

Ventral-inlay buccal mucosal graft urethroplasty for female urethral stricture

Prasant Nayak, Swarnendu Mandal*, Manoj Das

Department of Urology, AIIMS, Bhubaneswar, Odisha, India

*E-mail: urol_swarnendu@aiimsbhubaneswar.edu.in

ABSTRACT

Introduction: The aim of the study is to present our initial experience with ventral-inlay buccal mucosal graft urethroplasty (VI-BMGU) in female urethral stricture disease (USD).

Methods: Between May 2016 and June 2018, 12 women with USD underwent VI-BMGU. All women were evaluated preoperatively with the American Urological Association (AUA) symptom score, uroflowmetry, calibration with a 12 Fr catheter, and ultrasonography with postvoid residual (PVR) urine measurement. Intraoperative confirmation of stricture was done with a 6 Fr cystoscope. Postoperatively, the women were followed at 3, 6, and 12 months after surgery with AUA symptom score, uroflowmetry, and PVR estimation. Increase in AUA symptom score, maximum flow rate (Q_{max}) <12 ml/s, and failure to calibrate with 18 Fr catheters were considered as indicative of recurrence of the disease.

Results: The mean age of the patients was 41 years. The mean follow-up period was 18 months. All women voided successfully after catheter removal. There was an improvement in AUA symptom score and Q_{max} and a reduction in PVR at 3, 6, and 12 months. One woman had recurrence of stricture at 6 months and was treated by urethral dilatation followed by the institution of a self-dilatation regimen. The success rate was 92% in our case series.

Conclusions: VI-BMGU is a simple and safe method of urethroplasty in women. Studies with a larger sample size and a longer follow-up are required to document the long-term success of this procedure.


INTRODUCTION

Stricture of the female urethra is thought to be a rare disease accounting for 4%–13% of women who present with bladder outlet obstruction.^[1,2] Bladder outlet obstruction is seen in 3%–8% of women who present to urologists with voiding complaints.^[3] Various techniques for reconstruction using flaps^[4,5] and free grafts^[6–11] have been described. Free grafts that have been used in various studies are buccal mucosal grafts,^[6–11] lingual mucosal grafts,^[7,11] vaginal grafts,^[12] and labial grafts.^[13] Free grafts have commonly been used dorsally using an onlay technique.^[6–12] Studies on ventral onlay^[13–16] are also available where a plane is created between the urethra and vagina at 6 o'clock. No case series are available on ventral inlay (where graft is placed through the urethra and no dissection

is done between the urethral and the vaginal plane), and there is only a case report of the ventral-inlay technique.^[17] Several review articles^[1,18,19] are available in the literature on ventral-onlay technique, but none describes the ventral-inlay technique including the recent studies^[10,20–24] available in the literature. We report our experience of ventral-inlay buccal mucosal graft urethroplasty (VI-BMGU) in patients with female urethral stricture disease (USD).

METHODS

A retrospective review was performed on 12 females with urethral stricture who underwent VI-BMGU from May 2016 to June 2018. Full informed consent was taken from all patients. The diagnostic criteria for defining stricture were AUA symptom score more than 7 and/or a maximum urinary

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flow rate of less than 12 ml/s and/or an inability to calibrate the urethra with a 12 Fr Foley’s catheter and/or ultrasonography showing a thick-walled/trabeculated urinary bladder with a significant postvoid residual urine (PVRU >100 ml). Patients with abnormal focal neurological examination or neurogenic bladder were excluded. Strict diagnostic criteria have not been defined for female USD because of its low incidence. Cystoscopy was done with a 6 Fr 30° pediatric cystoscope (Olympus A3765A) to confirm the diagnosis of urethral stricture. Postoperatively, the women were followed up at 3, 6, and 12 months after surgery with AUA symptom score, uroflowmetry, and PVR estimation. Recurrence in symptoms, increase in AUA symptom score, maximum flow rate (Q_{max}) <12 ml/s, failure to calibrate the urethra with an 18 Fr catheter, and demonstration of narrowing of the urethra on CPE with a standard 19 Fr sheath were used to define recurrence of the stricture.

