

Dorsal onlay graft urethroplasty for female urethral stricture improves sexual function: Short-term results of a prospective study using vaginal graft

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ABSTRACT

Introduction: Both dorsal and ventral approaches are acceptable options for the surgical reconstruction of female urethral strictures (FUS), but damage to the sphincter and the clitoral nerves resulting in sexual dysfunction is the chief argument against the dorsal approach. Most of the reported case series are retrospective and none has evaluated sexual functions. This study prospectively evaluates the early sexual and functional results after dorsal onlay vaginal graft urethroplasty (DVGU) for FUS.

Materials and Methods: All women with a history of obstructive voiding symptoms and previous urethral dilatation were evaluated with urodynamic study, voiding cystourethrography, and cystoscopy for the presence of FUS, which was defined as visual demonstration of anatomical narrowing on urethro-cystoscopy. DVGU was offered as a definitive management for all those identified with FUS. Surgical outcomes were assessed at 3 and 6 months with the International Prostate Symptom Score (IPSS), uroflowmetry, and postvoid residual (PVR) estimation. For sexually active females, sexual function was assessed using the Female Sexual Function Inventory (FSFI) score both preoperatively and at 3 months following surgery.


Results: Seventy-one women were evaluated. FUS was identified in 29 women (flimsy in 12 and dense in 17). Thirteen women with dense strictures underwent DVGU. The mean improvement in the IPSS score, Q_{max} , and PVR was 12.6, 16.64 ml/s, and 103.08 ml at 3 months, respectively. The FSFI score improved with a mean of 6.42 points after urethroplasty. None of the patients developed incontinence. There were three failures after a mean follow-up of 8.5 months.

Conclusion: The early functional results after DVGU are good without any negative impact on the continence or the sexual functions.

INTRODUCTION

As female urethral strictures (FUS) are increasingly being recognized as an entity, it is being realized that formal urethral reconstruction, rather than urethral dilatation, provides the best chance of cure.^[1,2] One can appreciate a debate in the literature between the dorsal (12 o'clock) and the ventral (6 o'clock)

approaches, where both are poised in a balance as far as the outcomes are concerned. The main concerns pertaining to the dorsal approach are the potential for incontinence and the damage to the clitoral neurovascular bundles leading to sexual dysfunction. Whereas, the concerns with the ventral approach are the development of urethrovaginal fistula and jeopardizing the planes for future incontinence surgery.^[1]

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The sexual function after female urethroplasty has never been evaluated.

Hence, we conducted a prospective study to evaluate women undergoing repeated urethral dilatation for the presence of urethral stricture and to assess early functional and sexual outcomes after dorsal vaginal graft urethroplasty, which was offered as a definitive management in patients with true strictures.

MATERIALS AND METHODS

In this prospective observational study approved by the institutional ethical committee, we evaluated all women presenting to our outpatient department between November 2015 and April 2017 with a history of obstructive lower urinary tract symptoms (LUTS) and symptomatic relief after prior urethral dilatations, an International Prostate Symptom Score (IPSS) >7, and a maximum flow rate <20 ml/s on uroflowmetry, after taking informed consent, for the presence of FUS. We excluded women with neurogenic bladder, prior urethral surgery, prior pelvic fracture/urethral disruption, and concomitant genitourinary malignancy. All patients underwent a calibration, pressure flow urodynamic study (UDS), voiding cystourethrography (VCUG), and cystoscopy with 17 Fr sheath with a 0° lens. We defined FUS only after visual demonstration of anatomical narrowing of the urethral lumen on cystoscopy. If a stricture was found, a pediatric scope was used to evaluate its extent (13 or 9.5 Fr depending on the lumen). Alternative diagnoses were assigned to all women not having a stricture.

A dorsal onlay vaginal graft urethroplasty (DVGU) was performed in women with FUS as described by Petrou *et al.*^[3] After dilating the urethra with a sound and inserting a 12 Fr Foley catheter, a semilunar circum-meatal incision from 9 o'clock to 3 o'clock position was given. Using a combination of sharp and blunt dissections, a space was created on the dorsum of the urethra to dissect the urethra off the clitoral cavernosal bed and undersurface of the pubic symphysis till the bladder neck, identified by feeling

