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# Outcome of Dorsolateral Buccal Mucosal Graft Urethroplasty in Comparison to Dorsal Onlay Urethroplasty for Long Segment Anterior Urethral Stricture

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## Abstract

***Background***: Location of placement of the graft either dorsally, dorsolaterally or ventrally for the treatment of long segment anterior urethral stricture has become an issue with different series reporting different outcomes. Regarding dorsolateral and dorsal onlay technique, there are various published articles worldwide. In Bangladesh, there are limited study regarding the issue though there are lots of patients suffering from urethral stricture disease. ***Objective***: Objective of the study is to compare the outcomes of these two techniques. ***Method***: Present Quasi experimental study was conducted in the department of Urology, Rangpur Medical College Hospital & KMMCH, Rangpur, Bangladesh, during the period of October 2022 to September 2024. Total 50 patients with long segment (>2 cm) anterior urethral stricture were included in present study. Among them 25 patients underwent dorsolateral (group-A) and another 25 patients underwent dorsal onlay (group-B) urethroplasty. Patients were followed up for 06 months. ***Result***: Mean ± SD age of group-A and Group-B were 43.72 ± 7.64 and 44.08 ± 7.56 years respectively (p >0.05). Mean ± SD of length of stricture of group-A and Group-B were 4.25±1.28 and 4.22±1.31 cm respectively (p >0.05). In Group-A and Group-B preoperative mean Peak urine flow rate on uroflowmetry ($Q_{max}$) were 6.68±1.35 and 7.00±1.46 ml/sec respectively (p >0.05). Mean post-operative $Q_{max}$ were 20.00±3.20 & 20.52±4.38 ml/sec in Group-A, and 19.39±3.13 & 19.19±4.93 ml/sec in Group-B, on 1st and 2nd follow up respectively (p >0.05). There was statistically significant difference of mean $Q_{max}$ in the same group before and after BMG urethroplasty. Success was defined as peak urine flow rate on uroflowmetry ≥15ml/sec with no stricture diagnosed on RGU & VCUG and urethroscopy, and no need of any post-operative urethral intervention. Re-stricture developed in 2 (8.0%) cases in Group-A and 4 (16.0%) cases in Group-B which needed urethral intervention. Success rate was 23(92%) cases and 21(84%) cases in group A and group B respectively (p >0.05). 02(8.0%) cases in Group-A and 03(12%) cases in Group-B had wound infection, 1(4.0%) case in Group-A and 3 (12%) cases in Group-B had chordee. Urethrocutenous fistula developed in 1 (4.0%) case in Group-A and 3 (12.0%) cases in Group-B; results between the two groups were not statistically significant. ***Conclusion***: Outcome of dorsolateral buccal mucosal graft urethroplasty was comparable with dorsal onlay urethroplasty in present study. Well controlled randomized study with adequate sample size and follow up may reveal more divergent outcomes.

**Keywords:** Urethral stricture, dorsolateral graft, dorsal onlay, buccal mucosal graft.



## INTRODUCTION

Abnormal narrowing of a segment of urethra may be referred as stricture urethra [1]. The modalities of treatment for urethral stricture ranging from simple dilatation to complex multistage procedure. Among various procedures of treatment, none claim to be the best for all patients.

If urethrotomy under direct vision fails, open surgical repair should be performed. Short strictures (<2 cm) of the anterior urethra should be completely excised

and primary anastomosis done. Strictures >2 cm in length can be managed by patch graft urethroplasty. A full-thickness graft is obtained— preferably from the penile skin or buccal mucosa, and all subcutaneous tissues are carefully removed. The graft is then tailored to cover the defect and meticulously sutured into place [2].