Surgical technique

Cystoscopy was done with a 6 Fr 30° pediatric cystoscope (Olympus A3765A) to confirm the diagnosis of urethral stricture. [Figure 1a and b]. The urethra was progressively dilated by inserting a guidewire and passing a nontoothed forceps across the urethral length. Strictured urethral mucosa and spongiosum were incised at 6 o’clock position [Figure 2d] until the urethra was wide enough to allow a nasal speculum [Figure 2a] to be inserted. Homeostasis was achieved with sparse use of bipolar cautery. Now, the urethral bed [Figure 2d] was deemed ready for the placement of buccal mucosa [Figure 2e]. The normal 5-0 PDS needle [Figure 2b] was straightened to a J-shape as shown in Figure 2c. This helped in taking stitches at the proximal edge of the incised urethra, to fix the buccal mucosa. The buccal mucosa [Figure 2e] was fixed to the urethra at four points: two at proximal edge of the incised urethra and two at the external meatus [Figure 2f]. Additional stitches were taken laterally, if necessary. A 16 Fr silicon Foley’s catheter was placed to drain the bladder and provide extrinsic compression for the buccal mucosa on to the urethral bed. Catheter removal was done after 1 month.

RESULTS

The average age of all the patients was 41 years. The average follow-up period was 18 months. All the women could urinate

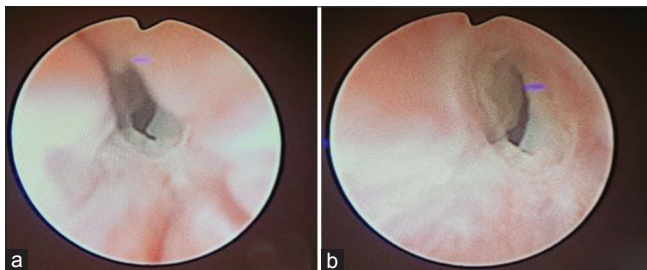


Figure 1: (a and b) Cystoscopy images showing strictures

successfully after foley removal. There was an improvement in AUA symptom score and Q_{max} and a reduction in PVR at 3, 6, and 12 months [Table 1]. One patient had recurrence of symptoms at 6 months, while another patient had recurrence at 10 months of follow-up. Cystopanendoscopy (CPE) showed no stricture in the second patient, and urethra could be calibrated with an 18 Fr Foley’s catheter. Hence, only one patient had documented failure and the success of surgery in our limited series was 92% (11/12).

DISCUSSION

Surgical management of female urethral stricture disease is in a phase of evolution. The terms ventral “inlay” and ventral “onlay” are often intermingled in the literature. Creating a plane of dissection between the urethra at 6 o’clock position and the vagina, incising the entire thickness of urethra, and applying the graft or flap should be called ventral “onlay.” However, when the graft is applied endoluminally through the urethra, cutting only the urethral mucosa and fibrotic tissue below and not opening the entire urethra and not creating a plane between the urethra and vagina should be called ventral “inlay.” This technique has been earlier described by Hoag *et al.* in 2016^[17] and has been described as a vaginal sparing approach by them. There are many purported advantages of this technique. First, vaginal and urethral dissection and manipulation are not required decreasing

