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BMG Urethroplasty for Female Urethral Stricture: A Retrospective Study

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Abstract

Background & Objectives: *Female urethral strictures are rare but can cause severe symptoms. Etiology can be infection, iatrogenic and non-iatrogenic trauma, radiation etc. It can be treated by minimally invasive techniques and urethral reconstruction. The purpose of this study is to describe the outcome of female urethroplasty using buccal mucosal graft.*

Methods: *This is a retrospective study from September 2019 to November 2021 involving 24 women with urethral stricture who underwent BMG urethroplasty. The diagnosis of urethral stricture was confirmed based on a combination of patient's symptoms, post-void residual urine, uroflowmetry, urethral calibration, urethroscopy, PVR and self-reported satisfaction score were compared between pre and post-operative periods.*

Results: *Mean (range) age of the patients was 54.1 years (42-68) years. The mean Qmax before and after surgery was 8.81 &24.6 ml/s, respectively. The mean PVR decreased from 152.08 ml (preoperative) to 45.41 ml (postoperative). Before and after surgery, the mean calibration size was 12.4 F and 24.1F, respectively ($p < 0.05$). Self-reported satisfaction score showed that Seven (7) patients scored 1 (very much better), fourteen (14)patients scored 2 (much better) and three (3) patients scored 3 (a little better). Three women (12.5%) had stricture recurrence. Overall, the success rate was 79.1%. No patient reported any significant postoperative pain or signs of graft necrosis.*

Conclusion: *BMG urethroplasty is a safe and practical approach allowed us to reconstruct an adequate urethra in females, with a reasonable success rate, decreasing the risks of fistula and incontinence.*

Keywords: *urethroplasty; buccal mucosal graft; urethral stricture.*

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I. Introduction:

Female urethral strictures are rare but can result in serious symptoms that lower a patient's quality of life [1], with prevalence of 4%-13% in women with bladder outlet obstruction[2]. It may be caused due to inflammation, infection, iatrogenic and non-iatrogenic trauma, etc[1]. The most frequent causes of iatrogenic urethral strictures are frequently excessive urethral dilatation with subsequent fibrosis as a result of haemorrhage and extravasation[3]. Compared to male strictures, this reduced occurrence in females is explained by the shorter length, improved anatomical mobility, and a straighter path of urethra[4].

The two main therapeutic modalities are urethral reconstruction and minimally invasive methods. The minimally invasive methods include urethral dilation[5] (UD), endoscopic incision with laser[6] and internal urethrotomy[7].BMG represents the gold standard for urethral reconstruction in males with complex hypospadias or urethral strictures[8]. The urethral reconstruction in men with strictures has improved with a dorsal approach to the urethra. We suggest employing BMG urethroplasty with a dorsal approach to treat females with urethral strictures.

Surgical Terminology

Male urethroplasty gave rise to the terminology of dorsal and ventral for the position at the urethra, but from an anatomical standpoint, it makes no sense in females[9]. In males, the ventral part of the urethra is the part pointing forward during erection whereas the ventral part of the bulbar urethra is pointing downwards. The ventral portion of the urethra in females points backward, towards the vagina. The dorsal part is towards the pubic bone.

II. Materials And Methods

Study design: Retrospective study

24 patients with urethral stricture disease underwent urethral reconstruction using BMG during a period from September 2019 to November 2021. All patients complained of recurrent urinary infection, straining and a burning sensation during voiding, dribbling and decreased flow.

Case selection

Female patients with diagnosis as stricture urethra of age between20 to 70 year age were included. Based on a combination of symptoms, cystoscopy and urethral calibration, ultrasonography, and videourodynamics research results, urethral stricture was diagnosed. The patients who are not fit for surgery were excluded. All patients underwent a thorough pelvic and genitourinary examination. Using voiding cystourethrography, all patients were assessed prior to surgery to determine the extent of the strictures.

Surgical Technique

With the patient under general anaesthesia in the dorsal lithotomy position a 10Fr silicone urethral catheter is positioned. BMG is harvested from the right inner cheek. The BMG is 2 to 3 cm wide between about 4 and 5 cm long. Using the dorsal approach to the urethral lumen, every patient has undergone a free graft urethroplasty. The operative part is painted and draped with strict aseptic measures.