Since the 1990, a large variety of free extragenital graft tissues have been used for urethroplasty, such as the ureter, saphenous vein, appendix, full-thickness skin, bladder mucosa, and buccal mucosa. Current opinion is that, if free extragenital tissue is needed to perform urethroplasty, a buccal mucosal graft (BMG) provides excellent clinical result but may also cause oral complications [3]. The first use of buccal mucosa for urethral substitution was as early as 1941; but it was only in 1992, that the BMG was rediscovered [4, 5]. In the same time, some authors reported the first good results of the application of a free BMG for hypospadias and urethral strictures [6, 7].

In 1996, Morey & McAninch described the ventral onlay graft technique and in the same year, Barbagli *et al*. described the dorsal onlay graft technique. New surgical techniques have been developed based on the dorsal onlay graft urethroplasty described by Barbagli *et al*. In 2000, Kulkarni *et al*. also described a new one-sided anterior urethroplasty that is dorsolateral urethroplasty [8, 9].

Techniques of urethral repair are various and the location of the patch has become a continuous issue with different series reporting buccal mucosal grafts placed either dorsally or dorsolaterally to augment the stricture segment of the urethra. Recently, dorsal free graft urethroplasty by mobilizing the urethra and incising the stricture dorsally has gained popularity, as there is reduced graft shrinkage, the corporal bodies prevent ballooning and there is good surgical outcome [10-13]. In dorsal onlay, requires circumferential mobilization of the urethra, which might cause ischaemia of the urethra in addition to chordee. That's why some surgeons managed anterior urethral stricture, applying a dorsolateral free graft by unilateral urethral mobilization. This is a surgical technique which preserves the lateral vascular supply on one side of the urethra thereby minimizing ischaemia [14]. Since circumferential mobilization of urethra is not carried out in this technique, there is no chance of developing chordee (Shing *et al*. 2009; Chaudhary *et al*. 2011) [15].

The present study is designed to compare the outcomes of buccal mucosal graft urethroplasty for long segment anterior urethral strictures based on the surgical success rates in relation to the site of graft placement i.e. dorsolateral and dorsal onlay.

## MATERIALS AND METHOD

This quasi-experimental study was conducted at the Department of Urology, Rangpur Medical College Hospital & KMMCH, Rangpur, Bangladesh, from October 2022 to September 2024. The study population consisted of male patients diagnosed with urethral stricture. A purposive sampling technique was used, with patients selected based on inclusion and exclusion criteria. Participants were then divided into two groups: Group A underwent dorsolateral buccal mucosal graft urethroplasty, while Group B received dorsal onlay buccal mucosal graft urethroplasty. After admission, counselling, and written consent, 50 patients were selected as cases as per selection criteria. All odd numbered cases (25 cases) were allocated for Group-A (dorsolateral BMG urethroplasty) and even numbered cases (25 cases) were allocated for Group-B (dosal onlay BMG urethroplasty).

**Sample Size Calculation:** The sample size was calculated using the following formula-

$n = P_1(100-P_1) + P_2(100-P_2) \times (Z_\alpha + Z_\beta)^2$ (Shein-Chung *et al*., 2017). $(P_1-P_2)^2$

n= the desired sample

**$P_1$=** Proportion of patient with success outcome in dorsolateral group = 94% (Singh *et al.,* 2009)

$P_2$= Proportion of patient with success outcome in dorsal onlay group = 70% (Pathak *et al.,* 2017)

$Z_\alpha$= 1.96, Z value at 5% level of significance.

$Z_\beta$= Z value of standard normal distribution at a definite power i.e. $Z_\beta$=0.85 at 80% power.

So,

$n = \frac{94(100-94) + 70(100-70)}{(1.96+0.85)^2 \cdot (94-70)^2}$

n = 36

Estimated sample size was 36 in each group. But due to limit of time and budget, we enrolled 25 patients for each group, total 50.

**Selection Criteria:**

**Inclusion Criteria**:

- Patients having anterior urethral stricture.
- Stricture Length >2 cm.
- Age 30 to 60 years.

