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Original Research Article

A prospective study on outcome of dorsal versus ventral buccal mucosal graft urethroplasty for bulbar urethral stricture

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ABSTRACT

Background: In urological practice, urethral stricture disease is a prevalent condition. In comparison to the other sites, the bulbar urethral stricture imposes a greater load. The buccal mucosal graft (BMG) has been considered an optimal kind of urethral replacement since 1941. A lifetime success rate of 92% is achieved with standard bulbar urethroplasty employing BMG. There exist several methodologies for BMG urethroplasty, namely dorsal, ventral, and lateral approaches, which depend on the discretion of the surgeon.
Methods: An observational study was done among 40 patients, divided into two groups each based on the procedure done. Age more than 18 years who are fit for the procedure, stricture length more than 2 cm on retrograde urethrogram (RGU) and patients who were willing to give informed consent were included in the study. Post operatively, all the patients were assessed at every 3-month interval up-to 18 months. The outcome parameters noticed were post voidal residual (PVR), Q_{max}, international prostate symptom score (IPSS) score.
Results: There was no difference between the pre-operative and post-operative Q_{max}, PVR, IPSS score between the study groups.
Conclusions: The findings of the present study concluded that there is no difference between dorsal and ventral onlay BMG urethroplasty in terms of increase in Q_{max} and decrease in PVR at the end of study period.

Keywords: BMG urethroplasty, IPSS, Stricture urethra

INTRODUCTION

The term urethral stricture refers to fixed anatomic narrowing of the urethra so that the lumen will not accommodate instrumentation without disruption of the urethral mucosal lining. A stricture involving the urethra that is surrounded by the corpus spongiosum is considered an anterior urethral stricture, and the associated scarring may be associated with a scarring process involving the spongy erectile tissue of the corpus spongiosum (spongiofibrosis).[1]

According to the European association of urology, the overall, the incidence of urethral stricture is estimated to be 229-627 per 100,000 males. In males, a sharp increase in incidence is observed after the age of 55 years, with a mean age of 45.1 years. The anterior urethra is most frequently affected (92.2%), in particular the bulbar urethra (46.9%).[2,3]

Etiology

The potential causes of urethral stricture disease according to the systematic review published are Infective cause in 40%, which occur as a result of sexually transmitted infections.[4,5] Traumatic-second most common cause of stricture in males, next to infections. The higher rates of stricture are attributed to higher rate of road traffic

accidents in men.[4] Idiopathic-which constitutes to 34% of penile strictures and 63% of the total bulbar strictures.[6] Iatrogenic at 32-79% in well-resourced countries. Iatrogenic injuries include sequel of urinary tract surgeries, urinary catheterization and radio therapy of pelvic tumors.[7] Inflammatory-Lichen sclerosus in 20%.[8]

Management

The treatment options included for these patients are urethral dilation using metal dilators, grafts, or flap urethroplasty. The recurrence stricture rate following urethral dilation is high, necessitating repeated urethral dilations once every 6 months or earlier.[5]

Grafting procedures and choice of the graft

The properties of buccal mucosa such as the absence of hair follicles, highly vascular lamina propria promoting early ingrowth, wet environment compatibility, resilience to hormonal changes, and ease of harvest with a concealed donor site scar make BMG urethroplasty (BMGU) a better option in these patients.[9]

Need for the study

In urological practice, urethral stricture disease is a prevalent condition.[10] In comparison to the other sites, the bulbar urethral stricture imposes a greater load.[11] Based on the extent of the stricture, the available therapeutic options include optical internal urethrotomy, end to end anastomosis, and substitute urethroplasty.[12] The issue inherent in all the treatment alternatives is the reoccurrence of stricture. Indeed, the rate of recurrence is greater for DVIU and lower for substitution urethroplasty.

The BMG has been considered an optimal kind of urethral replacement since 1941.[13] A lifetime success rate of 92% is achieved with standard bulbar urethroplasty employing BMG.[14] There exist several methodologies for BMG urethroplasty, namely dorsal, ventral, and lateral approaches. The choice to choose any strategy during surgery is essentially at the discretion of the surgeon.

BMG urethroplasty has been the subject of extensive debate, but the methods employed have been inadequately addressed. The available data about the utilized approach is limited. Therefore, the current study was undertaken to assess outcome of ventral and dorsal BMG urethroplasty.

