



COMPARISON OF VARIOUS URETHROPLASTY TECHNIQUES FOR LONG SEGMENT URETHRAL STRICTURE: OUR EXPERIENCE OF A SINGLE CENTRE PROSPECTIVE STUDY OF 2 YEARS

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ABSTRACT **INTRODUCTION:** Male urethral stricture is a relatively common urological problem, with the highest prevalence in underdeveloped countries. The aim of this study was to assess the etiologies leading to stricture, success rate, complications of various types of urethroplasty techniques for long segment urethral stricture. **METHODS:** This is a prospective study that included patients who underwent surgical intervention for urethral stricture disease from April 2018 to April 2020. Pre-operative, intra-operative and postoperative data were recorded at 6- and 9-months follow-up. Complications were recorded during each visit. **RESULTS:** A total of 78 patients with urethral stricture were included in this study. Of these, 32 patients underwent single staged urethroplasty (Asopa's dorsal inlay BMGU [n=18] and Kulkarni's dorsal onlay BMGU [n=14]), 38 patients underwent staged reconstruction and eight underwent Orandi's flap. The mean hospital stay was significantly higher in the staged reconstruction group compared to single-staged group (9.83 vs. 5.78 days; P<0.0001). The success rate in Orandi's flap, single staged, staged reconstruction were 75.00%, 84.38% and 89.47%, respectively at 9 months follow-up. Wound infection (12.50%) was the most common complication observed in the single staged group. Donor site complication and wound infection was observed in 7.89% each in the staged reconstruction group. **CONCLUSION:** All the procedures had a high success rate with minimum complications. Asopa's dorsal inlay BMGU is easier than Kulkarni's dorsal Onlay BMGU. Staged urethroplasty is a better option for long segment stricture urethra, particularly with lichen sclerosis. However long-term follow-up is required to assess the success rate of various techniques.

KEYWORDS : urethral stricture, buccal mucosal graft, single staged urethroplasty, staged reconstruction urethroplasty, dorsal inlay technique of Asopa, Dorsal onlay technique of Kulkarni

INTRODUCTION

The term urethral stricture refers to anterior urethral disease. It is a scarring process involving the spongy erectile tissue of the corpus spongiosum (spongiofibrosis). Any process that injures the urethral epithelium or the underlying corpus spongiosum at the site of healing resulted in a scar can cause an anterior urethral stricture [1]. The scar is composed of dense collagen and fibroblasts and, thus, contracts in all directions, reducing urethral lumen [2]. The definition of the long segment is not standardized yet in the literature; some studies used 8 cm or 9 cm as a cut-off [3, 4], while others defined it as more than one stricture site [4]. Male urethral stricture is a relatively common urological problem, with the highest prevalence in underdeveloped countries. It has an incidence rate as high as 0.6% in some susceptible populations [5].

Meta-analysis of the literature has shown that most urethral strictures are iatrogenic (33%), idiopathic (33%) and, to a lesser extent, trauma (19%) and inflammation (15%) [6]. Iatrogenic strictures are also common, which can be attributed to endo-urological procedures. For long-segment strictures, buccal mucosa graft (BMG) substitution urethroplasty is preferred, however, Johanson's staged BMG urethroplasty is a time-tested technique for managing near obliterative penile, and pan-urethral strictures. However, a reconstructive surgeon refines and evolves his technique at regular intervals.

The recurrence rate is high in all types of long-segment strictures. Surgeons should know the correct technique, the indications, the advantages and the disadvantages of the different types of urethroplasties. The present study aimed to assess the etiologies leading to stricture, success rate, complications of various types of urethroplasty techniques for long segment urethral stricture.