From 3 to 9 o'clock, an inverted U-shaped incision is made posterior to the urethral meatus. To liberate the entire length of the urethra, the mucosa of the vulva is detached from the urethral channel, and a plane is established between the urethra and clitoral cavernous tissue above. Using sharp scissors to carefully avoid damaging the bulbs or the clitoral body, the dissection is continued in the periurethral tissue. Finding the proximal dissection point is made easier using digital pubic bone palpation. From the meatus to the bladder neck, the full thickness of the dorsal urethra (mucosa and spongiosal tissue) is incised. The ventral urethral plate is clearly exposed by pulling on the borders of the opening urethra using stitches. The BMG is then stitched to the right and then the left margins of the urethral plate. To cover the new urethral roof, the expanded dorsal urethra is quilted to the clitoris body. Distally, the BMG is tailored and split to achieve a normal meatal slit-like appearance. Finally, the mucosa of vulva is reapproximated. The bladder is fitted with an indwelling 16 F Foley catheter for gravity drainage. Patients were discharged home after 2 days. The catheter was removed after 2 weeks.

Patients were monitored clinically through routine postoperative visits for at least 12 months, and then through walk-in postoperative visits beyond that. Each time, the patient was assessed using uroflowmetry, ultrasonography, and a symptom assessment. The calibration size was evaluated during the initial follow-up, dilatation was not attempted.

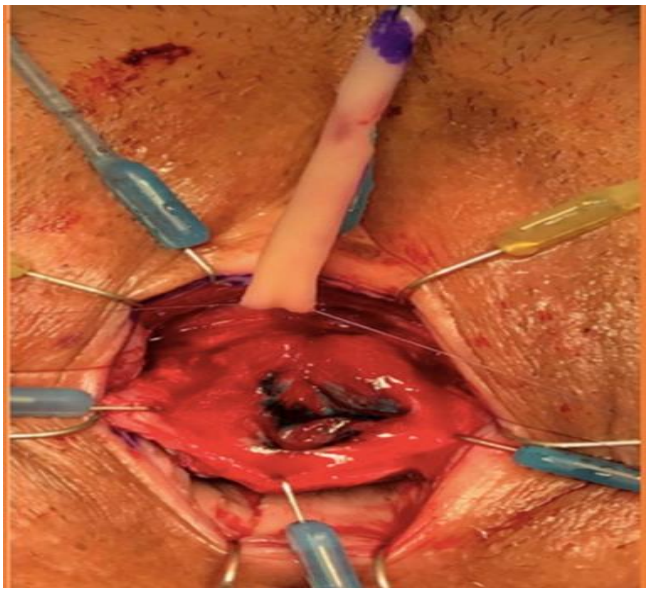

Figure 1: Surgical technique BMG urethroplasty

III. Results

We did a study on 24 female patients who have undergone BMG urethroplasty for urethral stricture disease during a period from September 2019 to November 2021. The mean age was 54.1 years (range 42-68 years), and the mean follow-up period was 16.6 months (range 12–24 months).

The mean operative time was 85.41 min (range 70–120 min). No patient reported any significant postoperative pain, fowl urethral discharge (infection) or signs of graft necrosis.

Self-reporting QOL score using the PGI-S showed that Seventeen out of 24 women graded their symptoms as class 4 (severe) and Seven patients as class 3 (moderate). In Twenty patients (83.3%), the strictures were located in the middle one-third of the urethra, while only Four (16.6%) had both middle and distal urethral involvement.

The mean stricture length was 1.3 cm (range 0.8–1.9 cm). Twenty patients had preoperative urethral dilatation of which, Three patients had urethral calibration size of < 10 F while Five calibrated at 12 F, Nine women calibrated to 14 F while the remaining Three women calibrated to 16 F. Twenty two of the 24 women had preoperative urinary urgency and frequency. Eighteen of them had their symptoms resolve after the surgery. After the operation, there is no new-onset urinary urgency. The mean (range) and median preoperative urethral calibration size of were 12.4 (6–16) F and 13 F, respectively, while the mean (range) and median postoperative calibration size were 24.1(22–26) F and 24 F; the improvement (median 11 F) is significant ($p < 0.05$). The mean (range) and median preoperative Qmax were 8.81 (3.5–8) ml/s and 7 ml/s, respectively, whereas the mean (range) and median postoperative Qmax were 24.6 (19.5–28.6) ml/s and 24.45 ml/s, respectively; the improvement (median 17.45 ml/s) is significant ($p < 0.05$). Similarly, the mean (range) and median preoperative PVR were 152.08 (110–200) ml and 145 ml, respectively, while the mean (range) and median PVR decreased to 45.41 (20–100) ml and 40 ml, respectively; the

