

Dorsal Versus Ventral Onlay Buccal Mucosal Graft Urethroplasty in Bulbar Urethral Stricture Disease: A Prospective Randomized Study

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ABSTRACT

Aim: Our aim was to study efficacy and safety of ventral versus dorsal onlay buccal mucosal graft urethroplasty in patients having long-segment incomplete bulbar urethral stricture. **Methods:** This was a prospective, randomized study, conducted in a tertiary care hospital. Forty patients with long-segment (>2 cm) incomplete bulbar urethral stricture were included in the study. They were divided into two study groups of 20 each: group A undergone dorsal onlay buccal mucosal graft urethroplasty and group B undergone ventral onlay buccal mucosal graft urethroplasty. The two groups were studied with regard to International Prostate Symptom Score, maximum flow rate and complications and their success rate were compared. **Results:** The mean IPSS improved from 24.10 to 4.95 in Group A and from 23.90 to 4.80 in Group B. The mean Qmax improved from 5.57 ml/min to 18.21 ml/min in Group A and from 5.68 ml/min to 18.09 ml/min in Group B. The difference in improvements between the two study arms was not found to be statistically significant. The mean IPSS in both the groups showed sustained improvement at 12 months after surgery. In Group A, the mean IPSS improved from 23.67 to 5.57 and in Group B, the mean IPSS changed from 23.36 to 5.15. In Group A, the mean Qmax improved from 5.71 ml/min to 17.32 ml/min at 12 months post-operative and in Group B, the mean Qmax changed from 5.83 ml/min to 17.31 ml/min. The difference in improvements between the two study arms was not found to be statistically significant. **Conclusion:** Dorsal onlay buccal mucosal graft urethroplasty and ventral onlay buccal mucosal graft urethroplasty, both have good efficacy and low complication rates for treatment of long segment incomplete bulbar urethral strictures. Both the techniques have similar outcomes.

Keywords: Onlay, Buccal mucosal graft, Urethroplasty, Bulbar, Urethral stricture.

INTRODUCTION

The term urethral stricture refers to anterior urethral disease, or a scarring process involving the urethral epithelium or spongy erectile tissue of the corpus spongiosum. Male urethral stricture disease occurred at a rate as high as 0.6% in some susceptible populations and resulted in more than 6,000 inpatient visits yearly in US.^[1] The aetiologies of the anterior urethra stricture are generally categorized as traumatic (45%) or infectious (5%). The remaining 50% are idiopathic, but most likely secondary to unrecognized trauma or prior urethral instrumentation.^[2] A variety of techniques to reconstruct anterior urethral strictures are presently available either by flap or free graft. Evaluations by various studies showed the curative success rate of direct visual internal urethrotomy to be approximately 30% to 35%, however excision of the stricture and primary, spatulated, end-to-end anastomosis is the “gold standard.” It is 96% to 98% effective, and the results are durable but, it is best reserved for strictures approximately 2 cm

long.^[3] For more complex strictures of intermediate length (2.5–6.0 cm), tissue-transfer techniques are frequently used; however, these techniques decrease the overall efficacy to around 90% and are of questionable durability. For the management of bulbar urethral stricture >2 cm in size the buccal mucosa graft is now accepted as a standard procedure for substitution urethroplasty because it is technically easier to learn, provides good results. Buccal mucosal graft urethroplasty can be done by dorsal onlay technique, ventral onlay technique, lateral onlay technique and combined technique, but none is ideal.^[4] In the present study we compared the results of dorsal onlay buccal mucosal graft urethroplasty and ventral onlay buccal mucosal graft urethroplasty for long segment bulbar urethral strictures.