METHODS

This is a prospective study conducted at the Department of Urology and Renal Transplant, Gauhati Medical College Hospital, Guwahati, India between April 2018 and April 2020. We reviewed the clinical records and follow-up data of patients with urethral stricture. All patients who underwent surgical intervention for urethral stricture disease during this period were included except those mentioned in the exclusion criteria. Exclusion criteria were pediatric age group less than 14 years and patients with malignant urethral stricture. Preoperative

evaluation included detailed clinical history with local examination, general and systemic examination including oral examination and investigations such as urinalysis to rule out any active urinary tract infection, renal function test, ultrasonography of kidney, ureter, bladder, prostate (KUBP) region with post-void residual urine, uroflowmetry to document peak urinary flow rate (Q_{max}), retrograde urethrography and micturating cystourethrography (RGU and MCU) to evaluate the site and extent of urethral stricture.

Preoperative and intraoperative parameters

All patients received broad-spectrum antibiotic preoperatively 1 hour before induction of anesthesia and continued postoperatively. On table urethroscopy was done to evaluate stricture length, condition of the urethra and any obliterative lumen. The first dressing of the urethroplasty wound site was done at 48 hours of surgery and daily till discharge from the hospital. Patients were discharged with per urethral catheter and suprapubic catheter in situ and on an oral antibiotic. All patients were advised to report any wound-related complications. Per urethral catheter (PUC) was removed after 4 weeks and the suprapubic catheter removed after 5 days of successful voiding trial.

Patients with long-segment stricture / pan-urethral stricture underwent either single-stage BMGU or staged urethroplasty or longitudinal skin island flap (Orandi's flap). We have followed up data for up to 9 months of all the patients. Q_{max} was recorded at 6- and 9-months follow-up. Patients with the poor urinary flow (Q_{max} <15 mL/s) and typical box-shaped curve in uroflowmetry during the follow-up underwent RGU+MCU and urethroscopy. Complications were recorded during each visit. Patients with the redevelopment of stricture that required any surgical intervention was considered as failure.

STATISTICAL ANALYSIS

Data were analyzed using statistical package for the social science (SPSS) version 23.0. Unpaired t-test was used to detect the difference between the intervention arms. The categorical data were analyzed by Fisher's exact test. The P value <0.05 was considered significant.

RESULTS

A total of 78 patients with urethral stricture were included in this study. Of these, 32 patients underwent single staged urethroplasty (among them, 18 had Asopa's dorsal inlay BMGU and 14 had Kulkarni's dorsal

onlay BMGU), 38 patients underwent staged reconstruction and eight underwent Orandi's flap.

The etiology of strictures were idiopathic in 51% (n=40), histologically proven lichen sclerosis et atropicus in 35.3% (n=28), iatrogenic in 13.7% (n=10) (Table 1) (Figure 1 and 2).

Table 1: Number of patients included according to etiology for various BMG procedures

Parameter	Single-stage (N=32)		Staged reconstruction (N=38)	Orandi's flap (N=8)	Total (N=78)
	Asopa's BMGU (n=18)	Kulkarni's BMGU (n=14)			
Idiopathic	9 (50.00)	7 (50.00)	20 (52.63)	4 (50.00)	40 (51.28)
Lichen sclerosis et atropicus	6 (33.33)	5 (35.71)	14 (36.84)	3 (37.50)	28 (35.89)
Iatrogenic	3 (16.67)	2 (14.28)	4 (10.53)	1 (12.50)	10 (12.8)

Data shown as n (%).

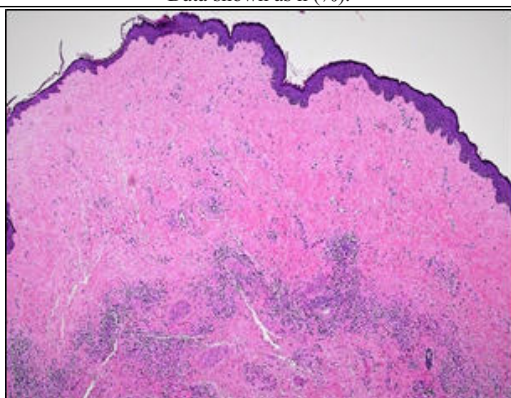


Figure 1: Low magnification photomicrography showing band of lymphocytes (lichenoid cells) in deep lamina propria