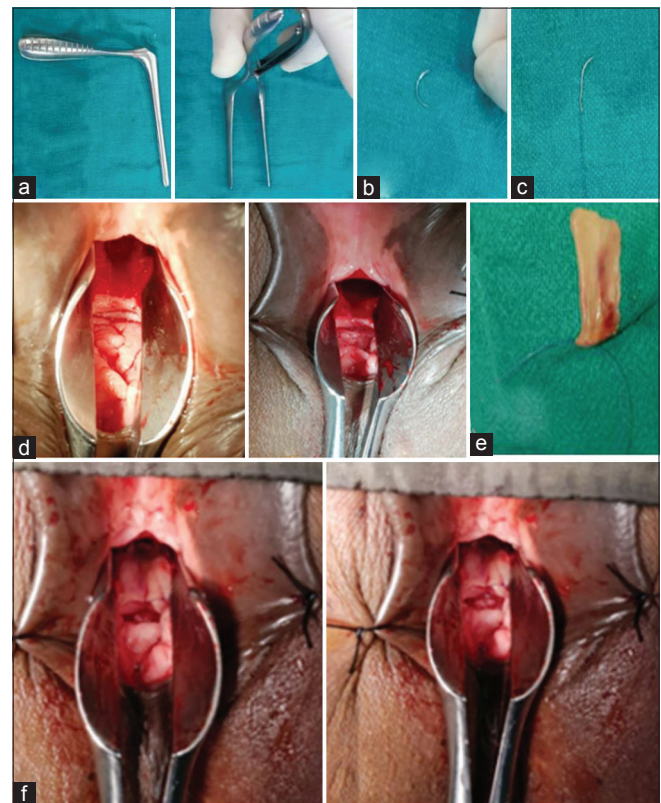


Figure 2: (a) Nasal speculum, (b) normal needle, (c) curved needle, (d) after incising the strictured mucosa and spongiosum, (e) buccal mucosa with suture, (f) after fixing the buccal mucosa to the bed

Table 1: Patient characteristics

Patient number	Age	Etiology	Previous dilation	Native urethral lumen size	Preoperative			Site of stricture	Outcome	Postoperative			Follow-up in months
					AUA	Q _{max}	PVR			AUA	Q _{max}	PVR	
1	45	Idiopathic	Yes	8	32	NA	155	Dis	Success	9	26	25	28
2	32	Idiopathic	No	12	25	10	240	Dis	Failure	26	8	360	26
3	54	Idiopathic	Yes	10	26	5	80	Mid	Success	7	26	12	25
4	36	Postcarucle excision	Yes	10	29	9	120	Mid	Success	8	24	29	22
5	23	Post-TURBT	Yes	8	24	NA	90	Pro + mid	Success	26	14	100	21
6	27	Idiopathic	Yes	12	28	10	160	Mid	Success	7	19	50	18
7	29	Idiopathic	No	12	23	7	138	Dis	Success	9	22	30	15
8	45	Idiopathic	Yes	10	34	3	269	Dis	Success	10	26	20	14
9	49	Idiopathic	Yes	10	27	8	39	Dis	Success	7	22	10	13
10	43	Idiopathic	Yes	12	28	9	78	Mid + dis	Success	11	28	18	13
11	58	Postcatheterization	No	10	27	10	290	Dis	Success	7	24	36	12
12	46	Idiopathic	Yes	8	31	5	130	Mid	Success	9	30	20	8

Dis=Distal, Mid=Middle, Pro=Proximal, NA=Not available, AUA=American Urological Association, TURBT=Trans- urethral resection of bladder tumor, PVR=Postvoid residual

the postoperative pain and hence morbidity. Second, since vaginal and urethral dissection and manipulation are not required, the risk of urethrovaginal fistula can be avoided. Third, by avoiding dissection in the anterior vaginal wall, it is protected for future anti-incontinence procedure.^[11] Fourth, as compared to the dorsal approach, where mobilization of the urethra is done at 12 o'clock position, the ventral approach avoids cutting of the pubourethral ligament and therefore reduces the risk of postoperative stress urinary incontinence.^[17] All of the studies available in the literature [Table 2] on ventral approach^[13-16,20,25] use ventral onlay, and none have used ventral inlay except a case report of a single patient by Hoag *et al.*^[17]

Pain may be reduced by avoiding the dorsal mobilization of the urethra.^[17] In the ventral approach, dissection is not done in the clitoral bed which preserves its vascular and neural supply which leads to decreased intra-operative blood loss and lesser sexual dysfunction in the post operative period.^[17] The external urinary sphincter in female has been shown in previous studies to be thinner in the ventral part and thicker in the dorsal part.^[1] Since the striated muscle fibers are relatively deficient in the ventral part, the ventral approach may have a theoretical benefit.^[1,17] In dorsal approach, the fear of injuring the urethral sphincter mechanism may lead to a limited incision on the strictured urethra, leading to an increased chance of failure. The incidence of developing incontinence is very low after either dorsal or ventral approach. The incidence of incontinence can be considered theoretical only and practically zero as most studies^[6-8,10,13] and review articles^[1,19] report no incontinence except in a single patient having urgency incontinence as reported by Gormley.^[24] Stress urinary incontinence has not been reported, indicating that significant injury to the sphincter is rare and less likely to happen depending on current understandings.^[19]