MATERIALS AND METHODS

After getting ethical approval from the institutional ethics committee, this prospective randomized study was conducted in the Department of Urology, S C B Medical College & Hospital, Cuttack, Odisha from November 2015 to November 2017. Patients with long segment (> 2 cm) incomplete bulbar urethral stricture disease requiring buccal mucosal graft onlay urethroplasty were selected. Written informed consent was taken from all the patients

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before enrolling them for the study. Patients with age less than 18 years, previous urethroplasty, comorbidities rendering the patient unfit for anaesthesia, active urinary tract infection and malignant stricture disease were excluded from study. Forty patients were categorized into 2 groups:

- **Group A:** Dorsal onlay buccal mucosal graft urethroplasty.
- **Group B:** Ventral onlay buccal mucosal graft urethroplasty.

General identification data of all patients (e.g. Name, age, address, and phone numbers) was recorded for the purpose of record keeping and identification. Preoperative evaluation consisted of the recording aetiology of urethral stricture, signs and symptoms, general and systemic examination (including oral examination), IPSS score, any co-morbid conditions and treatment history. Ultrasonography of KUB region with post void residual urine and Uroflowmetry were done. Other investigations like retrograde urethrogram (RGU); and micturating cystourethrogram (MCU) were done to record the site and length of stricture and to confirm that stricture was partial in nature. Intraoperative evaluation consisted of recording the operative details including the duration of operation, approximate amount of blood loss during surgery, length and location of stricture and calibre of urethra. Length of buccal mucosa harvested was recorded. Any intraoperative complications were also noted. Patients were counselled regarding the graft/flap harvest in the preoperative period and any question asked by them regarding the procedure was answered. The buccal mucosa graft was harvested based on the technique of Morey et al.^[5] and Wessels et al.^[6] Dorsal onlay buccal mucosal graft urethroplasty was done in Group A. Ventral onlay buccal mucosal graft urethroplasty was done in Group B.

Post-operative phase: In the post-operative phase, patients were put on injectable antibiotics (Ceftriaxone) for 3 days. Adequate post-operative analgesia was maintained using Tramadol (injectable followed by oral). The oral pack was removed in the evening and the patient was asked to rinse the mouth with cold water and dilute mouthwash. The surgical site was first inspected at 48 hours post-op. The dressing was changed at the same time and on a daily basis thereafter for the duration of hospital stay.

Discharge: Patients were discharged from the hospital as early as possible with per urethral catheter in-situ, if he had no complications. Patients were advised to continue oral antibiotics (Levofloxacin 500 mg OD) for 7 days. The patients were advised to get the dressing changed every day in the hospital dressing room. Further, the patient was advised to return on 7th post-op day for suture removal.

Follow-Up: Patients were called at one week for 1st follow-up. The surgical site was examined and suture removal was done. At 4 weeks post-op, patients were called and a pericatheter study was done as an outdoor procedure. If there were no extravasations, PUC was removed. If pericatheter study showed extravasation, PUC was kept for one more week, to give extra time for healing. After PUC removal, if the patient voided, he was sent home with instructions to report at 3 months. At 3 month post-op, Uroflowmetry was done and IPSS was recalculated and recorded. Detailed history of late complications was taken. If Qmax was less than 14 ml/sec or the patient complained of poor flow then additional investigations like RGU and/ or MCU were carried out. Then patient was next called at 1 year post-op for evaluations with uroflowmetry and IPSS recalculation. If Qmax was less than 14 ml/sec or the patient complained of poor flow then additional investigations like RGU and/ or MCU were carried out.

Outcome Criteria: Primary success was defined as subjective and objective improvement in urinary flow (>14 ml/sec).

Statistical Analysis: Data was collected in the pre-determined format. All the data was coded and entered into a master spreadsheet on MS Office Excel 2007 (Microsoft Corporation, Seattle, USA, 2007). SPSS (IBM SPSS Statistics 21.0; IBM SPSS, 2012) was used for analysis. The mean/median and standard deviations were calculated for continuous variables such as age, different length variables and proportions (percentage) were calculated for discrete variables. The paired t-test was used to detect significance from baseline to follow up time in case of continuous variables and unpaired t-test was used to detect the difference between continuous variables in the two intervention arms. The p-value <0.05 was considered as significance.