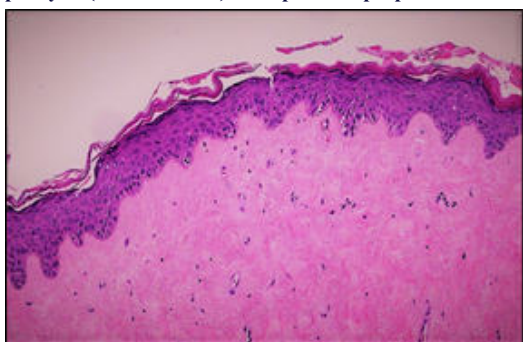


Figure 2: High magnification photomicrography showing mild atrophy with vacuolar

The mean age of the patients with Orandi's flap was 42.70 years (Table 2). The post-operative maximum urine flow rate was 15.90 mL/s at 6 months and 15.32 mL/s at 9 months follow-up. The success rate of Orandi's flap was 75% at 9 months.

Table 2: Preoperative, intraoperative and postoperative parameters of patients with penile longitudinal skin island flap (Orandi's flap)

Parameter	Total (N=8)
Age (years)	42.70 (10.02)
Qmax at post-operative 6 months (mL/s)	15.90 (3.09)
Qmax at post-operative 9 months (mL/s)	15.32 (4.12)
Success rate at post-operative 6 months, n (%)	7 (87.5)
Success rate at post-operative 9 months, n (%)	6 (75.0)
Stricture length (cm)	6.7 (2.54)

Data shown as mean (SD), unless otherwise specified.
Qmax, maximum urine flow rate.

Except hospital stay, the preoperative, intraoperative and

postoperative outcomes between single-stage and staged reconstruction groups were comparable (Table 3). The mean hospital stay was significantly higher in the staged reconstruction group compared to single-stage group (9.83 vs. 5.78 days; P<0.0001).

Table 3: Preoperative and intraoperative parameters of single-stage BMG and staged BMG reconstruction groups

Parameter	Single-stage (n=32)	Staged reconstruction (n=38)	P value
Penile stricture, n (%)	22 (68.75)	25 (65.79)	0.794
Pan-urethral stricture, n (%)	10 (31.25)	13 (34.21)	0.794
Age (years)	38.32 (14.34)	42.28 (18.56)	0.233
Qmax (mL/s)	5.34 (2.03)	5.17 (1.97)	0.724
Stricture length (cm)	7.46 (2.45)	7.11 (2.39)	0.548
Length of harvested graft (cm)	6.99 (2.12)	7.85 (1.98)	0.084
Hospital stays (days)	5.78 (2.23)	9.83 (2.11)	<0.0001

Data represented as mean (SD), unless otherwise specified.
Qmax, maximum urine flow rate.

The mean urine flow rate was 16.63 mL/s and 16.11 mL/s in single stage group and 17.22 mL/s and 16.76 mL/s in staged reconstruction at 6 and 9 months follow-up, respectively. The success rate was comparable between both the groups (Table 4). Wound infection (12.50%) was the most common complication observed in single staged group. Donor site complication and wound infection was observed in 7.89% each in staged reconstruction group.

Table 4: Post-operative follow-up data of single-stage BMG and staged BMG reconstruction groups

Parameter	Single-stage (n=32)	Staged reconstruction (n=38)	P value
Qmax at 6 months (mL/s), mean (SD)	16.63 (3.89)	17.22 (4.44)	0.560
Qmax at 9 months (mL/s), mean (SD)	16.11 (3.01)	16.76 (3.21)	0.388
Success rate at 6 months	29 (90.63)	35 (92.11)	0.825
Success rate at 9 months	27 (84.38)	34 (89.47)	0.529
Complications			
Donor site complication	2 (6.25)	3 (7.89)	0.792
Wound infection	4 (12.50)	3 (7.89)	0.525
Wound hematoma	1 (3.12)	1 (2.63)	0.903

Data shown as n (%), unless otherwise specified.
Qmax, maximum urine flow rate.