the balloon while giving a tug to the Foley catheter. The urethra was then incised in the midline dorsally starting from the meatus through the strictured segment till a dilated proximal urethra was reached [Figure 1a and b]. A suitable sized vaginal graft (about 3–3.5 cm long and 1.5–2 cm wide) was harvested and placed as a dorsal onlay patch over the stricturotomy and secured using interrupted 4-0 PDS suture over a catheter [Figure 1c]. After fixing, the graft was further quilted with interrupted sutures to the clitoral cavernosal bed, and the introital mucosa was closed [Figure 1d]. As a slight modification, we chose to take a scaphoid graft, instead of a rectangular, where the meatus was normal to avoid its unnecessary widening. A vaginal pack was placed. The site, length, and caliber of the stricture and perioperative complications were noted. Catheter was removed at 3 weeks in all the patients. Outcomes at 3 and 6 months were assessed with the IPSS score, uroflowmetry, and postvoid residual (PVR) estimation. All sexually active females were allowed resumption of sexual activity at 6 weeks of surgery. For sexually active females, sexual function was assessed using the Female Sexual Function Inventory (FSFI) score^[4] both preoperatively and at 3 months following surgery. Development of urinary incontinence was assessed with a direct question to the patient enquiring about leakage. Success after urethroplasty was defined as a Q_{max} of >20 ml/s at 6 months without the need for instrumentation.

Categorical variables were presented as number and percentage (%), whereas continuous variables were presented as mean ± standard deviation and median.

RESULTS

Seventy-one patients with a history of relief after urethral dilatation were evaluated; out of which, ten patients had external findings at the meatus, in whom FUS was ruled out with cystoscopy while on treatment for external conditions [Figure 2]. The remaining 61 patients underwent urethral calibration, VCUG, UDS, and urethroscopy to look for the presence of FUS. Twenty-nine patients were identified with an actual stricture. The mean age of this subset of patients

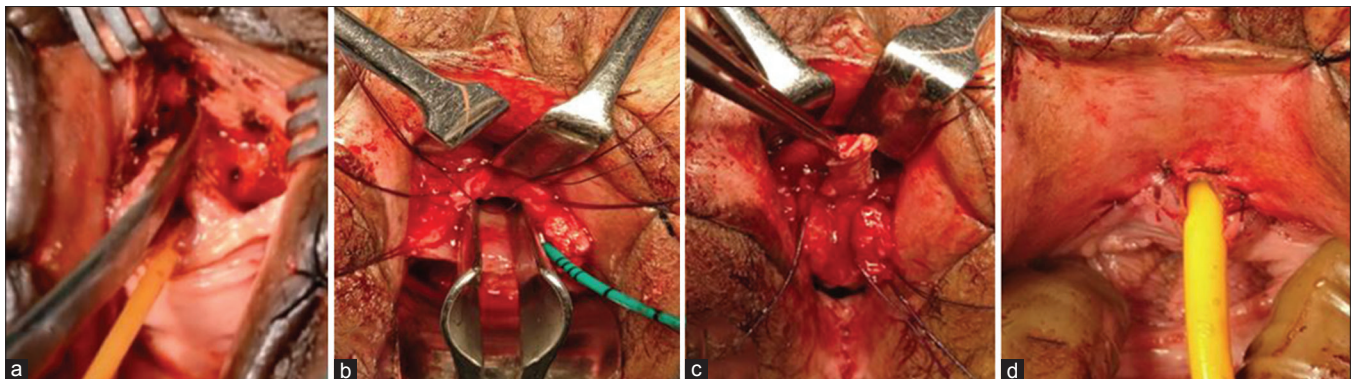


Figure 1: (a and b) Dorsal midline urethral incision from the meatus through the strictured segment till a dilated proximal urethra, (c) dorsal vaginal graft (about 3–3.5 cm long and 1.5–2 cm wide) placement as an onlay patch over the stricturotomy, (d) the final appearance of the neo meatus with catheter *in situ*