**Exclusion Criteria**:

- Patient with posterior urethral injury.
- Patients with a history of urethral & urinary bladder malignancy.
- Patients with leukoplakia, submucosal fibrosis or malignancy of the oral cavity, oral neuropathies.
- Neurogenic bladder with neurological abnormality.

**Ethical Consideration:**

Informed written consent from the patient and approval from the ethical committee of Rangpur Medical College Hospital & KMMCH, Rangpur was obtained for this study.

**Data Collection:**

Data were collected from history, findings of clinical examination and results of investigations before surgery and during follow up. Data were recorded in a pre-designed data collection sheet.

**Data Analysis:**

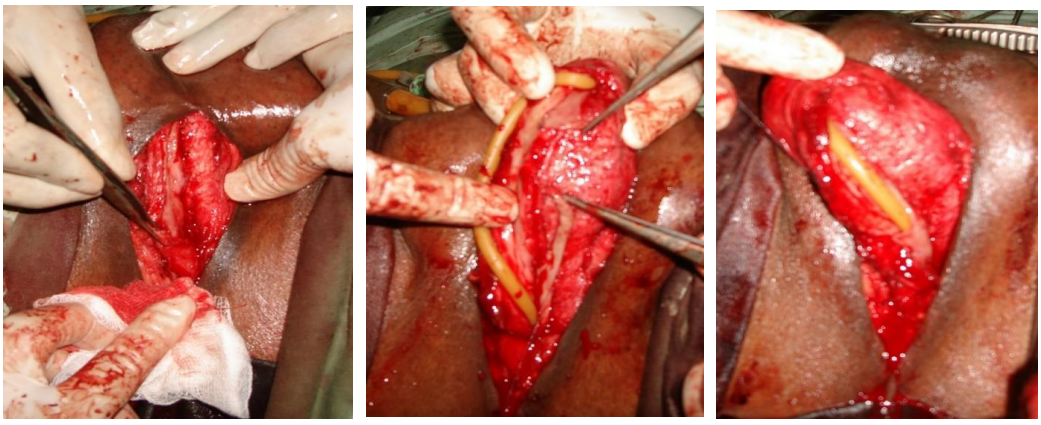
All the collected data were compiled. Further Statistical analyses of the results were obtained by using Microsoft Xcel, 2013 (Microsoft Corporation, Washington DC, U.S.A) and web-based computer software – Graph Pad (Graph Pad Software, Inc., USA). Quantitative data were expressed as mean and standard deviation and compared by Student "t" test. Qualitative data were expressed as frequency and percentage, compared by Fisher's exact test. A probability value (p) of less than 0.05 was considered to indicate statistical significance. The summarized findings were then presented in the form of tables and charts.

**Operative Procedure:**

Surgery was performed under general anesthesia with nasal intubation and patient in lithotomy position. Two teams worked simultaneously, one at the donor site and other at the recipient site.

**Preparation of Urethra for dorsolateral urethroplasty:**

The urethra was prepared for dorsolateral urethroplasty by shaving and disinfecting the suprapubic region, scrotum, and perineum with Hexiscrub and povidone iodine. Urethroscopy was performed to assess the urethra beyond the stricture, and a Terumo guide wire was placed into the bladder. A midline perineal incision exposed the bulbar urethra while preserving key anatomical structures and maintaining lateral blood supply. The penile urethra was similarly dissected, with partial rotation on the left side to allow dorsolateral access. Finally, the incision extended approximately 1 cm beyond both ends of the stricture, ensuring complete exposure of the lumen.

