

Buccal mucosa: is it ideal for long segment stricture urethroplasty?

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Abstract

Background: Reconstruction of male urethra poses a continuing urological challenge. The ideal material for substitution urethroplasty remains controversial. Candidate tissues have included split and full thickness skin graft from scrotum, penis and extra-genital areas like bladder mucosa and buccal mucosa. This study was done to evaluate the short term and long-term results of buccal mucosal urethroplasty and analyzed them with different variables like etiology of stricture, length of stricture, operative procedure and associated complications and success rate. **Material and Methods:** All the Cases of anterior stricture urethra who had stricture length more than 1 cm and who underwent buccal mucosal substitution urethroplasty were included in this study. The short term and long-term results of buccal mucosal substitution urethroplasty were assessed. Patients were divided into two groups according to their length, patients with stricture length up to 6 cm and 7 cm or more and the results of buccal mucosal substitution urethroplasty were assessed in terms of etiology of stricture, length of stricture, operative procedure and its associated complications and success rate. **Results:** In the present study, the success rate of long segment strictures was inferior (77%). The success rate of two staged BMGU for long segment strictures was satisfactory (80%) if not associated with proximal urethral stenosis. Success rate of urethral strictures associated with BXO was lower (75%) as compared to others. Success rate of BMGU with almost tube (50%) was very poor. **Conclusion:** Buccal mucosa gives a good and viable option for substitution urethroplasty for long segment stricture. It is easy to harvest and handle, is resilient to infections and accustomed to a wet environment. As of date, it provides good material for substitution for treating all types of strictures with fairly good results and fewer complications.

Keywords Graft shrinkage, Stricture formation, Balanitis xerotica obliterans (BXO) buccal mucosal graft Urethroplasty (BMGU)

Introduction

Stricture urethra is an ailment which is responsible for intense and prolonged mental and physical suffering to the patient. As stricture of urethra presents a very complex problem, various modalities of treatment ranging from simple dilatation, urethrotomies, penile skin graft, skin pedicle, buccal mucosal graft, bladder mucosal graft, excision with end to end anastomosis have been advocated over years.

Reconstruction of male urethra poses a continuing urological challenge. The ideal material for substitution urethroplasty remains controversial. Candidate tissues

have included split and full thickness skin graft from scrotum, penis and extra-genital areas like bladder mucosa and buccal mucosa. Initial attempt of using full thickness skin graft from non- hairy sites provided a reasonable success rate. But it causes the risk of graft shrinkage, stricture formation, balanitis xerotica obliterans and scar formation at donor site along with unsatisfactory long-term results.

Humpy in 1941, first suggested the use of buccal mucosa for urethral reconstruction. Buccal mucosa has advantage over both skin and bladder. The thick epithelial layer, abundant elastic fibres, less tendency to shrink and favorable imbibition's properties make it more suitable for urethral reconstruction. Comparing

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the histological characteristic of buccal and bladder mucosa, buccal mucosa has a very thick epithelial layer and thin lamina propria. The thick epithelial layer may account for mechanically stiff characteristic of buccal mucosa. Elastic fibres has also been shown to be more abundant in buccal mucosa that may explain its resilience [1, 2].

In urethral reconstruction buccal mucosal urethroplasty was reserved for complex strictures of penile and bulbar urethra. The outcome of procedure depends on vascularity of the recipient site and revascularisation of the donor graft. A well vascularised graft bed allows good neovascularisation of the graft. Graft length, graft bed location and patient age may all reflect quality of the graft bed Although the results of buccal mucosal urethroplasty is most satisfactory, there are certain complications associated with it.

This study was about the short term and long-term results of buccal mucosal urethroplasty and analyzed them with different variables like etiology of stricture, length of stricture, operative procedure, complications and success rate.

Materials and Methods

Study design/Type of study - This was a retrospective and prospective study done from Feb 2005 to July 2010 in Department of Surgery, N.S.C.B. Medical College, Jabalpur, M.P. in which all the cases of long segment anterior urethral stricture of size more than 1cm were included in this study.

These patients had undergone radiological evaluation by RGU. Patient in whom the length of stricture segment was found to be more than 1 cm, buccal mucosal substitution urethroplasty was done. Patients were divided into two groups according to their length, patients with stricture length upto 6 cm and patients with stricture length 7cm or more.

Inclusion criteria: All cases of anterior urethral strictures that required different types of buccal mucosal substitution urethroplasty were included.