Table 1: Preoperative patient variables

Sl. No	Age (years)	Symptoms	Previous h/o dilatation	Qmax ml/s	PVR (ml)	Urethral calibration (F)	Site of stricture/ length(cm)	PGI-S
1.	45	PF, UF,IV	Yes	6.5	125	6	Mid/1.2	4
2.	47	PF, UF	Yes	3.5	140	14	Mid/1.0	4
3.	42	PF, UF	No	4.0	200	10	Mid/1.3	4
4.	46	PF, UF,IV UF,	No	7.8	150	10	Mid+Distal/1.8	4
5.	60	UTI	Yes	7.4	124	14	Mid/1.4	3
6.	63	PF, UF	Yes	6.2	130	12	Mid/1.5	3
7.	45	UF,IV	Yes	7.0	122	8	Mid/0.8	4
8.	47	PF, UF	Yes	7.5	135	12	Mid/1.7	4
9.	63	PF, UF,IV	Yes	7.2	200	14	Mid/1.1	3
10.	65	PF, UF,IV	Yes	8.0	150	14	Mid/1.2	4
11.	60	PF, UF	Yes	3.6	130	12	Mid+Distal/1.9	4
12.	61	PF, UF,IV	No	5.8	160	10	Mid/0.8	3
13.	58	PF, UF,IV	Yes	7.3	175	14	Mid/1.5	4
14.	60	PF, UF,IV	Yes	7.0	120	14	Mid/1.2	4
15.	65	PF, UF	Yes	4.5	180	12	Mid/1.5	4
16.	68	PF, UF,IV	Yes	6.2	140	10	Mid/1.3	3
17.	50	PF, UF,IV	Yes	7.5	128	14	Mid+Distal/1.8	4
18.	57	PF, UTI	Yes	6.5	155	14	Mid/1.2	3
19.	45	PF, UF,IV	Yes	7.4	200	16	Mid/1.3	4
20.	42	PF, UF,IV	Yes	7.2	140	12	Mid/1.3	3
21.	57	PF, UTI	Yes	5.8	156	16	Mid/1.4	4
22.	53	PF, UF	Yes	6.4	180	14	Mid/0.8	4
23.	48	PF, UF,IV	No	8.0	200	10	Mid/1.2	4
24.	52	PF, UF	Yes	7.5	110	16	Mid+Distal/1.8	4

Mid-middle one third Distal-distal one third PF-poor flow UF-urgency frequency IV-incomplete voiding PGI-S score-Patient Global Impression of symptom Severity

amount of decrease (median 105 ml) is significant ($p < 0.05$). We used the PGI-I score to assess self-reporting satisfaction after surgery. It showed that Seven (7) patients scored 1 (very much better), fourteen (14) patients scored 2 (much better) and three (3) patients scored 3 (a little better). No patient obtained a score of 4–7(no change to very worse).

IV. Discussion

Female urethral stricture (FUS) is a rare entity. Women with FUS can experience both storage and voiding symptoms that are often complicated by recurrent UTIs[10]. The exact aetiology of FUS is still unclear, often due to infection, chronic irritation, repeated prior dilatation, difficult catheterisation, urethral surgery or

trauma[11,12]. Osman et al. described FUS as: "A symptomatic, anatomical narrowing of the urethra based on a failure of catheterisation, urethral calibration, visual inspection, or endoscopy or radiography"[13]. This definition guided us in deciding the exclusion criteria of FUS. These are meatal stenosis, primary or functional bladder neck obstruction, neurogenic bladder, pelvic irradiation,

