Original Article

Outcome of buccal mucosa and lingual mucosa graft urethroplasty in the management of urethral strictures: A comparative study

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Abstract

Objective: The objective of the study was to compare the outcome of buccal and lingual mucosa graft (LMG) augmentation urethroplasty along with donor sites morbidities in anterior urethra stricture.

Subjects and Methods: From September 2010 to January 2014, 125 patients underwent single stage augmentation urethroplasty. They were randomly divided into two groups to receive either buccal mucosa graft (BMG) or LMG. The patients were prospectively followed for complications and outcome.

Results: Baseline characteristics such as mean age, etiology, stricture length, and location were comparable in both groups. Overall success rate for Group 1 and Group 2 were 69.2% and 80%, respectively. Mean follow-up periods were 28.2 and 25 months in Group 1 and Group 2, respectively.

Conclusions: LMG provides the better outcome with fewer immediate and delayed complications as compared to BMG. The length of stricture and width of graft were main factors affecting the outcome.

Key Words: Augmentation, buccal, lingual, urethral stricture, urethroplasty

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INTRODUCTION

Long segment urethral strictures are one of the common referrals in tertiary institutes. Surgical treatment of urethral strictures has been continuously evolving. Various graft tissues have been used for urethroplasty, with variable outcome. However, the quest to find the best tissue continues. The use of buccal mucosa graft (BMG) for urethral reconstruction was first reported, in 1894.[1] Currently, the buccal mucosa is the preferred donor site for substitution urethroplasty.[2] However, its harvesting is associated with donor site morbidities, such as perioral numbness, difficulty in opening the mouth and less commonly, dry mouth, and scarring.[3] In 2006, Simonato *et al.* first reported the use of lingual mucosa graft (LMG) for urethroplasty.[4] LMG harvesting is associated with donor site morbidities like difficulty in articulation for initial few days.[5] After a pilot study by Simonato *et al.* other studies have reported almost equal outcome between BMG and LMG.[4,6] However, there has been a lack of adequate number of randomized controlled trials, which compare the long-term outcomes

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of these two grafts. Therefore, we conducted a randomized prospective study to compare the long-term outcomes and complications between BMG and LMG.

SUBJECTS AND METHODS

Study design

After ethics committee approval, we enrolled 125 patients of anterior urethral stricture for the study. They were randomly allocated to two groups using chit in box method, 63 in Group A and 62 in Group B. After excluding nine patients, who had follow-up less than 1-year, and 14 patients who lost to follow-up 102 patients, 52 from BMG group; and 50 cases from LMG group were finally analyzed. This study was performed at SMS Medical College and Hospital, Jaipur from September 2010 to January 2014.

Inclusion and exclusion criterion

Patients with short stricture (<2.5 cm), strictures with caliber <6 mm, complex strictures (strictures associated with abscess, fistula), posterior urethral strictures, history of oral surgery, visible oral mucosal changes, restricted mouth opening, tongue tie (decreased mobility of tongue tip due to unusually short frenulum), and previous failed urethroplasty were excluded from the study. Those patients who had no enlisted contraindications were randomized into two groups to receive either BMG or LMG.

Preoperative workup

Patient characteristics and baseline data were recorded. All patients underwent uroflowmetry (UFM), urine culture/sensitivity, urethrography, and cystourethroscopy. The oral mucosal characteristics were assessed in all patients during the initial workup.

Technique

Single stage dorsolateral onlay graft urethroplasty was done in all patients. After intubation under general anesthesia, initially perineal dissection was done. After giving midline perineal incision, bulbospongiosus muscle was dissected and retracted or splitted in distal third if needed. The urethra was mobilized from cavernosa only on one side beyond midline to conserve the vascular supply coming from cavernosa [Figure 1a]. The urethra was opened longitudinally in eccentric position or lateral side. Exact stricture length was measured [Figure 1b]. Graft to be procured was harvested 2 cm longer than the measured stricture length, as there is approximate 10% contraction over time,[7] and width of 15–25 mm was taken so that there is lumen of at least 24 Fr after tubularization. Bilateral grafts were taken, when required. For BMG, graft procurement was started with the submucosal infiltration of xylocaine and adrenaline (1:100,000) under the marked buccal mucosal patch. Approximately, 0.5–1.0 cm mucosa from Stenson's duct and 1.0–1.5 cm from the angle of mouth were left to prevent duct injury and lip eversion, respectively. All defects were left open to prevent tension, pain, and disfigurement.

