboratory of Traditional Chinese Medicine, Hangzhou, Zhejiang, China; [3]Departmend of Urology, Jiaxing Hospital of Zhejiang Provincial Corps Hospital of Chinese People's Armed Police Force, Jiaxing, Zhejiang, China. [*]Equal contributors.

Received May 29, 2018; Accepted August 4, 2018; Epub November 15, 2018; Published November 30, 2018

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

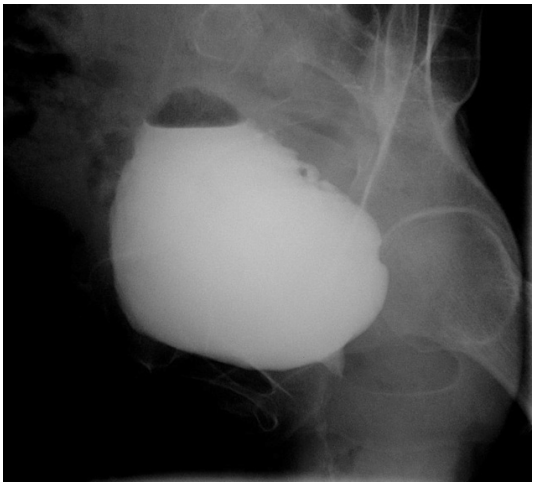

Figure 1. Voiding cystourethrography (VCUG) showing distal urethrostenosis and proximal urethral dilatation.

Figure 2. Voiding cystourethrography (VCUG) showing vesicoureteral reflux (VUR).

may be more likely to cause urethral injuries and scarring, clearly increasing occurrence of urethrostenosis. Furthermore, this will increase incidence of urinary tract infections [14]. Transurethral urethrotomy management, using a cold knife or laser incision, has been associated with risk of recurrence and urinary incontinence. In an earlier review of the literature, Osman [13] suggested that urethroplasty might represent a superior therapy for urethrostenosis, with success rates of 80-94%.

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 urethrostenosis with a length of 0.5 to 1 cm and proximal urethral dilatation (**Figure 1**). One patient showed obvious bilateral vesicoureteral reflux (VUR) (**Figure 2**).

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 dorsal lithotomy position. A 20-Fr urethreurynter was inserted through the urethral orifice to estimate the length of the urethrostenosis. The urethra was carved at point 12 of the dorsal urethra until reaching the normal urethra, while separating tissues surrounding the urethra. A tongue-shaped piece of pedicel flap was then selected, depending on the length and caliber

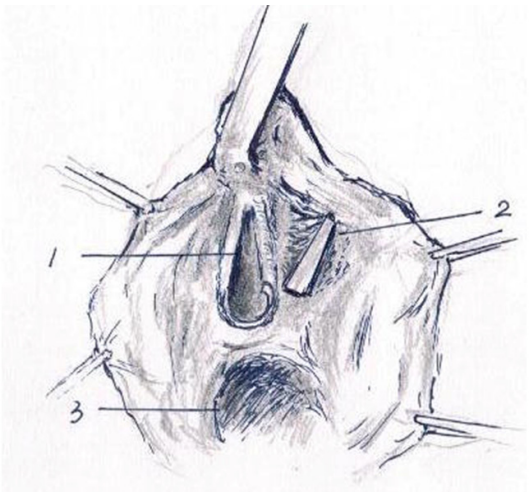

Figure 3. The urethra was carved at point 12 of the dorsal urethra and the Tongue-shaped pedicel flap of the labia was selected. (1 urethral incision, 2 pedicel flap, 3 orificum vaginae).

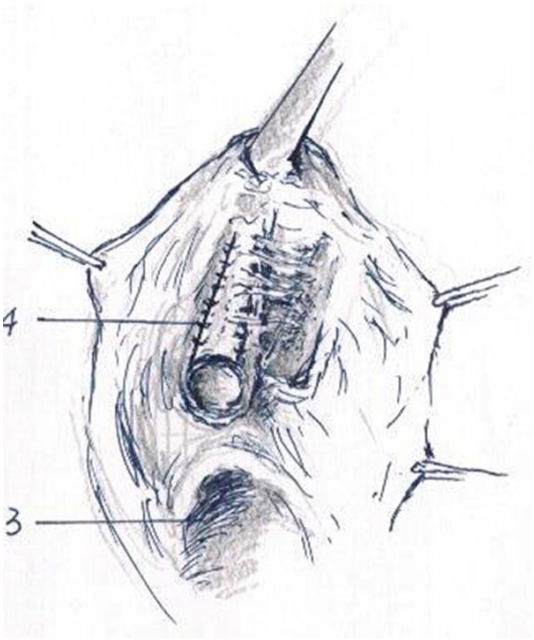

Figure 4. The flap was rotated and sutured to the urethra defect. (3 orificum vaginae, 4 pedical flap was embedded into the urethral incision).