RESULTS

The age distribution of patients in both the study groups was not found to be statistically significant ($p > 0.05$). In this study the most common cause of urethral stricture was found to be idiopathic (45% in Group A and 40% in Group B). The next most common cause of stricture was iatrogenic followed by inflammatory and traumatic causes. The proportions of patients according to etiology of stricture were similar in each arm of the study. The differences in distribution were not statistically significant ($p > 0.05$). [Table 1]

The pre-operative International Prostate Symptom Score (IPSS) was calculated for all patients. The mean IPSS was found to be 24.1 (SD = 7.06) for the dorsal onlay BMGU group (Group A) and 23.9 (SD = 7.42) for the ventral onlay BMGU group (Group

B). This difference in mean IPSS was not statistically significant. The functional status was measured using Uroflowmetry and Qmax was calculated for all patients. The mean pre-operative Qmax for patients in the dorsal onlay BMGU group (Group A) was 5.57 ml/ min (SD = 2.92) while for the patients in ventral onlay BMGU group it was 5.68 ml/ min (SD = 2.96). The difference in means was not found to be statistically significant. [Table 2]

Early post-operative complications observed were few, with a total of 4 patients (10%) having some kind of complication. Wound hematoma was seen in 1 patient in Group A which was managed conservatively. Wound infection and graft necrosis occurred in 2 patients, one in each group. They were managed by intravenous antibiotics. Donor site complication (decreased mouth opening) was seen in 1 patient in Group B. This was because of local pain and was managed conservatively by oral analgesics and local anesthetic gel for application. [Table3]

The mean IPSS in both the groups showed improvement after surgery. In Group A, the mean IPSS improved from 24.10 to 4.95 at 3 months post-operatively and in Group B, the mean IPSS changed from 23.90 to 4.80. Within the groups, the improvement seen in mean IPSS was found to be statistically highly significant. Between the two groups, the difference in improvement of IPSS was not found to be statistically significant ($p > 0.05$). [Table4]

The mean Qmax in both the groups showed improvement after surgery. In Group A, the mean Qmax improved from 5.57 ml/ min to 18.21 ml/ min at 3 months post-operatively and in Group B, the mean Qmax changed from 5.68 ml/ min to 18.09 ml/ min. Within the groups, the improvement seen in

mean Qmax was found to be statistically highly significant. Between the two groups, the difference in improvement of Qmax was not found to be statistically significant ($p > 0.05$). [Table5]

The mean IPSS in both the groups showed sustained improvement at 12 months after surgery. In Group A, the mean IPSS improved from 23.67 to 5.57 and in Group B, the mean IPSS changed from 23.36 to 5.15. Within the groups, the improvement seen in mean IPSS at 12 months was found to be statistically highly significant. Between the two groups, the difference in improvement of IPSS was not found to be statistically significant ($p > 0.05$). [Table6]

The mean Qmax in both the groups showed sustained improvement at 12 months after surgery. In Group A, the mean Qmax improved from 5.71 ml/ min to 17.32 ml/ min at 12 months post-operative and in Group B, the mean Qmax changed from 5.83 ml/ min to 17.31 ml/ min. Within the groups, the improvement seen in mean Qmax at 12 months was found to be statistically highly significant. Between the two groups, the difference in improvement of Qmax was not found to be statistically significant ($p > 0.05$). [Table7]

At 3 months post-op, 1 patient in each group had a poor flow rate ($Q_{max} < 14$ ml/ min) and was declared as a failure. Both these patients had wound infection and graft necrosis in the early post-operative period. At 12 months, two more patients (one in each group) were observed to have a poor flow rate ($Q_{max} < 14$ ml/ min). Among these patients, one patient had developed wound hematoma in the early post-operative period. In the other patient, no cause could be determined for the failure. All the above four patients were later taken up for redo urethroplasty. [Table8]

Table 1: Distribution of etiology of stricture among study groups

	Etiology of Stricture				Total	Significance
	Traumatic (%)	Inflammatory (%)	Iatrogenic (%)	Idiopathic(%)		
Dorsal Onlay BMGU (Group A)	2 (10%)	4 (20%)	5 (25%)	9 (45%)	20 (100%)	Chi2 = 0.170, df = 3, p = 0.982
Ventral Onlay BMGU (Group B)	2 (10%)	5 (25%)	5 (25%)	8 (40%)	20 (100%)	