For LMG, traction suture was applied on the apex of tongue. The segment to be harvested is marked on the ventrolateral surface [Figures 1ci and ii] and submucosal wheel of xylocaine and adrenaline (1:100,000) put. The mucosa was harvested sharply with scalpel and tenotomy scissors [Figure 1d], leaving 4–5 mm mucosal edge from dorsal edge to prevent injury to taste buds. At least 1 cm of the mucosa was spared from the tip of the tongue to prevent slurring of speech. Utmost care was taken to avoid taking underlying genioglossus muscle and lingual nerve in the graft, which is the cause of contractures, numbness, and increased bleeding. Hemostasis was achieved with the help of bipolar cautery [Figure 1e]. All defects were left open so that comparison can be carried out between donor site morbidities.

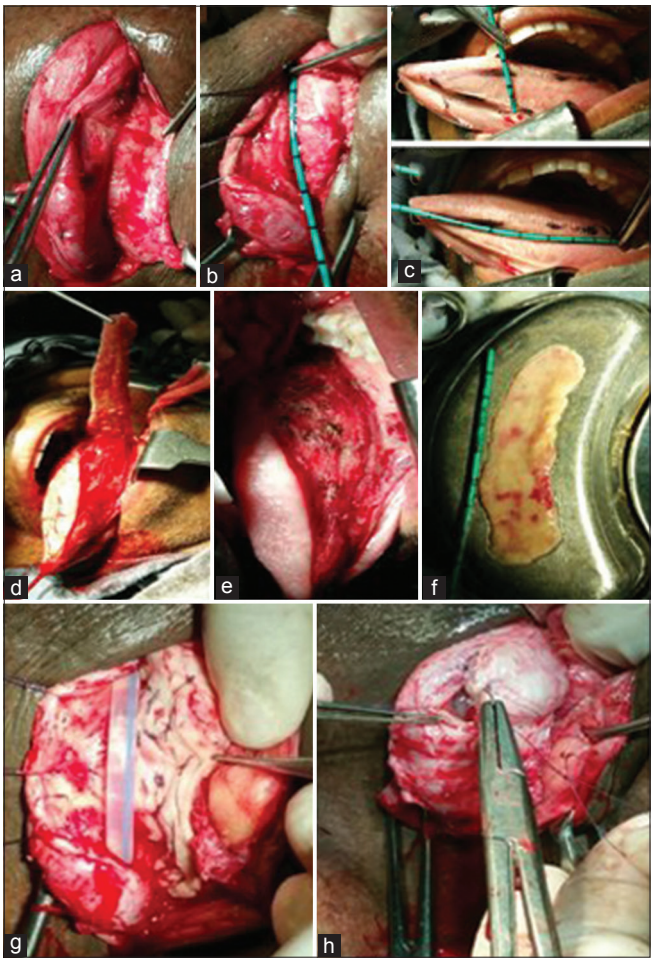

Figure 1: Steps of graft harvesting. (a) A dorsolateral mobilization of urethra; (b) Measuring stricture length; (c) (i and ii) Marking donor site for graft harvesting; (d) Lingual graft; (e) Donor site after hemostasis with bipolar cautery; (f) Defatting of graft; (g) Dorsolateral placement of graft with quilting; (h) Tabularization over silicone catheter

After graft harvest, defatting was done till the graft appeared creamy white [Figure 1f]. Graft and urethral plate were stretched to avoid postoperative saccules and postvoid dribbling; quilted on cavernosal bodies and after that it was sutured to the urethral plate in dorsolateral onlay fashion [Figure 1g]. Finally, the urethra was closed over 16 Fr silicone catheter with 4–0 vicryl [Figure 1h].

Postoperative

All patients were given intravenous antibiotics for 3 days, followed by oral antibiotics till catheter removal, which was done at 3 weeks. The patient was allowed clear fluids or ice cream on day 1 and then gradually soft and regular diet in the days that followed. In the postoperative period, a nonvalidated questionnaire was given to patients for reporting the grade and severity of complications.