However, the advantages of dorsal approach are that there is a lesser chance of sacculation due to strong mechanical

support and vascular bed provided by clitoral/cavernosal tissue and a more physiological urethral meatus directed upward.^[6]

Like male urethral stricture, even in female urethral stricture, many techniques of dorsal and ventral graft/flap urethroplasty have been described.^[4-17] However, which technique is to be chosen and when, are not standardized. It generally depends on the ease and discretion of the reconstructive surgeon.^[6]

The success rate of female urethroplasty varies between 80% and 94%,^[1,18,19] which is similar to our study with a success rate of 92%. However, in all the studies [Table 2] the sample size is small and duration of follow-up is also less.

Although the incidence of urethral stricture in female is considered low, we were able to enroll 12 patients in 25 months because our center is a tertiary care referral center and with a lack of surgical expertise in this rare disease at other nearby centers. This is also because female urethral stricture is usually an under-diagnosed condition,^[8] and it was treated in the past with repeated urethral dilatations and internal urethrotomies.

We could demonstrate a decrease in AUA symptom score, increase in Q_{max}, and decrease in PVRU during the follow-up, which establishes the effectiveness of our procedure. Two women had similar complains at 6 and 10 months after surgery. In the first patient, on CPE, stricture was seen proximal to the placement of buccal mucosa. The cause of failure might be due to surgeon's initial learning curve, the progressive nature of stricture disease, or poor vascular supply of the graft bed.^[25] She underwent dilation of the urethra followed by a regimen of self-calibration and is doing well on follow-up. CPE of the second patient showed a normal urethra. The patient was detected to have an underactive bladder on a subsequent UDS. Hence, this patient was not considered a surgical failure. Published data shows that most

Table 2a: Ventral urethroplasty

Author	Year of publication	Number of patients	Onlay/inlay	Flap/graft	Success in (%)	Mean follow-up in months
Simonato <i>et al.</i> ^[20]	2010	6	Onlay	Vaginal flap	83	70
Kowalik <i>et al.</i> ^[21]	2014	10	Onlay	6 - vaginal flap 4 - Dorsal BMGU	80	34
Mukhtar <i>et al.</i> ^[22]	2017	22	Onlay	BMGU	95	21.5
Spilotros <i>et al.</i> ^[23]	2016	16	Onlay	14 - BMGU 2 - vaginal flap	93 100	35.6
Gormley ^[24]	2010	12	Onlay	Vaginal flap	83	36
Önol <i>et al.</i> ^[10]	2017	11	Onlay	10 - vaginal graft	88	24
Our study	X	12	Inlay	BMGU	92	18

BMGU=Buccal mucosal graft urethroplasty

Table 2b: Indian study

Author	Institute	Year of publication	Number of patients	Technique	Donor area of graft	Success in (%)	Mean follow-up in months
Goel <i>et al.</i> ^[6]	KGMU	2014	8	Dorsal onlay	Buccal	75	15
Singh <i>et al.</i> ^[8]	SGPGI	2103	16	Dorsal onlay	Vaginal	93	25
Sharma <i>et al.</i> ^[7]	BHU	2010	15	Dorsal onlay	Buccal	93	12
Our study	AIIMS, Bhubaneswar	X	12	Ventral inlay	Buccal	92	18

recurrence after female urethroplasty generally occur in the first year of follow-up.^[7,9,16] Intra-operative technical issues are the causes of recurrence, if they occur within days of foley removal.^[13] Our earliest recurrence was at 6 months, which again shows that our study was in concordance with other studies.

As with other studies in the literature, even our study has a small sample size (n = 12).The longest follow-up was 28 months and shortest follow-up was 8 months. Further studies with longer follow-up and randomization to either ventral inlay versus onlay could be performed to know the best approach. However, with such a low incidence of the disease, randomization may be difficult. Again, measurement of pain scores by visual analog scale can be done between groups.

CONCLUSIONS

While the surgical management of female USD is still evolving,^[18,26] we are the first to describe, to the best of our knowledge, a case series with the ventral-inlay technique. We found the technique to be simple, successful, and with many perceived advantages.

Declaration

The authors state that all the subjects have given their informed consent and that the study protocol has been approved by the institute's committee on human research.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information

to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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