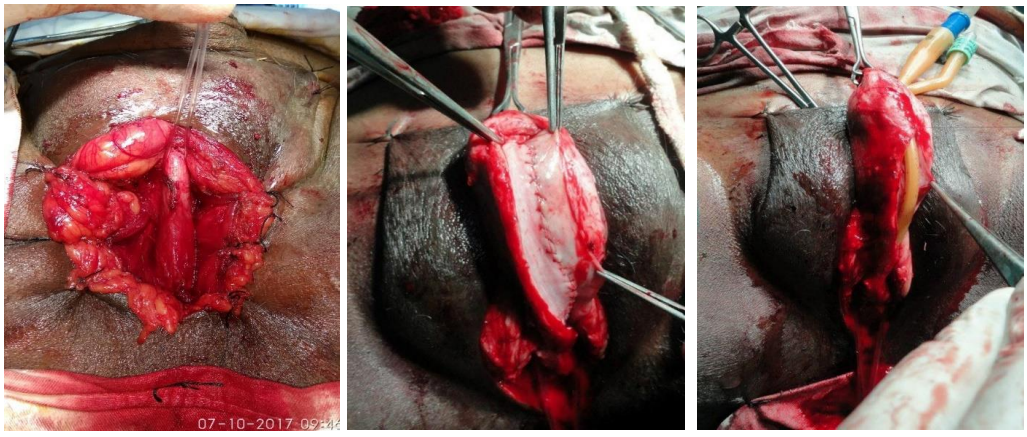


**A** **B** **C**

**Photograph 1: Different steps of dorsolateral BMG urethroplasty**

**Preparation of Urethra for dorsal onlay urethroplasty:**

The suprapubic, scrotal, and perineal skin was shaved, disinfected, and appropriately draped before performing urethroscopy to assess the stricture, followed by guide wire placement into the bladder. A midline perineo-scrotal incision exposed the stricture segment, which was dissected, mobilized, and rotated 180 degrees. A dorsal midline incision was then made on the stricture, extending 1 cm proximally and distally into the healthy urethra.



**A** **B** **C**

**Photograph-2: Different steps of dorsal onlay BMG urethroplasty**

**Harvesting and preparation of buccal mucosal graft:**

The defect in the urethra was measured using a foil sheet, and the corresponding buccal mucosal graft site was marked inside the cheek with a mouth retractor. After submucosal injection of 1% lignocaine with adrenaline for hydro-dissection and haemostasis, a full-thickness mucosal graft was harvested while avoiding injury to vital structures. The donor site was inspected, bleeding points secured, and closed with a running 3/0 chromic catgut suture before placing the graft in saline mixed with Gentamicin.

## RESULTS

A total of 50 patients with anterior urethral stricture aged from 31 to 56 years were included in this study according to the selection criteria. Patients were divided into two groups, Group A-Dorsolateral buccal mucosal graft and Group B-Dorsal onlay buccal mucosal graft. All patients attended at follow up clinic (there was no drop out) and were followed up for 06 months. The different parameters of the patients have been shown in tabulated form and statistical analysis has been done in both groups to see any significant difference. p value was set at 0.05 and $p<0.05$ was considered as significant.

**Age distribution:**

**Table I: Age of the patients**

| Age (years) | Group | | P - value |
|---|---|---|---|
| | Group A Dorsolateral (n=25) | Group B Dorsal onlay (n=25) | |
| Mean ± SD | 43.72 ± 7.64 | 44.08 ± 7.56 | 0.868 |

SD = Standard Deviation.
# Unpaired t-test was used to analyze the data.

Age of the patients ranged from 31 to 55 years in group-A and 33 to 56 years in group-B. Table-I shows, Mean ± SD age of group-A and Group-B were 43.72 ± 7.64 and 44.08 ± 7.56 years respectively. Statistically there was no significant difference of mean age between the two groups (p value >0.05).

Preoperatively, length of stricture was determined by retrograde urethrogram and voiding cystourethrogram (RGU & VCUG). Length of stricture of Group-A was ranged from 2.4-7.0 cm and Group-B from 2.3-6.8 cm.