Exclusion criteria: Patients who required end to end urethroplasty or some other type of reconstruction were excluded.

Surgical technique

a) Single Stage dorsal onlay buccal muosal substitution Urethroplasty.

b) Two-Staged Buccal Mucosal substitution urethroplasty: The distal diseased urethra was opened fully along its ventral surface. The diseased corpous spongiosum was excised and the buccal mucosal graft was spread and fixed onto the corporal bodies. Urethral closure was done after 6 months.

c) Cheek harvesting technique for buccal mucosa graft of appropriate size.

In the present study, short term results that were up to 30 days and long term results were up to 1 year were observed.

Follow-Up: Suprapubic catheter was removed on day 7. Per urethral catheter was removed on day 18-21. Follow-up of patient at 1month, 2 months and 6 months respectively. Retrograde urethrography was done in follow up if required.

Short term complications

1. Wound infections
2. Long term catheter in situ
3. SPC leak
4. Fistula formation

Long term complications

- Post micturition dribbling
- Re-stricture

Evaluation of the response to intervention: Success of our procedure was defined as -

- No voiding symptoms.
- No need of CIC, dilatation, OIU or redo surgery.
- Radiological evaluation by RGU, if required.

Data analysis: The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis done using student t-test. SPSS 13.0 software was used to calculate p value.

Statistical analysis- After getting the required information, the collected data were coded, tabulated and analyzed. The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis done using student t-test. SPSS 13.0 software was used to calculate p value. P<0.05 was taken as statistically A descriptive analysis

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was done on all variables to obtain a frequency distribution. The mean + SD and ranges were calculated for quantitative variables. Continuous variables were

compared by the Student t test. Proportions were analyzed with the chi-square test

Results

In the present study, 35 patients of long segment anterior urethral stricture were included who underwent BMGU. The mean stricture length was 7.6 (range 3-15) cm. The mean follow up was 21 (range 6-56) months. The overall success rate was 77%. Majority of the patients in the present study were young adults (48.6%) having median age of 35 years.

Table-1: Results in relation to etiology

	No. of cases	Percent
H/O Catherization	6	17.1
Inflammatory	9	25.7
Trauma	3	8.6
BXO	9	25.7
Idiopathic	9	25.7

Table-2: Site of stricture

	Site	No.	%
	Bulbar	14	40.0
	Penile	4	11.4
	Peno-bulbar	6	17.1
	Panurethral	11	31.4

Table-3: Length/failure cross tabulation

			Failure		Total
			N	Y	
Length	<7	Count	14	5	19
		% Within length	73.7%	26.3%	100.0%
	>7	Count	13	3	16
		% Within length	81.3%	18.8%	100.0%
		Total count	27	8	35
		% Within Length	77.1%	22.9%	100.0%

Table-4: Results in relation to association with BXO:

	BXO	Cases	Percent
	N	27	77.1
	Y	8	22.9
	Total	35	100.0

Table-5: Failure / BXO Cross tabulation

Length 7 or more	BXO		
	No	Yes	Total
Failure	7 (87.5%)	6 (75.0%)	13 (81.3%)
Yes	1 (12.5%)	2 (25.0%)	3 (18.8%)
Total	8 (Z100.0%)	8 (Z100.0%)	16 (Z100.0%)

Table-6: Surgical procedure

Surgery	Cases	Percent
Two stage	5	14.3
Dorsal onlay	24	68.5
Almost tube	6	17.1
Total	35	100.0

Table-7: Failure /surgery cross tabulation

		Surgery			
		Two staged	Dorsal onlay	Total	
Failure	N		4	23	27
			80.0%	76.6%	77%
	Y		1	7	8
			20.0%	23.4%	23%
	Total		5	30	35
			100.0%	100.0%	100.0%

Table-8: Short term results of BMGU

	No. of cases	Percent
Surgical site infection	6	17.1
Fistula	1	2.9
Long term catheter in situ	7	20

Table-9: Long term results of BMGU

	No. of cases	Percent
Post micturition dribbling	27	77.1
Re-Stricture	8	22.9

Table-10: Management of failed cases

	No. of cases	Percent
Self-catheterization	7	20.0
Dilatation	5	14.3
OIU	4	11.4
Redo surgery	2	5.7

- The success rate of long segment strictures was inferior (77%).
- The success rate of two staged BMGU for long segment strictures was satisfactory (80%) if not associated with proximal urethral stenosis.
- Success rate of urethral strictures associated with BXO was lower (75%) as compared to others.
- Success rate of BMGU with almost tube (50%) was very poor.
- Recurrence of stricture after BMGU was found to be at proximal anastomotic site in majority of cases (62%).
- Minor wound complications did not affect the long-term outcome.