Table 2: Mean IPSS and Qmax distribution among patients in the study group

	Group	Mean	SD	Range	Significance
IPSS	A	24.1	7.06	20.79 – 27.40	t = 0.087, p = 0.931
	B	23.9	7.42	20.42 – 27.38	
Qmax (ml/ min)	A	5.57	2.92	4.20 – 6.94	t = -0.124, p = 0.902
	B	5.68	2.96	4.30 – 7.10	

Group A = Dorsal Onlay BMGU, Group B = Ventral Onlay BMGU

Table 3: Early post-operative complications observed in the study groups.

Early Post-operative Complications	Type of Surgery	
	Dorsal Onlay BMGU (Group A)	Ventral Onlay BMGU (Group B)
Wound hematoma	1 (5%)	0 (0%)
Wound infection and graft necrosis	1 (5%)	1 (5%)
Donor site complication	0 (0%)	1 (5%)

Table 4: Improvement in IPSS at 3 month compared with pre-op values.

	Type of Surgery	
	Dorsal Onlay BMGU(Group A) [n = 20]	Ventral Onlay BMGU (Group B) [n = 20]
Mean pre-operative IPSS (SD)	24.10 (7.06)	23.90 (7.42)
Mean post-operative IPSS at 3 months (SD)	4.95 (3.89)	4.80 (4.20)
Mean IPSS improvement (SD)	19.15 (6.18)	19.10 (6.12)
Significance	p < 0.001	p < 0.001

Table 5: Improvement in Qmax at 3 month compared with pre-op values.

	Type of Surgery	
	Dorsal Onlay BMGU(Group A) [n = 20]	Ventral Onlay BMGU (Group B) [n = 20]
Mean pre-operative Qmax (SD)	5.57 (2.92)	5.68 (2.96)
Mean post-operative Qmax at 3 months (SD)	18.21 (3.17)	18.09 (3.38)
Mean Qmax improvement (SD)	12.64 (3.02)	12.40 (2.98)
Significance	p < 0.001	p < 0.001

Table 6: Improvement in IPSS at 12 month compared with pre-op values.

	Type of Surgery	
	Dorsal Onlay BMGU(Group A) [n = 20]	Ventral Onlay BMGU (Group B) [n = 20]
Mean pre-operative IPSS (SD)	23.67 (6.99)	23.36 (7.22)
Mean post-operative IPSS at 12 months (SD)	5.57 (4.72)	5.15 (4.56)
Mean IPSS improvement (SD)	18.10 (7.12)	18.21 (7.32)
Significance	p < 0.001	p < 0.001

Table 7: Improvement in Qmax at 12 month compared with pre-op values.

	Type of Surgery	
	Dorsal Onlay BMGU(Group A) [n = 20]	Ventral Onlay BMGU (Group B) [n = 20]
Mean pre-operative Qmax (SD)	5.71 (2.93)	5.83 (2.96)
Mean post-operative Qmax at 12 months (SD)	17.32 (4.04)	17.31 (4.00)
Mean Qmax improvement (SD)	11.61 (3.75)	11.47 (3.54)
Significance	p < 0.001	p < 0.001

Table 8: Failure rate at 3months and at 12 months in the two study groups

Failure rates	Type of surgery	
	Dorsal Onlay BMGU(Group A)	Ventral Onlay BMGU (Group B)
Failure at 3 months (Qmax< 14 ml/ min)	1 (5%)	1 (5%)
Additional failure at 12 months (Qmax< 14 ml/ min)	1 (5%)	1 (5%)
Total failures at 12 months(Qmax< 14 ml/ min)	2 (10%)	2 (10%)

DISCUSSION

Stricture urethra continues to present a challenge to the medical fraternity. End-to-end anastomotic urethroplasty still has the highest rate of success but it is only possible in relatively short segment strictures.