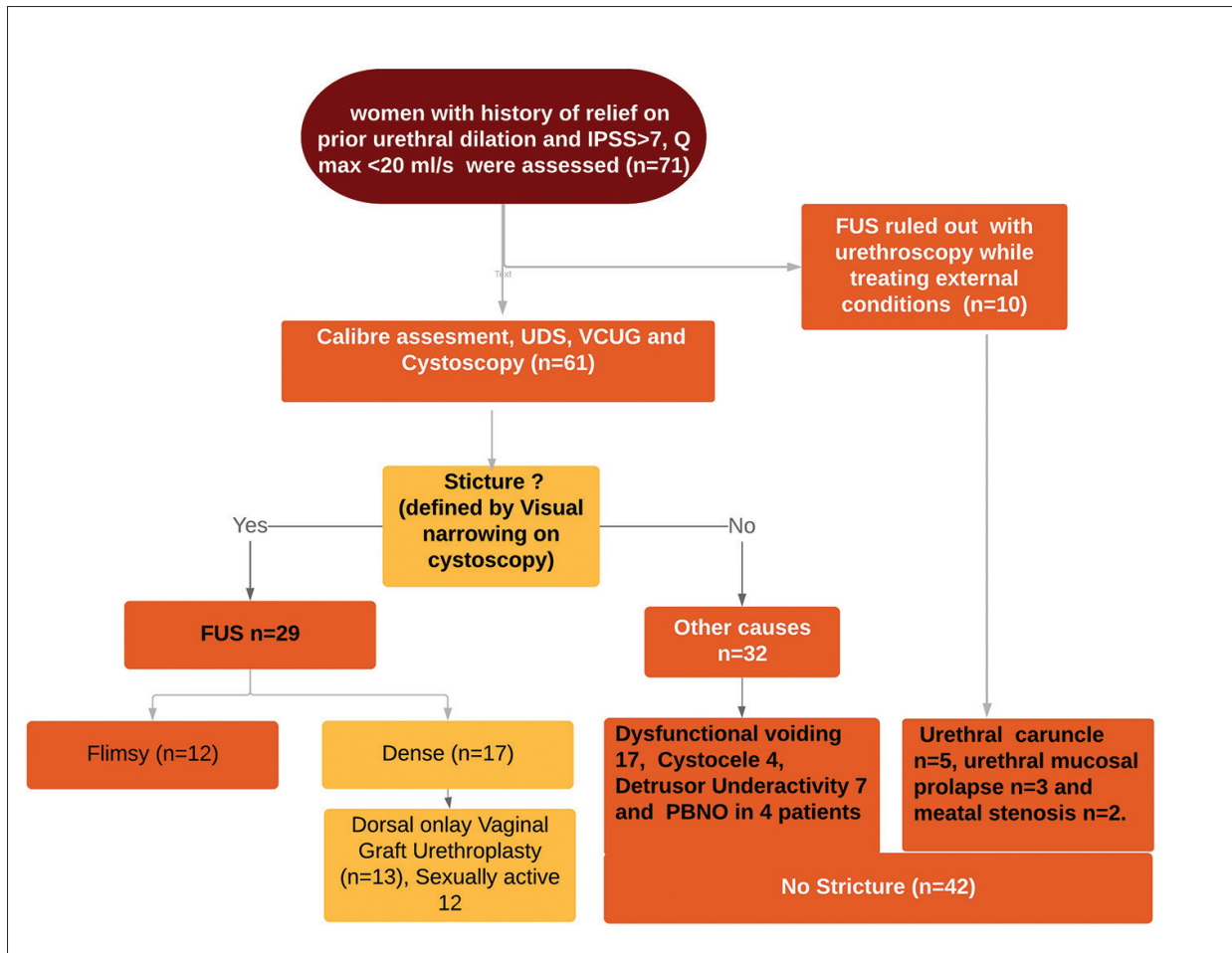


Figure 2: Study flowchart

was 43.5 years (range, 28–62 years). The final diagnosis in 42 women without a stricture is depicted in Figure 2.

The mean peak flow rate, PVR, and IPSS in FUS patients were 8.23 ± 3.38 ml/s, 113.2 ± 53.29 ml, and 17.58 ± 3.58 , respectively. The mean caliber of urethra in this subgroup was ~9 Fr. Although all the patients diagnosed with stricture had a urodynamic BOO and proximal urethral dilatation on VCUG [Figure 3a] but these findings alone were not diagnostic of FUS which could be confirmed only on cystoscopy. Based on endoscopic appearance, the strictures were classified into dense fibrotic ($n = 17$) or flimsy strictures ($n = 12$) (which looked membranous and broke easily with the beak of the cystoscope) [Figure 3b and c]. We did not offer urethroplasty for patients with flimsy strictures. They were taught self-dilatation with 16 Fr catheter and local estrogen application. DVGU was offered to 17 patients with dense fibrotic stricture. Thirteen patients opted for it, and the rest wished to continue on urethral dilatation.

Out of the 13 patients who underwent urethroplasty, the site of stricture was mid urethra in 11 patients and distal urethra in 2 patients. The length of the stricture was between 1 and 2 cm in all the patients as assessed with the pediatric