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

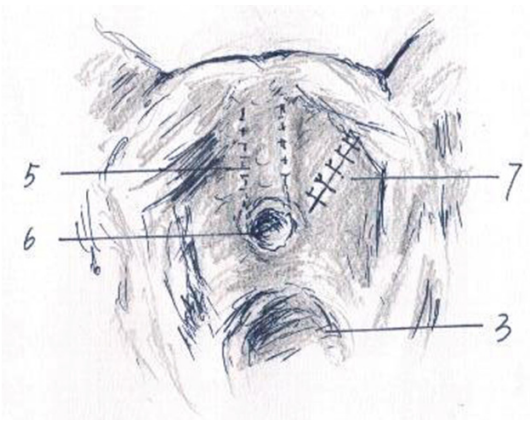

Figure 5. Post-operative image. (3 orificum vaginae, 5 and 6 reconstructed meatus urinarius, 7 suture of incision).

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 urethrostenosis, 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

Table 1. Pretreatment and posttreatment parameters (median (range))

Group		QOL	AUA symptom score	Storage score	Urination score	PVR (ml)	MFR (ml/s)
Operation (n=12)	Pre-op	5 (3-6)	19 (13-31)	7 (5-12)	12.5 (8-19)	88.5 (15.0-390.0)	8.2 (4.9-13.4)
	Post-op	2 (1-3)*	16 (12-21)*	7 (5-9)	9 (7-12)*	35.5 (0-89.0)*	17.9 (11.3-22.4)*
UD (n=10)	Pre-UD	4 (3-5)	20.5 (16-30)	7.5 (6-12)	13 (9-19)	57.0 (21.0-330.0)	8.7 (5.4-11.6)
	Post-UD	3 (2-4)*,Δ	16.5 (14-25)*	7 (6-10)	9.5 (7-15)*	33.5 (0-46.0)*	12.0 (9.5-15.0)*,Δ

*P<0.05 compared to pre-treatment; ΔP<0.05 compared to post-operation. Pre-op preoperation, post-op postoperation, PVR post-void residual, MFR maximum flow rate.

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 cmH_2O 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 urethrostenosis. 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].

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 urethrostenosis 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 veutro-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.

Acknowledgements

We would like to thank Dr Yi-Zheng Huang for help in drawing the diagrammatic sketch.

Disclosure of conflict of interest

None.

Address correspondence to: Yue Duan and Bo-Dong Lv, Department of Urology, The Second Affiliated Hospital of Zhejiang Chinese Medicine University, No. 318, Chaowang Road, Hangzhou, Zhejiang, China. Tel: 0571-85288276; E-mail: dyurology@163.com (YD); LBD168@126.com (BDL)

References

[1] Lin CD, Kuo HC and Yang SS. Diagnosis and management of bladder outlet obstruction in women. Low Urin Tract Symptoms 2016; 8: 30-37.

[2] Berglund RK, Vasavada S, Angermeier K and Rackley R. Buccal mucosa graft urethroplasty for recurrent stricture of female urethra. Urology 2006; 67: 1069-1071.

[3] Blaivas JG, Santos JA, Tsui JF, Deibert CM, Rutman MP, Purohit RS and Weiss JP. Management of urethral stricture in women. J Urol 2012; 188: 1778-1782.

[4] Malde S, Solomon E, Spilotros M, Mukhtar B, Pakzad M, Hamid R, Ockrim J and Greenwell T. Female bladder outlet obstruction: common symptoms masking an uncommon cause. Low Urin Tract Symptoms 2017.

[5] Malde S, Solomon E, Ockrim JL and Greenwell TJ. 353 Female bladder outflow obstruction: An increasing but under-diagnosed phenomena. European Urology Supplements 2015; 14: e353.

[6] Groutz A, Blaivas JG and Chaikin DC. Bladder outlet obstruction in women: definition and characteristics. Neurourol Urodyn 2000; 19: 213.

[7] Kuo HC. Videourodynamic characteristics and lower urinary tract symptoms of female bladder outlet obstruction. Urology 2005; 66: 1005.