Orandi et al,^[7] described the first successful use of penile skin flap for anterior urethral strictures. Buccal mucosal graft for urethral reconstruction was first used in cases of hypospadias by Humby in 1941.^[8] After that, various methods of bulbar urethral reconstruction using buccal mucosal graft have been described, dorsal onlay (Barbagli),^[9] ventral onlay (Wessels),^[10] lateral onlay and combined techniques; all having acceptable success rates. Out of the above, dorsal onlay and ventral onlay techniques are the most commonly used. There is a controversy as to whether BMG should be placed dorsally or ventrally.^[11] Multiple studies have shown that both dorsal and ventral-onlay BMG have good blood supply and mechanical support. The

success rate for dorsal onlay is reported to be between 85 and 100%.^[12,13] Ventral-onlay BMG graft placement have shown comparable success rates of 84 to 100%.^[14-16]

In the present study, in the dorsal onlay group (Group A), we found that the mean stricture length was 5.76 cm, the mean length of mucosa harvested was 6.25 cm and follow-up was 12 months for all patients. We had a success rate of 90% at 12 months post-op. In group B, the mean stricture length was 5.78 cm, the mean length of mucosa harvested was 6.24 cm and follow-up was done for 12 months. The success rate was found to be 90% at 12 month follow-up.

There are only a few published studies which compare dorsal onlay BMGU with ventral onlay BMGU. Andrich et al in 2001 reported a study comparing dorsal onlay and ventral onlay BMGU in which 42 patients had dorsal onlay BMGU by Barbagli procedure and 29 patients had ventral onlay BMGU. They found that at 5 years of follow-up, recurrence rate was lower for dorsal onlay (5%) as

compared to those having ventral onlay (14%). A similar finding was reported in 2003 by Pansadoro et al,^[20] who conducted a retrospective study of 56 patients undergoing dorsal onlay BMGU and 9 patients with ventral onlay BMGU and found that recurrence rate was lower in dorsal onlay group (1.8%) than in ventral onlay group (11.1%). Barbagli et al,^[17] in 2005 reported a study involving 50 patients undergoing BMGU. Among these 27 had a dorsal onlay, 17 had a ventral onlay and 6 patients had a lateral onlay BMGU. After a mean follow-up of 42 months, the success rates reported were similar for all three sites i.e. 85% for dorsal onlay BMGU, 83% for ventral onlay BMGU and 83% for lateral onlay BMGU. In 2011, Hosseini et al,^[18] in a study involving 29 patients undergoing dorsal onlay and 24 patients undergoing ventral onlay BMGU for bulbar urethral strictures, reported a success rate of 80% for dorsal onlay and 79% for ventral onlay.

In the present study we did not find any statistically significant difference between the two groups in terms of the mean improvements in IPSS scores and Qmax values at 3 month and at 12 month follow-up in both groups. The success rates we found for both groups were same (90%).

Our finding of similar success rate for both groups is similar to the findings of Barbagli et al,^[17] and Hosseini et al.^[18] However our findings differed from those of Andrich et al,^[19] and Pansadoro et al.^[20] The success rates of the individual groups were also comparable to those reported by Barbagli et al.^[17] The success rates were slightly higher than those reported by Hosseini et al,^[18] for both the groups separately. However, on comparing with the findings of Andrich et al,^[19] and Pansadoro et al,^[20] our success rates for dorsal onlay BMGU (90%) was lower than in the previous two studies (95% by Andrich et al,^[19] and 98.2% by Pansadoro et al,^[20] while the success rate for ventral onlay BMGU (90%) was slightly higher than that reported in their studies (86% by Andrich et al,^[19] and 89% by Pansadoro et al).^[20]

CONCLUSION

Both dorsal onlay buccal mucosal graft urethroplasty and ventral onlay buccal mucosal graft urethroplasty have good efficacy and low complication rates for treatment of long segment incomplete bulbar urethral strictures. Both the techniques have good success rate and low complication rate.

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