Follow-up

The patients were followed at 1, 3, and 6 months after surgery and then at 6 months interval. Voiding symptoms, questionnaires, and UFM were done in all as primary screening for stricture recurrence. Urethrography and cystourethroscopy were done as a secondary screening only if the patient developed obstructive symptoms or UFM showed Q_{max} <15 ml after ruling out lower urinary tract infection.

The success of urethroplasty was considered as the primary outcome of the study. We defined success as the absence of any obstructive symptoms and no need of subsequent procedures, such as dilatation, CIC, cystourethroscopy, and optical internal urethrotomy.

Statistical analysis

Data were entered in the MS Excel and analyzed in SPSS version 20 software (IBM Corp. IBM SPSS Statistics for Windows, Version 20.0). Continuous variables were presented as means ± standard deviation. Proportions (percentages) were calculated for discrete variables. To find out the difference in mean between two groups the Student's *t*-test was used, and Chi-square test was used for discrete variables. Multiple regression analysis was used to assess the relation of etiology, a suprapubic catheter (SPC), stricture length, tobacco chewing, and graft width with the final outcome, adjusting for the covariate. Two-tailed $P = 0.05$ was considered to be statistically significant.

RESULTS

Characteristics of patients are tabulated in Table 1. No significant difference was observed in variables among both groups. The stricture length ranged from 3.2 to 13.4 cm in BMG group and 3.8 to 12.2 cm in LMG group. The success rate for BMG and LMG was 69.2% and 80%, respectively though it did not reach statistical significance. Sixteen patients presented with voiding difficulty in the first 3 months, 6 in the next 3 months, and 4 in the next 6 months; mean follow-up was 28.2 months in BMG and 25 months in LMG group.

Early and immediate donor site complications were more common in BMG group except for bleeding, which was more common in LMG group due to more vascularity of tongue. Numbness (61.76%) and difficulty in chewing (54.9%) were the most common morbidities overall. Swelling (48%) and articulation (40%) seemed to be the common problems during the first week [Table 2]. Though numbness of donor site was the most common complication, but it was transient in most patients. Late donor site complications included persistent numbness of donor site in one in BMG group, and articulation difficulty in one in LMG group. Postoperative pain, numbness, and salivary flow changes were more common in patients whose bilateral grafts were harvested.

Table 1: Comparative analysis of various characteristics among the groups

Characterstics	BMG *N*=52	LMG *N*=50	*P* value	Level of significance
Age				
Mean±SD	40.69±14.32	40.50±13.08	0.944	NS
Length of stricture				
Mean	6.5 cm (3.2-13.40)	6.69 cm (3.8-12.20)	0.68	NS
2.5-5 cm	16	14	2.921 with 3 df *P*=0.549	NS
5.1-7.5 cm	21	19	(df)	
7.6-10 cm	11	16		
>10 cm	4	1		
Graft width				
Mean±SD (range)	2.17 cm±0.2 (1.8-2.5)	2.11 cm±0.25 (1.5-2.5)	0.188	NS
Graft harvesting				
Unilateral (%)	25 (48.1)	16 (32)	2.113 with 1 df; *P*=0.146	NS
Bilateral (%)	27 (51.9)	34 (68)		
Mean operative time (min)	148.44±17.39 (120-185)	145.98±17.96 (114-184)	0.483	NS
Mean follow up (months)	28.2±11.54 (12-52)	25±12.19 (12-52)	0.17	NS
Success rate	69.2% (36)	80% (40)	1.041 with 1 df; *P*=0.308	NS

NS: Not significant, SD: Standard deviation, df: Degree of freedom

Table 2: Early and immediate donor site complications

Donor site morbidity	POD 2		POD 6		At 3 month		At 6 month		At 1 year	
	BMG	LMG	BMG	LMG	BMG	LMG	BMG	LMG	BMG	LMG
Oral pain	33	20	12	9	1	0	0	0	0	0
Bleeding	4	8	0	0	0	0	0	0	0	0
Difficulty in chewing	32	24	21	11	4	1	0	0	0	0
Swelling of cheek/tongue	36	13	5	2	1	0	0	0	0	0
Difficulty in articulation	19	22	7	6	1	2	0	1	0	1
Difficulty in mouth opening	30	19	17	6	1	0	0	0	0	0
Dry mouth	6	7	4	3	0	0	0	0	0	0
Altered sensations	40	23	15	9	6	3	1	0	1	0