**Table II: Length of Stricture**

| Finding | Group | | p value |
|---|---|---|---|
| | Group-A Dorsolateral (n=25) (Mean±SD) | Group-B Dorsal onlay (n=25) (Mean±SD) | |
| Lengths of Stricture(cm) | 4.25±1.28 | 4.22±1.31 | 0.935 |

SD = Standard Deviation.
# Unpaired t-test was used to analyze the data.

Table-II shows, Mean ± SD of length of stricture of group-A and Group-B were 4.25±1.28 and 4.22±1.31 cm respectively. Statistically there was no significant difference of the length of stricture between the two groups (p value >0.05)

**Table III: Pre-& Post-operative $Q_{max}$**

| Peak urinary flow rate | Mean $Q_{max}$ (ml/sec) in Groups | | p-value |
|---|---|---|---|
| | Group-A (Mean±SD) | Group-B (Mean±SD) | |
| Pre-operative | 6.68±1.35 | 7.00±1.46 | 0.604 |
| 1st follow up (03 months) | 20.00±3.20 | 19.39±3.13 | 0.693 |
| 2nd follow up (06 months) | 20.52±4.38 | 19.19±4.93 | 0.542 |

SD = Standard Deviation.
#Unpaired t-test was used to analyze the data.

Table-III shows, In Group-A and Group-B preoperative mean $Q_{max}$ was 6.68±1.35 and 7.00±1.46 ml/sec respectively. Mean $Q_{max}$ were 20.00±3.20 & 20.52±4.38 ml/sec in Group-A, and 19.39±3.13 & 19.19±4.93 ml/sec in Group-B, on 1st and 2nd follow up respectively. There was no statistically significant difference in mean $Q_{max}$ in between group A & B in pre-operative, 1st and 2nd follow up (p value >0.05).

**Table IV: Comparison of Pre-operative and post-operative mean $Q_{max}$ in the same group**

| Group | $Q_{max}$ (ml/sec) (mean±SD) | | P value |
|---|---|---|---|
| | Pre operative | Post operative | |
| Group-A | 6.68±1.35 | 20.52±4.38 | 0.002 |
| Group-B | 7.00±1.46 | 19.19±4.93 | 0.001 |

SD = Standard Deviation.
**#Paired t-test** was used to analyze the data.

Table IV shows, in Group-A and Group-B pre-operative mean $Q_{max}$ was 6.68±1.35 and 7.00±1.46 ml/sec and post-operative (after 6 month) was 20.52±4.38 and 19.19±4.93 ml/sec respectively. There was statistically significant difference of mean $Q_{max}$ in the same group before and after BMG urethroplasty (p value <0.05).

**Table V: Status of RGU & VCUG at follow up**

| Follow up | Stricture in RGU & VCUG | | p-value |
|---|---|---|---|
| | Group A (n=25) No. (%) | Group B (n=25) No. (%) | |
| 1st follow up | 02(08) | 03(12) | 1.000 |
| 2nd follow up | 02(08) | 04(16) | 0.667 |

Figures in the parentheses indicate corresponding percentage.
# Fisher's Exact test was done to analyze the data.

Table-V shows, during 1st follow up, RGU & VCUG shows stricture in 02(08%) cases and 03(12%) cases in group A and group B respectivey. During 2nd follow up, RGU & VCUG shows stricture in 02(08%) cases and 04(12%) cases in group A and group B respectively. The differences between these two groups were not statistically significant (p >0.05) in both follow up.

**Table VI: Status of urethrocystoscopy at follow-up**

| Urethrocystoscopy | Group | | p-value |
|---|---|---|---|
| | Group A (n=25) No. (%) | Group B (n=25) No. (%) | |
| Failure (%) | 02(08) | 04(16) | 0.667 |

Figures in the parentheses indicate corresponding percentage.
**# Fisher's Exact test** was done to analyze the data.

Table-VI shows, at follow up, abnormal urethrocystoscopic findings were noted in 02(08%) cases and 04(16%) cases in group A and group B respectively. Results between the two groups were not statistically significant (p value >0.05).