Aim

Aim was to evaluate the outcome of dorsal versus ventral BMG urethroplasty for urethral stricture.

Objectives

Objectives were to determine IPSS score before and after surgery, stricture recurrence, PVR and uroflometry between dorsal and ventral BMG urethroplasty groups.

METHODS

Study design

It was a observational study.

Settings

Study conducted at department of urology, Narayana Medical College and Hospitals, Nellore.

Study carried out from January 2023 to August 2025 for a period of 18 months from the date of approval.

A total of 40 male patients with stricture urethra who were admitted in the inpatient department, department of urology, Narayana hospital, Nellore, satisfying the inclusion criteria were enrolled into the study.

Inclusion criteria

Patients of age >18 years, with stricture length >2 cm on RGU, who are fit for surgery and willing to give informed consent for participating in the study were included.

Exclusion criteria

Patients with age <18 years and patients with neurogenic bladder, spinal injury, tumors of buccal mucosa, ICU, AKI, who were not fit for surgery and who were not willing to participate in the study were excluded.

Study sample size calculation

According to the study done by Singh et al the difference between the means of peak flow rate between the ventral and dorsal outlay techniques in 0.09.[15] The sample size calculation is done based on the formula given below:

$N=2(SD)^2 (Z\ alpha+ Z\ Beta)^2/(Mean\ difference)^2$

1.96 is Z alpha, 0.84 is Z beta, standard deviation:0.098. Mean difference of Q_{max} between two procedures is 0.09.

$N=2(0.098\times0.098)/(2.8\times2.8)/0.09\times0.09=18.59$

18.59+10% attrition=20.49=20

Rounded off to 20 in each group.

Procedure

The patients who satisfied inclusion criteria were enrolled after written informed consent. All 40 patients selected by convenient sampling method. Data collected prospectively by direct observation in specially designed proforma containing all detailed investigations that patient underwent pre-op like routine preoperative baseline investigation, uroflowmetry, ultrasound-abdomen and pelvis for pre and post void volume, RGU and VCUG.

Operative procedure

The procedure involves two parts: harvesting of the buccal graft and the urethral reconstruction.

Harvesting of the grafts

BMG harvest is typically performed using the following method: the face and cheek are prepped and draped in the usual sterile fashion. A Denhardt mouth gag and "baby" sweetheart retractor are used to facilitate exposure. Using a marking pen, the graft is outlined-2.5 cm wide and as long as is required.

Bupivacaine 0.5% with epinephrine is injected underneath the graft for good analgesia and intraoperative hemostasis. The graft is then incised and dissected off of the buccinator muscle, while avoiding Stensen's duct. Some urologists close the defect with an absorbable suture. However, it may be left open to close by secondary intention. The graft is pinned out and defatted/thinned on the back table. It is kept in saline until the time implantation.

Urethral reconstruction

The urethroplasty is performed in the high lithotomy position. Great care is taken to ensure the patient is properly padded and secured. Subsequently, the patient's perineum is prepped and draped in normal sterile fashion. After urethral exposure, a #15 blade scalpel is used to incise the urethra over the urethral catheter and the urethral stricture is opened completely. The lumen of the stricture is usually intubated with either an 8 French feeding tube or with a 0.035-inch guide wire, and the stricture is incised until normal urethra is identified. Both proximal and distal urethral stumps are bougied to ensure they are wide open to 30 French.

Placement of the grafts

Group A: Patient undergoing dorsal BMG (n=20) and group B: Patients undergoing ventral BMG, (n=20).

The buccal mucosa is then sewn onto the defect based on the study group the patient belonged to, using a running 5-O polydioxanone suture to obtain a watertight seal. A 16 French silicone catheter is placed through the urethra. The bulbospongiosus muscle is closed with a running 3-O polyglactin suture. The Dartos fascia is closed with a running 2-O polyglactin and the skin is closed with multiple vertical mattress stitches using 2-O chromic suture. Prior to skin closure, the wound is anesthetized using 0.5% bupivacaine to augment pain control.

Post-operative follow up

Post operatively, all the patients were assessed at 3-months, 6 months, 9 months, 12 months and 18 months. The parameters assessed on follow-up: Physical examination and IPSS score.

IPSS score

The American urological association (AUA) has developed the following questionnaire to help men determine how bothersome their urinary symptoms are and to check how effective their treatment is. It is also known as IPSS. According to IPSS score, grading of score 0-7 is considered as mild, score of 8-19 is considered as moderate and 20-35 is considered as severe grade.