BMG: Buccal mucosa graft, LMG: Lingual mucosa graft

Univariate analysis of variables

In BMG group, tobacco chewing, stricture length, and graft width were found to have significant correlation with the outcome ($P < 0.05$), whereas, the etiology and SPC did not have any significant correlation with the outcome [Tables 3 and 4]. In LMG group, only graft width was found to have significant correlation with the outcome ($P = 0.001$) whereas etiology, SPC and length of stricture did not have significant correlation with the outcome [Tables 3 and 4]. Association of success with etiology and SPC was not significant in both the groups. Tobacco nonchewer had significantly higher success as compared to chewer (85% vs. 42%) in BMG group. Success was higher in shorter stricture and when wider graft was used in both groups.

Wald criteria demonstrated that among the BMG group, graft width, stricture length, and tobacco chewing ($P < 0.05$) made a significant contribution to the prediction of success. While among the LMG group, graft width and length of stricture made a significant contribution to the prediction of success [Table 5]. Hence, graft width and shorter stricture length seems to be the common critical variable in deciding the outcome in both groups and along with that nontobacco chewing affecting the outcome in BMG group.

DISCUSSION

Buccal mucosa is preferred donor site for augmentation urethroplasty because of its thick epithelium, high content of elastic fibers and rich vascularity due to pan laminar plexus, and good graft uptake. It is easy to harvest, constantly available, compatible with wet environment, and boosts the local immune status with its increased amount of IgA, resistant to infection and has better healing properties as evidenced by fast healing of aphthous ulcers. Lingual mucosa shares these beneficial properties, and, in addition, is thinner, easy to harvest as tongue can be pulled out with traction and with less of perioperative and postoperative morbidity, thus making it an attractive or maybe a better alternative. It has an added advantage of use in patients with restricted mouth opening. Graft width is the only limitation with LMG.

Table 3: Association of outcome with Etiology, SPC and Tobacco chewing

	BMG outcome			LMG outcome		
	Total	Success	%	Total	Success	%
Etiology						
Inflammatory	21	15	71	15	11	73
PUC	14	10	71	17	12	71
Trauma	5	4	80	8	7	88
BXO	8	4	50	6	6	100
Iatrogenic	4	3	75	4	4	100
Total	52	36	69	50	40	80
Chi square test	1.803 with 4 df; *P*=0.772NS			4.139 with 4 df; *P*=0.388NS		
SPC						
Absent	19	10	53	16	12	75
Present	33	26	79	34	28	82
Total	52	36	69	50	40	80
Chi square test	2.742 with 1 df; *P*=0.098NS			0.052 with 1 df; *P*=0.820NS		
Tobacco						
Non Chewer	33	28	85	27	22	81
Chewer	19	8	42	23	18	78
Total	52	36	69	50	40	80
Chi square test	8.432 with 1 df; *P*=0.004S			0.005 with 1 df; *P*=0.943NS		

df: Degree of freedom, BMG: Buccal mucosa graft, LMG: Lingual mucosa graft, NS: Not significant

Table 4: Association of outcome with stricture length and graft width

	BMG outcome			LMG outcome		
	N	Mean	SD	*N*	Mean	SD
Stricture length						
Failure	16	8.37	2.633	10	7.58	1.53
Success	36	5.70	1.540	40	6.47	1.94
P value LS		<0.001 S			0.098 NS	
Graft width						
Failure	16	1.99	0.126	10	1.84	0.14
Success	36	2.26	0.179	40	2.19	0.23
P value LS		<0.001 S			<0.001 S	

BMG: Buccal mucosa graft, SD: Standard deviation, LMG: Lingual mucosa graft

Enormous literature is present on the use of oral mucosa grafts in stricture urethra, but reports about their complications are sparse. The lack of comparative study between LMG and BMG in terms of success and complications promoted us to undertake this study. A study by Kane *et al*. reported only one complication of oral bleed out of 53 patients.[8]