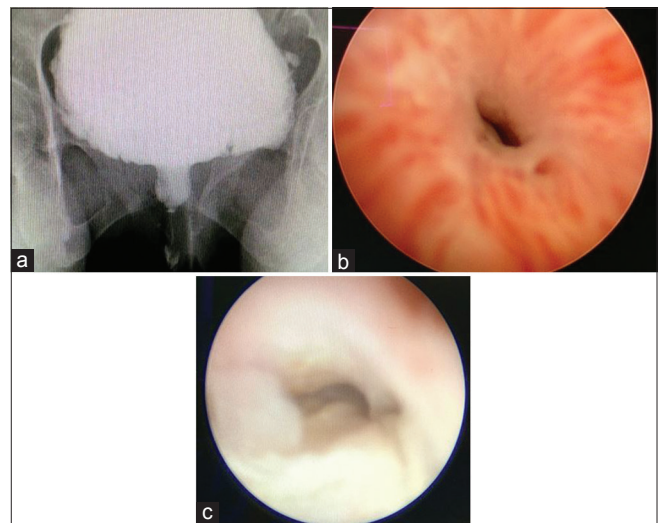


Figure 3: (a) Voiding cystourethrography showing dilatation of the proximal urethra with a mid-urethral narrowing and (b and c) cystoscopy confirms the presence of stricture, both flimsy (b) and dense (c)

cystoscope (in approximation only). The mean operative duration was 44 min. All the patients were allowed oral diet on the evening of surgery. The vaginal pack was removed, and ambulation was allowed on the next morning. All

Table 1: Comparison of pre- and postoperative sexual function score

Patient's serial number	Sexual function score	
	Preoperative	Postoperative at 3 months
1	18	22
2	15	15
3	18	22
4	16	21
5	Sexually inactive	Sexually inactive
6	21	25
7	20	28
8	22	28
9	23	31
10	20	29
11	19	29
12	21	30
13	19	29
	19.33	25.75

patients voided well after catheter removal at 3 weeks. None of the patients developed urinary incontinence.

The mean improvement in the IPSS score, Q_{max} , and PVR was 12.6, 16.64 ml/s, and 103.08 ml at 3 months and 11.0, 15.64 ml/s, and 90.31 ml at 6 months, respectively. One patient had recurrence of symptoms within 3 weeks of catheter removal; she had an atrophic vaginal mucosa and underwent redo urethroplasty using the dorsal approach but with a buccal graft. All the other procedures were considered as successful at 3 months. During further follow-up at 6 months, two more patients presented with recurrence of symptoms. Both these patients were re-evaluated with uroflowmetry, VCUG and urethroscopy and were found to have recurrent stricture disease. Re do dorsal urethroplasty using buccal mucosal graft was performed in one patient, whereas the other patient underwent optical internal urethrotomy.

Twelve of the 13 patients were sexually active. As there was no validated version of the FSFI questionnaire in vernacular language, the original English version of FSFI questionnaire was translated by an OPD nurse for all the patients. Sexual function improved in all but one patient in whom the surgery had failed at 3 months. The mean improvement in FSFI score was 6.42 [Table 1]. The mean follow-up period at the end of the study was 8.5 months (range, 6–14 months).

DISCUSSION

As dissection during DVGU in women commences between the urethra and the clitoral body to create a space between them and the graft is quilted with the clitoral structures, it is a concern that the innervation may get damaged which may affect the female sexual function. Majority of the sexually active females in the present study did not report any sexual dysfunction. On the contrary, the FSFI scores improved.

Clitoris is a multiplanar structure with two corpora on the inferior pubic ramus on each side coming together in midline, a single glans which projects beyond the introital plane as a hood, and two bulbs which are on the either side of the urethra and anterior vaginal wall below the pubic symphysis. Apart from the glans, rest of the structures are erectile. The clitoral glans is the most sensitive structure and derives its supply from the dorsal nerve of clitoris which is a branch of pudendal nerve and runs under the inferior pubic ramus on the either side. The nerve is thick and can even be identified in infant cadavers with naked eyes. Both the nerves while reaching the midline, slip on the dorsal aspect of the glans to innervate the tip and hence are not at risk during the dissection. The erectile bulbs are innervated by cavernosal nerves which originate from the plexus on the lateral upper vaginal wall and descend on either side of the urethra at 11' o clock and 1' o clock positions. These can only be identified microscopically, and the exact role of the bulbs in female sexual function is unknown.^[5-7] The graft is quilted on the clitoral bulbs, and the cavernosal nerves may be susceptible to damage while dissecting in this plane; however, remaining close to the urethra may be protective. The way the clitoral complex wraps the distal vagina it may be susceptible to injury even in ventral approaches for urethroplasty, and hence, further studies focusing on this aspect may bring clarity.