	Not at All	Less Than 1 Time in 5	Less Than Half the Time	About Half the Time	More Than Half the Time	Almost Always
1. Over the past month, how often have you had a sensation of not emptying your bladder completely after you finished urinating?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
2. Over the past month, how often have you had to urinate again less than 2 hours after you finished urinating?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
3. Over the past month, how often have you found you stopped and started again several times when you urinated?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
4. Over the past month, how often have you found it difficult to postpone urination?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
5. Over the past month, how often have you had a weak urinary stream?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
6. Over the past month, how often have you had to push or strain to begin urination?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
7. Over the past month, how many times did you most typically get up to urinate from the time you went to bed at night until the time you got up in the morning?						
☐ 0 none ☐ 1 1 time ☐ 2 2 times ☐ 3 3 times ☐ 4 4 times ☐ 5 5 or more times						
AUA symptom score = sum of questions 1 to 7.						
From Barry MJ et al. *J Urol.* 1992;148:1549–1557.[14]						

Figure 1: IPSS questionnaire.

Uroflowmetry

Uroflowmetry (Q_{max})

Uroflowmetry is the measurement of voided urine (in milliliters) per unit of time (in seconds). The important elements of the test are voided volume (which should be >150 mL), maximum flow rate (Q_{max}), and the curve of the flow (which should be bell shaped). In men, a Q_{max}>15 mL/s is considered normal, whereas a Q_{max}<10 mL/s is considered abnormal. Assigning normal values in females is more difficult. In women, uroflowmetry is characterized by the shorter urethra and no resistance, such as that caused by the prostate gland in the male. Normal values are described as a Q_{max} between 20 and 36 mL/s.

Success was defined as subjective improvement in symptoms, Q_{max}>12 ml/s and insignificant PVR.

Recurrence of disease is defined by recurrence of symptoms or reversal of Q_{max} again to <12 ml/sec and failure to pass 14 Fr catheter.

Data entry and analysis

The data was entered in Microsoft excel 2010 version. Data was analyzed using Microsoft excel 2010 and Epi Info 7.2.0. Descriptive and inferential statistical analysis were used in the present study. Results on continuous measurements were presented on mean±SD (Min-Max) and results on categorical measurements were presented in number (%). Significance was assessed at 5% level of significance. ANOVA was used to compare inter group variation for continuous variables. Chi square test was used to compare categorical variables. A $p<0.05$ was considered as statistically significant.

Ethical clearance

Ethical clearance was obtained from the institutional ethical committee, Narayana medical college, Nellore.

RESULTS

A total of 40 patients who were satisfying the inclusion criteria enrolled into the study. The results of the study are as follows:

Mean values

Among the study population, the mean age was 52.5±6.78 years. The mean length of the stricture was 1.5±0.89 cm. The mean operating time 214.22±54.57 minutes. The mean follow up time was 14.5 months.

Etiology of stricture

Among the study population, most common cause of urethral stricture appeared to be idiopathic in nature in 60%, followed by iatrogenic type (30%) and traumatic type (10%). Among the study population, stricture urethra was present in distal part in 60% with history of instrumentation in 65%.

Pre operative voiding parameters

Among the study population, among group A, the mean Q_{max}-pre operative in ml/sec as 6.5±2.86 ml/sec. The mean pre operative PVR was 192±48.89 ml. Among group B, the mean Q_{max}-pre operative in ml/sec as 6.45±2.75 ml/sec. The mean pre operative PVR was 189±49.58 ml. The mean Q_{max} in ml/sec and mean PVR in ml were similar between the groups with $p>0.05$.

Comparison of IPSS in both the study groups

Among the study population, the severity according to the IPSS score was moderate in 60% and severe among 40%. When both the groups were compared in terms of severity of IPSS, both the groups were comparable with $p=0.99$. Among the study population, BMG urethroplasty was successful in 90%. Failure and recurrence were observed in 10%.

Complications

Among the study population, in both the groups the complications were seen in 20% each with 5% of recurrence in each group. Rest of them were minor complications. There was no significant difference in terms of complications between the groups. Both the groups were similar. Among the study population who developed complications,25% of them both urethral and donor site complications, 50% had only urethral site complications and 25% had only donor site complications. Out of the ones who had urethral site complications, 33.33% of them had splaying of urine. Rest of the 66.66% went on to develop recurrence. Recurrence was seen in 4 cases-2 in group A, the other 2 in group B. Out of the ones who had donor site complications, restriction of opening of mouth was observed in 50% and facial numbness in 50%.