[8] Spilotros M, Malde S, Solomon E, Grewal M, Mukhtar BM, Pakzad M, Hamid R, Ockrim JL and Greenwell TJ. Female urethral stricture: a contemporary series. World J Urol 2017; 35: 991-995.

[9] Smith AL, Ferlise VJ and Rovner ES. Female urethral strictures: successful management with long-term clean intermittent catheterization after urethral dilatation. BJU Int 2006; 98: 96.
[10] Faiena I, Koprowski C and Tunuguntla H. Female urethral reconstruction. J Urol 2016; 195: 557-567.
[11] Romero-Maroto J, Verdu-Verdu L, Gomez-Perez L, Perez-Tomas C, Pacheco-Bru JJ and Lopez-Lopez A. Lateral-based anterior vaginal wall flap in the treatment of female urethral stricture: efficacy and safety. Eur Urol 2018; 73: 123-128.
[12] Ackerman AL, Blaivas J and Anger JT. Female urethral reconstruction. Curr Bladder Dysfunct Rep 2010; 5: 225-232.
[13] Osman NI, Mangera A and Chapple CR. A systematic review of surgical techniques used in the treatment of female urethral stricture. Eur Urol 2013; 64: 965-973.
[14] Ngugi PM and Kassim A. Clean intermitent catheterisation in the management of urethral strictures. East Afr Med J 2007; 84: 522-524.
[15] Brannan D. Stricture of the female urethra. J Urol 1951; 66: 242-253.
[16] Goel A, Paul S, Dalela D, Sankhwar P, Sankhwar SN and Singh V. Dorsal onlay buccal mucosal graft urethroplasty in female urethral stricture disease: a single-center experience. Int Urogynecol J 2014; 25: 525-530.
[17] Defreitas GA, Zimmern PE, Lemack GE and Shariat SF. Refining diagnosis of anatomic female bladder outlet obstruction: comparison of pressure-flow study parameters in clinically obstructed women with those of normal controls. Urology 2004; 64: 675.
[18] Onol FF, Antar B, Kose O, Erdem MR and Onol SY. Techniques and results of urethroplasty for female urethral strictures: our experience with 17 patients. Urology 2011; 77: 1318-1324.
[19] Simonato A, Varca V, Esposito M and Carmignani G. Vaginal flap urethroplasty for wide female stricture disease. J Urol 2010; 184: 1381-1385.
[20] Osman NI and Chapple CR. Contemporary surgical management of female urethral stricture disease. Curr Opin Urol 2015; 25: 341-345.
[21] Petrou SP, Rogers AE, Parker AS, Green KM and McRoberts JW. Dorsal vaginal graft urethroplasty for female urethral stricture disease. BJU Int 2012; 110: E1090-1095.
[22] Mukhtar BMB, Spilotros M, Malde S and Greenwell TJ. Ventral-onlay buccal mucosa graft substitution urethroplasty for urethral stricture in women. BJU Int 2017; 120: 710-716.
[23] Sharma GK, Pandey A, Bansal H, Swain S, Das SK, Trivedi S, Dwivedi US and Singh PB. Dorsal onlay lingual mucosal graft urethroplasty for urethral strictures in women. BJU Int 2010; 105: 1309-1312.
[24] Onol FF, Onol SY, Tahra A and Boylu U. Ventral inlay labia minora graft urethroplasty for the management of female urethral strictures. Urology 2014; 83: 460-464.
[25] Dalela D, Gupta P, Dalela D and Govil T. W-V flap: a new technique for reconstruction of female distal urethral stricture using vestibular mucosa. BMJ Case Rep 2016; 2016.
[26] Tanello M, Frego E, Simeone C and Cosciani Cunico S. Use of pedicle flap from the labia minora for the repair of female urethral strictures. Urol Int 2002; 69: 95-98.
[27] Yalcinkaya F, Zengin K, Sertcelik N, Yigitbasi O, Bozkurt H, Sarikaya T and Karabacak R. Dorsal onlay buccal mucosal graft urethroplasty in the treatment of urethral strictures - does the stricture length affect success? Adv Clin Exp Med 2015; 24: 297-300.
[28] Barbagli G, Selli C, Tosto A and Palminteri E. Dorsal free graft urethroplasty. J Urol 1996; 155: 123-126.
[29] Tsivian A and Sidi AA. Dorsal graft urethroplasty for female urethral stricture. J Urol 2006; 176: 611.