Contrary to our hypothesis, we noted improvement in FSFI scores in sexually active women who underwent urethroplasty. The FSFI is a validated questionnaire for screening women with sexual dysfunction, which includes 19 questions that evaluate the various domains of female sexual function, namely, desire, arousal, lubrication, orgasm, pain during penetration, and overall satisfaction. The complete FSFI score is available on <http://www.fsfiquestionnaire.com>. Female sexual function is still poorly understood but is thought to be dependent on multiple organs including labia, vaginal wall, urethra, and breasts apart from the clitoris. Although there is significant overlap in the domains of sexual function impacted by each of these organs, yet the domains of arousal and orgasm were expected to deteriorate if the dissection were to affect the sexual function. The improvement may be a finding similar to the improvement in sexual function seen in men after treatment of obstructive LUTS.^[8]

Surgery has the potential to offer cure for this rare disease. Substitution with grafts or flaps is generally performed, which should be considered as an initial management option rather than as a salvage procedure after multiple failed dilatations. We used a DVGU. The dorsal approach has the advantage of theoretically lesser chances of developing a urethrovaginal fistula or a hypospadias, preserves undisturbed ventral tissues for a possible future sling, and provides a well-vascularized bed in the form of clitoral cavernosal tissue and it also preserves the anterior

angulation of the urethra.^[9] Higher chance of bleeding and the possibility of incontinence due to sphincteric injury and sexual dysfunction due to injury of the cavernosal neurovascular bundles are the concerns.^[9] None of our patients developed incontinence. This may be because of staying in the midline, leading to possible preservation of pubo urethral ligamentary support, preservation of urethral mucosal coaptation mechanism, and also that the ventral suburethral hammock mechanism remains undisturbed. The risk of development of *de novo* urinary incontinence after dorsal approach is only theoretical as none of the patients operated through dorsal approach in the two comprehensive systematic reviews developed incontinence.^[1,2]

Although oral mucosa has the highest success rate in few available studies on this issue, we opted for vaginal mucosa as it is hairless, naturally wet, robust, elastic, and locally accessible, making it useful as a graft.^[3] One patient in which the urethroplasty failed had vaginal tissues of suboptimal quality and we chose not to use it for the re-do procedure and used oral mucosa instead. After redo urethroplasty, she was asymptomatic at 3 months. The reason for failure in the other two patients is unknown. There is paucity of literature evaluating surgical procedures in patients with failed female urethroplasty to guide the approach for a re do female urethroplasty.

However, in both the re do urethroplasties, the original stricture was mid urethral and the urethra had already been incised dorsally, as we did not want to jeopardize the ventral side for the fear of incontinence, we chose the dorsal approach once again. We were able to get a good plane on the dorsal side again without any significant difficulty.

Symptom assessment and uroflowmetry were used for follow-up in all the patients. Although we obtained a VCUG for patients who failed the initial urethroplasty before a re do urethroplasty, but only cystoscopy would have been sufficient to diagnose a re-stricture. Because the natural state of a female urethra is to stay thrown in folds, we feel that there are more chances of formation of cross adhesions after urethroplasty, which can exclude the graft altogether. We, therefore, feel that urethroscopy should be performed early if there is recurrence of symptoms or there is a change in the uroflowmetry pattern suggesting obstruction.

FUS was first described by Liz Frank in 1824, and he was the first one to report a case to the Earl of London in 1828.^[10] The true incidence of FUS appears to be low. In a selected population of women presenting with symptoms of bladder outlet obstruction (BOO), FUS represents 4%–13% of the causes of BOO.^[1] Incidence in women undergoing urethral dilatation has never been studied, and it was found to be 40.8% in our study.

The simplest and the most commonly performed procedure is overdilatation of the urethra.^[1] Although urethral dilatation does not intend cure, it improves the voiding symptoms and urodynamic parameters temporarily.^[11] Even without supportive scientific evidence as a long-term cure, it is still being regularly practiced by around 69% of urologists as per a recent British survey.^[12] Data has suggested that after failure of an initial urethral dilatation, further attempts are less likely to be successful, probably because of worsening and extension of the urethral scarring. It is known that women with voiding dysfunction without a stricture also improve temporarily after dilatation^[13] and this along with poor dissemination of available scientific evidence for workup of female voiding dysfunction is the reason why urethral dilatation is still prevalent among grassroot practitioners.

Our initial results with dorsal graft are promising. We used criteria for success which were more stringent than what was defined by Singh *et al.*^[14] in the largest published experience of dorsal graft female urethroplasty, as we did not advise self-calibration in the postoperative period.

This is the first prospective study on outcomes after urethroplasty for FUS to have objectively assessed sexual function before and after the procedure. Small number of patients along with a shorter follow-up duration is the obvious shortcoming of the study.

CONCLUSION

DVGU is a safe and effective procedure with no perioperative morbidity and no effect on continence. Early outcomes are favorable. It does not negatively impact the sexual functions. The sexual functions improve after the relief of obstruction in women.

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