Table 2: Postoperative patient variables

Sl. No	Follow up (months)	Urethral calibration	Q max (ml/s)	PVR (ml)	PGI-I score	Need for further dilatation	Operative time (min)
1.	12	26	28.4	20	1	No	80
2.	15	24	24.6	30	2	Yes	90
3.	12	24	22.7	60	2	No	75
4.	24	24	24.2	35	2	No	85
5.	12	24	28.4	20	3	No	80
6.	15	24	19.6	25	2	No	100
7.	24	22	28.3	30	2	Yes	120
8.	12	24	25.3	65	2	No	80
9.	12	26	26.3	70	1	No	90
10.	15	22	22.4	100	2	No	100
11.	24	24	19.8	50	1	No	75
12.	12	24	24.0	20	1	No	70
13.	15	26	27.6	65	1	No	70
14.	18	24	28.5	20	1	No	75
15.	12	26	22.8	35	1	No	90
16.	24	22	19.5	40	3	Yes	85
17.	24	22	26.4	35	2	No	100
18.	24	24	28.6	60	2	Yes	90
19.	12	26	20.8	45	2	No	75
20.	24	26	22.5	50	2	No	80
21.	12	22	26.4	60	3	No	100
22.	12	24	24.3	80	2	Yes	70
23.	15	26	22.6	35	2	No	90
24.	18	24	28.4	40	2	No	80

PGI-I score patient global impression of improvement questionnaire

urologic or gynaecologic malignancy or trauma. In the absence of any strict diagnostic criteria, a combination of presenting symptoms and objective findings are often used to attain a diagnosis[10].

One of the variables utilised to identify FUS was urethral calibration. However, the lower calibre threshold remains undefined. In 1951, Brannan et al. stated that the typical female urethra usually accommodates 30F without difficulty and a narrowing ≤ 20F usually suggests a pathological narrowing[14].

We employed a combination of subjective clinical symptoms and objective signs, such as urethroscopy, office urethral calibration, bladder ultrasound (PVR), and uroflowmetry (Qmax), to make the diagnosis. The diagnostic criteria we adopted conform to those reported by Keegan et al.[10] and are widely accepted. The sole purpose of urodynamic tests is to rule out bladder dysfunction.

In this study, many patients had previously failed multiple sessions of minimally-invasive urethral procedures. Our results showed that although the success rate of female urethroplasty with buccal graft was far better than UD it is still underutilized[13]. This may be due to simplicity of the minimally invasive techniques, associated financial considerations and complexity of female urethroplasty. Patients who have not responded well to these minimally invasive techniques have been reserved for surgery. Repeated over-dilatation,

Table 3: Comparison between the Pre and Post operative variables

Sl. No	Preoperative calibration(F)	Postoperative calibration(F)	Preoperative PVR(ml)	Postoperative PVR(ml)	Preoperative Qmax (ml/s)	Postoperative Qmax (ml/s)
1.	6	26	125	20	6.5	28.4
2.	14	24	140	30	3.5	24.6
3.	10	24	200	60	4.0	22.7
4.	10	24	150	35	7.8	24.2
5.	14	24	124	20	7.4	28.4
6.	12	24	130	25	6.2	19.6
7.	8	22	122	30	7.0	28.3
8.	12	24	135	65	7.5	25.3
9.	14	26	200	70	7.2	26.3
10.	14	22	150	100	8.0	22.4
11.	12	24	130	50	3.6	19.8
12.	10	24	160	20	5.8	24.0
13.	14	26	175	65	7.3	27.6
14.	14	24	120	20	7.0	28.5

15.	12	26	180	35	4.5	22.8
16.	10	22	140	40	6.2	19.5
17.	14	22	128	35	7.5	26.4
18.	14	24	155	60	6.5	28.6
19.	16	26	200	45	7.4	20.8
20.	12	26	140	50	7.2	22.5
21.	16	22	156	60	5.8	26.4
22.	14	24	180	80	6.4	24.3
23.	10	26	200	35	8.0	22.6
24.	16	24	110	40	7.5	28.4

however, can result in scarring, a quick return with an dense stricture, and an increased risk of recurrent infections.

In our study, we chose BMG as graft because it is an excellent graft for urethroplasty, as it is elastic, hairless, and adapted to a moist environment and dorsal approach. If lichen sclerosus is the cause of the stricture in a female, the use of vaginal mucosa should be avoided. It is recommended to utilise oral mucosa instead because it is more lichen sclerosus resistant. In case of vaginal atrophy, vaginal mucosa is not suitable for urethral reconstruction[15]. Atrophic changes will take place after menopause even in women with normal vaginal mucosa. This could have an impact on the reconstruction and increase the risk of future stricture recurrence[16]. The anterior vaginal wall flap can cause an inward urine stream with vaginal voiding[17]. Dorsal procedures are more technically difficult and carry a higher risk of bleeding[10]. The dorsal technique, on the other hand, carries a lower risk of graft sacculation and the development of fistulas.

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