The mean age of patients with Asopa's dorsal inlay BMGU and Kulkarni's dorsal onlay BMGU was 41.11 years and 39.33 years. The preoperative and intraoperative parameters were comparable between Asopa's dorsal inlay BMGU and Kulkarni's dorsal onlay BMGU (Table 5).

Table 5: Preoperative and intraoperative parameters of single stage repair (Asopa dorsal inlay and Kulkarni dorsal onlay groups)

Parameter	Asopa's BMGU (n=18)	Kulkarni's BMGU (n=14)	P value
Age (years)	41.11 (14.45)	39.33 (11.76)	0.711
Qmax (mL/s)	5.56 (2.45)	5.96 (3.12)	0.687
Stricture length (cm)	6.34 (2.01)	6.53 (2.94)	0.829
Length of harvested graft (cm)	7.33 (2.19)	7.72 (1.83)	0.607
Hospital stays (days)	4.32 (1.28)	4.88 (2.84)	0.461

Data shown as mean (SD).
Qmax, maximum urine flow rate.

The mean urine flow rate was 17.92 mL/s in Asopa's dorsal inlay BMGU group and 17.38 mL/s in Kulkarni's dorsal onlay BMGU (P=0.696) at 9 months follow-up. The success rate was comparable between both the groups at 6 and 9 months follow-up (Table 6). Wound infection (12.50% and 14.28%) was the most common complication observed in Asopa's dorsal inlay BMGU group and Kulkarni's dorsal onlay BMGU.

Table 6: Post-operative follow-up data and complications of single stage repair (Asopa dorsal inlay and Kulkarni dorsal onlay groups)

Parameter	Asopa's BMGU (n=18)	Kulkarni's BMGU (n=14)	P value
Qmax at 6 months (mL/s), mean (SD)	19.10 (4.22)	18.33 (3.32)	0.579
Qmax at 9 months (mL/s), mean (SD)	17.92 (3.45)	17.38 (4.29)	0.696
Success rate at 6 months	17 (94.44)	13 (92.85)	0.856
Success rate at 9 months	15 (83.33)	11 (78.58)	0.737
Complications			
Donor site complication	2 (11.11)	1 (7.14)	0.706
Wound infection	3 (16.67)	2 (14.28)	0.856
Wound hematoma	1 (5.56)	-	-
Data shown as n (%), unless otherwise specified. Qmax, maximum urine flow rate.			

A total of 11 patients observed failure with urethroplasty at 9 month follow-up. The overall failure rate is summarized in Table 7.

Table 7: Number of failed urethroplasty patients included according to etiology for various BMG procedures after 9 month follow-up

Parameter	Single-stage (N=32)		Staged reconstruction (N=38)	Orandi's flap (N=8)	Total (N=78)
	Asopa's BMGU (n=18)	Kulkarni's BMGU (n=14)			
Idiopathic	1 (5.55)	1 (7.14)	1 (2.63)	0	3 (3.84)
lichen sclerosis et atrophicus	2 (11.11)	2 (14.28)	2 (5.26)	1 (12.5)	7 (8.97)
Iatrogenic	0	0	1 (2.63)	0	1 (1.28)
Data shown as n (%).					

DISCUSSION

The present study compared the feasibility and safety of various types of urethroplasty techniques for long segment urethral stricture. Out of total 78 patients, eight patients were selected for longitudinal skin island flap (Orandi's flap). Seventy patients were selected for single stage and staged urethroplasty with BMGU. The single-stage BMGU was performed in 32 patients. Among 32 patients who had undergone single-stage urethroplasty for long segment urethral stricture, 18 patients were Asopa dorsal inlay BMGU and 14 patients were Kulkarni's dorsal onlay BMGU. Staged reconstruction with BMG in the second stage was performed in 38 patients.