Table 5: Factors predicting outcome in both groups by using binary logistic regression (multivariate analysis)

Variables in the equation				
	BMG		LMG	
	Exp (B)	Sig.	Exp (B)	Sig.
Etiology	1.062	0.876	3.297	0.072
SPC	1.731	0.582	1.654	0.781
Length	0.669	0.059	0.362	0.038
Tobacco chewing	0.114	0.036	0.702	0.762
Graft width	23848.370	0.006	127587.100	0.008
Constant	0.000	0.022	0.000	0.015

SPC: Suprapubic catheter, BMG: Buccal mucosa graft, LMG: Lingual mucosa graft

Dublin and Stewart reported in his series of 35 patients using BMG: About 64% had complained of pain, 59% of numbness, and 75% of the tightness of the mouth at 48 h of surgery. Their 16% of patients had persisted oral numbness, and 32% had the tightness of the mouth till 21 months.[9] Whereas, 61% of our patients had numbness in the immediate postoperative period, and it was persisting only in 8.8% patients at 3 months follow-up. Numbness vanished in all except 1 at 1-year. About 52% complained of pain on second postoperative day, which persisted in 20.5% at 1-week, and only one patient complained of mild pain at 3 months, tightness of mouth was complained by 48% on day 2, and 22.5% patients on postoperative day 6. Though Barbagli *et al*. reported no dry mouth in 97%, and no oral swelling in 98.3% in 350 patients.[10] In our study, 12.7% complained dryness of mouth in the first week, and 48% had swelling of the donor site, which persisted for a week in 7% patients. There should be a consensus to report complications of oral mucosal graft harvesting.

BMG augmentation urethroplasty has been reported with success rates varying from 66.5% to 96% in various studies.[2,11-14] LMG has been reported to carry success rates varying from 79.3% to 90% in various studies,[4,15,16] but all studies had limited follow-up period.

We anticipated better results with BMG as per the literature reports but found LMG better. Our study has success rate for BMG and LMG as 69.2% and 80%, respectively with longer follow-up, but if we negate a single instrumentation or cystourethroscopy the success rate jumps to 80.7% and 88%, respectively because 6 patients of Group 1 and 4 patients of Group 2 did well after single instrumentation.

The reason of our lower success as a comparison to the western world may be secondary to long length and inflammatory nature of the stricture. Besides these our significant number (41.1%) of patients was tobacco chewers compromising oral mucosal quality. Our success rate is also less because of our stringent criterion, used for defining success. It is imperative to define the success criterion because internationally there is no uniform definition, and this is the main reason success rates vary markedly in different series.

To the best of our knowledge, there is only one randomized controlled trial of comparison of lingual and BMG. In this study, Sharma *et al*. have reported an equivalent outcome with use of either graft though the mean follow-up period was around 15 months. However, postoperative morbidity in the form of mouth opening and speech difficulty were more frequent in their study with the use of LMGs.[17] Though this study has shown comparable outcome with either approach, our study had a better outcome with use of LMG and fewer immediate and delayed complications as compared to BMG.

A Large number of patients in our study consumed paan masala and tobacco, which compromises oral mucosal health, also shown by Tan *et al*. and Sinha *et al*.[18-20] They probably had an unhealthy buccal mucosa thus explaining better results with LMG. Though, to the best of our knowledge, no study has been done to prove the association of tobacco specifically with lingual mucosa. It is presumed that while tobacco chewing, BMG comes more in contact with quid, so it becomes unhealthier.

In available literature correlation between the width of harvested graft and success rates have not been well documented. In our study, the width of graft had a significant impact on the outcome in both univariate, as well as multivariate analysis, with wider graft leading to the better outcome.

Strengths of our study include a large patient cohort, prospective study, and a longer follow- up. Though it is a single institution study, it could have been better if conducted in a multi-institutional setup.

CONCLUSIONS

BMG and LMG are good options for urethral reconstruction with LMG showing a better outcome in a subset of patients who are tobacco chewers. Both have a comparable and acceptable complication profile. The lingual graft is easier to harvest and have less morbidity in the postoperative period. Thus, LMG should be the preferred option in such patients.

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Conflicts of interest
There are no conflicts of interest.

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