Among the study population, among group A, Q_{max} increased from 6.5 ml/sec to 15.26 ml/sec at the end of study period with statistically significant $p<0.00001$. Similar trend was observed in group B, wherein the pre-operative Q_{max} was 6.45 ml/sec, which increased to 15.9 ml/sec at the end of follow up period with a statistically significant $p<0.00001$.

When both the groups were compared the rise in Q_{max} was similar, without any statistically significant difference between the groups with $p>0.05$. This shows that the positioning of the graft-dorsal or ventral has no effect on the Q_{max}.

Among the study population, among group A, PVR decreased from 192 ml to 64.42 ml at the end of study

period with statistically significant p<0.00001. Similar trend was observed in group B, wherein the pre-operative PVR was 189 ml, which decreased to 65.65 ml at the end of follow up period with a statistically significant p<0.00001.

When both the groups were compared, the fall in PVR was similar, without any statistically significant difference between the groups with p>0.05. This shows that the positioning of the graft-dorsal or ventral has no effect on the post void residual volume.

Table 1: Mean voiding parameters-Q_{max} during the follow up period.

Time period	Group A	Group B	P value
Pre operative period	6.5±2.86	6.45±2.75	0.96
3 months	19.42±1.67	19.98±1.84	0.48
6 months	19.8±1.36	19.87±1.48	0.91
9 months	18.86±1.37	18.99±1.58	0.84
12 months	17.83±1.04	17.98±0.95	0.74
18 months	15.26±0.85	15.9±0.85	0.1
P value (ANOVA)	<0.00001	<0.00001	--

Table 2: Mean voiding parameters-PVR during the follow up period.

Time period	Group A	Group B	P value
Pre operative period	192±48.89	189±49.58	0.43
3 months	31.46±6.89	32.56±6.98	0.89
6 months	39.13±8.42	40.25±7.42	0.72
9 months	42.42±6.28	43.65±6.78	0.75
12 months	42.99±5.42	43.65±5.95	0.67
18 months	64.42±4.86	65.65±5.98	0.79
P value	<0.00001	<0.00001	--

Table 3: Association between IPSS score before the surgery and after the follow up period.

Severity	IPSS score		P value
	Pre-operative	At the end of follow up	
Mild	0	32	Chi square value=56, degree of freedom=2, p<0.00001
Moderate	24	8	
Severe	16	0	
Total	40	40	

There was significant difference between the IPSS score observed by the end of follow up with p<0.00001.

Among the study groups, there was no difference between the IPSS grading (80% mild and 20% moderate in both the groups) of the study population at the end of study period.

Both the groups were similar in terms of severity with p=0.99.

DISCUSSION

The present study was conducted in the dept. of urology, Narayana hospitals. The objectives of the study were to evaluate the outcome of dorsal versus ventral BMG urethroplasty for urethral stricture and determine IPSS score before and after surgery, stricture recurrence, PVR and uroflometry between dorsal and ventral BMG urethroplasty groups.

The results of the study are discussed below:

Age and other parameters

In the present study, among the study population, the mean age was 52.5±6.78 years. The mean length of the stricture was 1.5±0.89 cm. The mean operating time 214.22±54.57 minutes. The mean follow up time was 14.5 months.

The findings of the present study can be compared with the following studies: In the study done by Singh et al the age distribution of patients in both the study groups was not found to be statistically significant (p>0.05).[15]

In another study done by Katiyar et al the average age of patients in the study was 45 years (range 27-68).[16]

Etiology

In the present study, among the study population, most common cause of urethral stricture appeared to be idiopathic in nature in 60%, followed by iatrogenic type (30%) and traumatic type (10%).

The findings of the present study can be compared with the following studies: In a study done by Singh et al the most common cause of urethral stricture was found to be idiopathic (45% in group A and 40% in group B).[15] The next most common cause of stricture was iatrogenic followed by inflammatory and traumatic causes. In another study done by Shekhar et al among 20 cases in group A, 20% were iatrogenic, 40% were idiopathic, 25% were inflammatory and 25% were traumatic based on etiology.[17] Among 20 cases in group B, 20% were iatrogenic, 40% were idiopathic, 30% were inflammatory and 10% were traumatic based on etiology.