The Orandi flap urethroplasty is a reliable and easy technique to treat a pendulous urethral stricture. However, it is important to get the right width of the flap. A flap width up to 25 mm can easily be taken without damaging penile skin closure. Goel et al. showed a success rate of 80% with a median follow-up was 12 months [7]. The present study demonstrated a slightly higher success rate of 81% with a median follow-up of 9 months.

Substitution urethroplasty has an important role in treating a long stricture. Augmentation can be done with different body tissues including prepuce, skin from the pinna, mucosa (lingual, urinary bladder and buccal). Among these, BMG is a good substitute for urethroplasty as it can be easily harvested. BMG is hairless, compatible in a wet environment, has pan laminar blood flow and is early taken up by the urethral bed. Due to its unique features, it becomes an integral part of reconstructive urology.

For the anterior urethral stricture, dorsal onlay graft procedure provides better mechanical support with better vascularity by the corporal bodies for better take-up of graft, in addition, reduce the incidence of sacculation and fistula formation [8]. Evidence from a systematic review by the Société Internationale d'Urologie (SIU) with the International Consultation on Urological Disease (ICUD) reported success rates of 88.3% after dorsal Onlay approach [9]. Kulkarni et al. treated 117 patients with 14 cm mean stricture length using dorsal onlay BMG and they reported an 83.7% success rate at a median follow-up of 59 months [4]. In parallel to these studies, the present study revealed a success rate of 84.83 % of this procedure.

A recently published retrospective study described a comparison

between Asopa's dorsal inlay and Kulkarni's dorsal Onlay BMGU technique. The results showed that both the technique had an equivalent success rate (86.67% and 83.33%) and comparable complications [9]. Bagchi PK, et al published a retrospective study of 90 cases with anterior urethral strictures where BMGU was performed. The success rate for dorsal onlay and dorsal inlay BMGU was 80.9% and 87.5% respectively [10]. Pisapati et al. reported a success rate of 87% using Asopa's technique for urethral strictures in which none of the recurrences had occurred in penile strictures [11]. In a previous study of 60 patients who underwent OMG urethroplasty, out of the 51 (85%) had a successful outcome and nine (15%) had failures. The success rate was 85.7% in the Asopa group, 85% in the Barbagli group and 15% in Kulkarni group [12]. The present study revealed that the Asopa's dorsal inlay and Kulkarni's dorsal Onlay BMGU efficiently produced better outcomes related to success rate and Qmax with minimal complications.

A two-stage urethroplasty with buccal mucosa is indicated in patients with long urethral strictures with severe spongiositis, multiple obliterative strictures and in lichen sclerosis. Joshi et al. [13] had done two-stage urethroplasty with BMGU in the second stage for long urethral strictures, showed that, of total 42 patients, at a median follow-up of 44 months, 34 (89.5%) were successful. Furr JR et al. [14], included 49 patients for staged BMG urethroplasty. The median stricture length was 7 cm. Long-term success was 96.4% in the patients with BMG only. This is in accordance with the present study where the success rate was 89.47%.

The present study was limited by a small sample size. This was a prospective comparative study from a single institution. Randomized trials with larger sample size and longer follow-up are necessary to conclude robustly which treatment modality is better.

CONCLUSIONS

Management of long segment urethral stricture is challenging. There are various feasible techniques for the management of long-segment urethral stricture. Asopa's dorsal inlay BMGU is easier than Kulkarni's dorsal Onlay BMGU. Staged urethroplasty is a better option for long segment stricture urethra, particularly with lichen sclerosis. In comparison to idiopathic, iatrogenic and lichen sclerosis patients of staged procedure, lichen sclerosis strictures had slightly poor results compared to others. However long-term follow-up is required to assess the success rate of various techniques.

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