**Table VII: Post-operative complications**

| Complications | Group | | P value |
|---|---|---|---|
| | Group A(n=25) No (%) | Group B (n=25) No (%) | |
| Wound infection | 02(8.0) | 03(12.0) | 1.000 |
| Chordee | 01(4.0) | 03(12.0) | 0.609 |
| Urethrocutecous fistula | 01(4.0) | 03(12.0) | 0.609 |
| Re-stricture | 02(8.0) | 04(16.0) | 0.667 |

Figures in the parentheses indicate corresponding percentage.
# Fisher's Exact test was done to analyze the data.

Table-VII shows, the post-operative complications observed in recipient site. Wound infection occured 02(08%) cases in group-A and 03(12%) cases in group-B, Chordee observed in 1 (4.0%) case in Group-A and 3 (12%) cases in Group-B. Urethrocutenous fistula developed in 1 (4.0%) case in Group-A and 3 (12.0%) cases in Group-B; Re-stricture developed in 2 (8.0%) cases in Group-A and 4 (16.0%) cases in Group-B. Results between the two groups were not statistically significant (p value >0.05) in all parameters.

## DISCUSSION

No significant differences were observed between the two groups regarding mean age and stricture length (p > 0.05), which is consistent with the findings [16]. The peak urinary flow rate (Qmax) increased significantly post-surgery, but no statistically significant difference was found between the two techniques. Datta

*et al*. (2007) reported preoperative and postoperative mean Qmax values of 8.4 ml/sec and 28.8 ml/sec, whereas Islam *et al*. (2011) reported a postoperative mean Qmax of 17.3 ml/sec, indicating variability in results [12, 17].

Postoperative complications such as wound infection, chordee, urethrocutaneous fistula, and restricture were evaluated. Complication rates were higher in Group-B, but results were not statistically significant. Wound infections were successfully managed with regular dressing and antibiotics. Chordee cases were mild and required no surgical intervention, though its higher occurrence in Group-B may be linked to circumferential urethral mobilization, possibly causing ischemia. Urethrocutaneous fistula cases were treated conservatively with suprapubic catheter (SPC) reinsertion, dressing, and antibiotics.

During the six-month follow-up, restricture developed in 2 cases in Group-A and 4 cases in Group-B, evaluated via RGU, VCUG, and urethrocystoscopy. Some proximal anastomotic strictures were due to failure in mucosa-to-mucosa approximation, requiring optical internal urethrotomy (OIU) and urethral dilation. One case in Group-A showed recurrent pan-urethral stricture, possibly due to a suboptimal buccal mucosal graft influenced by chronic tobacco use. Studies by Ghosh (2012) reported 8.6% and 15% recurrence rates, respectively, which align with our findings [18].

We did not evaluate postoperative sexual or ejaculatory function due to the lack of a validated questionnaire. Barbagli *et al*. (2005) reported comparable outcomes between ventral, dorsal, and lateral BMG placements for bulbar urethral strictures, supporting our findings[10].

Our study found a 92% success rate in dorsolateral and 84% in dorsal onlay BMG urethroplasty, consistent with previous literature. While dorsolateral BMG urethroplasty had a higher success rate, the difference was not statistically significant. Complication rates were higher in dorsal onlay urethroplasty, likely due to excessive urethral mobilization and vascular disruption, but were not statistically significant compared to dorsolateral urethroplasty.

Future well-controlled randomized trials with larger sample sizes and extended follow-up periods may provide more conclusive evidence on long-term efficacy and outcomes of dorsolateral and dorsal onlay BMG urethroplasty.

## CONCLUSION

The present study concluded that, short term outcome of dorsolateral BMG urethroplasty for long segment urethral stricture is good and comparable with dorsal onlay urethroplasty. The preservation of the one-sided vascular supply, its muscular & neurogenic support to the urethra in dorsolateral technique should represent a slight but significant step to minimize the complications rate.

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