Pre-operative findings

Q_{max} and PVR

In the present study, among the study population, among group A, the mean Q_{max}-pre operative in ml/sec as 6.5±2.86 ml/sec. The mean pre operative PVR was 192±48.89 ml. Among group B, the mean Q_{max}-pre operative in ml/sec as 6.45±2.75 ml/sec. The mean pre operative PVR was 189±49.58 ml. The mean Q_{max} in ml/sec and mean PVR in ml were similar between the groups with p>0.05.

The findings of the present study can be compared with the following studies: In the study done by Singh et al the mean pre-operative Q_{max} 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).[15] The difference in means was not found to be statistically significant. In another study done by Shekhar et al the Q_{max} at baseline in the group A was 7.70 ml/min and for group B it was 8.52 ml/min. The difference in means was not found to be statistically significant.[17]

IPSS score

In the present study, among the study population, the severity according to the IPSS score was moderate in 60% and severe among 40%. Among the study groups, there was no difference between the IPSS grading of the study population. Both the groups were similar in terms of severity with p=0.99.

The findings of the present study can be compared with the following studies: In the study done by Singh et al the pre-operative IPSS was calculated for all patients.[15] 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.

Outcome

In the present study, among the study population, BMG urethroplasty was successful in 90%. Failure and recurrence were observed in 10%.

The findings of the present study can be compared with the following studies: In a study done by Katiyar et al 91% of success rate in both the groups with one case of recurrence in each group.[16] In another study done by Vasudeva et al the success rate of surgery was similar between group A and B (92.5% vs 90%) with no significant difference noted between them.[16]

Post operative findings

Q_{max}

In the present study, among the study population, among group A, Q_{max} increased from 6.5 ml/sec to 15.26 ml/sec at the end of study period with statistically significant p<0.00001. Similar trend was observed in group B, wherein the pre-operative Q_{max} was 6.45 ml/sec, which increased to 15.9 ml/sec at the end of follow up period with a statistically significant p<0.00001. When both the groups were compared the rise in Q_{max} was similar, without any statistically significant difference between the groups with p>0.05. This shows that the positioning of the graft-dorsal or ventral has no effect on the Q_{max}.

The findings of the present study can be compared with the following studies: In the study done by Singh et al the mean Q_{max} 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.[15] The difference in improvements between the two study arms was not found to be statistically significant. In another study done by Shekhar et al the Q_{max} at baseline in group A was 7.70 which improved to 19.97 at 3 months and 19.05 at 6 months.[17] The percentage improvement was 61.44% at 3 months and 59.55% at 6months from the baseline. The Q_{max} at baseline in group B was 8.52 which improved to 20.47 at 3 months and 19.61 at 6 months. The percentage improvement was 58.37% at 3 months and 56.55% at 6months from the baseline. There was significant difference between the average Q_{max} values at baseline with 3 months and baseline at 6 months among both the groups.

PVR

In the present study, among the study population, among group A, PVR decreased from 192 ml to 64.42 ml at the end of study period with statistically significant p<0.00001. Similar trend was observed in group B, wherein the pre-operative PVR was 189 ml, which decreased to 65.65 ml at the end of follow up period with a statistically significant p<0.00001. When both the groups were compared, the fall in PVR was similar, without any statistically significant difference between the groups with p>0.05. This shows that the positioning of the graft-dorsal or ventral has no effect on the post void residual volume.

IPSS score

In the present study, among the study population, the severity according to the IPSS score was mild in 80% and

moderate among 20% There was significant difference between the IPSS score observed by the end of follow up with p<0.00001. Among the study groups, there was no difference between the IPSS grading of the study population. Both the groups were similar in terms of severity with p=0.99.

The findings of the present study can be compared with the following studies: In a study done by Singh et al the mean IPSS improved from 24.10 to 4.95 in group A and from 23.90 to 4.80 in group B.[15] 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 another study done by Vasudeva et al the mean IPSS showed 324.95% and 353.59% improvement in both the study groups.[18] There was no significant difference between IPSS data between the two groups at 3- and 12-month follow up.

Limitations

The results cannot be generalized to the whole population as they depend on study setting and also on the surgeon's precision and technical expertise.

CONCLUSION

The findings of the present study concluded that the type of BMG urethroplasty has no effect on the outcome parameters like Q_{max} and PVR.

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