Discussion

Penile skin flaps and buccal mucosal free grafts have emerged as reliable urethral substitutes with comparable long-term results. In the 1990s there was a radical change in the anatomical positioning of the flap/graft.

Previously flaps and grafts were applied ventrally on the urethra, which resulted in complications like pseudo-diverticulum, post-void dribbling and ejaculatory dysfunction. Barbagli et al and subsequently others reported that placing the free graft dorsally on the corpora resulted in better support and neovascularisation. In urethral reconstruction buccal mucosal urethroplasty was reserved for complex strictures of penile and bulbar urethra.

The outcome of procedure depends on vascularity of the recipient site and revascularisation of the donor graft. A well vascularised graft bed allows good neovascularisation of the graft. Graft length, graft bed location and patient age may all reflect quality of the graft bed [4].

The dorsal onlay graft procedure for bulbar strictures has advantages over ventral onlay graft urethroplasty. The graft is fixed to the undersurface of the corporeal body which has excellent blood supply and good mechanical support.

The spreading of the graft, making use of the tensile strength in the corporeal bodies, reduces the risk of graft shrinkage and chordee while the dorsal graft bed avoids the problem of ventral sacculation and by interposing the graft between the urethra and corporeal bodies, fistula formation appears to be limited.

A serious complication of free graft urethroplasty is the necrosis of the patch caused by vascularization failure from its bed. The dorsal placement of the graft provides a better opportunity for roof-strip epithelial regeneration [5].

Buccal mucosal free grafts were used because they give a better cure rate for the stricture, easier and quicker to harvest and leave no visible scars.

In addition, buccal mucosal grafts seem particularly resistant to infection and having better outcome in stricture associated with skin diseases such as BXO and are easy to work with, being a tough, resilient material to handle and less fastidious than full-thickness skin grafts.

In the present study, the mean age of patients was 35 (15- 72) years. Dubey et al, in their series the mean age of the patients was 39.5 (11–62) years. Barbagli et al, published their series of 50 bulbar urethral strictures with buccal mucosa grafts from 1997 to 2002. The mean age of patient was 42 years. Barbagli et al, reviewed retrospectively 375 patients who underwent bulbar urethroplasty using different one-stage techniques. The mean age of patients was 39 years (range 14 – 80) [6-8].

In the present study, the etiology of stricture was idiopathic in 9 (25.7%), trauma in 3 (8.6%), inflammatory in 9 (25.7%), BXO in 8 (22.85%) and h/o catheterisation was present in 6 (17.1%) patients. Andrich and Mundy in 2001, in their series of 71 patients, the etiology of the bulbar strictures was idiopathic in 35, after catheterization/instrumentation in 29 and infective in 7. Dubey et al in 2002 published their study on 109 patients who underwent substitution urethroplasty [9-14].

The cause was inflammatory in 44, ischemic (after catheterization) in 11, traumatic in 21, and unknown in 33 patients. Barbagli et al in 2005, published a series of 50 patients who underwent buccal mucosal substitution urethroplasty. The etiology of stricture was ischemia in 12, trauma in 6, instrumentation in 4 and unknown in 28 patients. Barbagli et al in 2008 reviewed retrospectively 375 cases. The stricture etiology was unknown in 245 (65.3%) patients, catheter was the cause in 52 (13.9%), trauma in 38 (10.1%), instrumentation in 29 (7.8%), infection in 7 (1.9%), radiotherapy in 2 (0.5%) and congenital causes in 2 (0.5%). Patients with BXO were included in the present series where other authors have excluded [15-17].

In the present study, stricture was present in penile urethra in 4 patients, 14 in bulbar, 6 in penile and bulbar and in 11 pan-urethral. Andrich and Mundy in 2001, in their series of 71 patients who underwent buccal mucosal urethroplasty, in all patient's stricture was present in bulbar region. Dubey et al in 2002 in their series, the stricture was in the pendulous urethra in 14, pendulobulbar in 39 and bulbar in 56 patients. Pisapati et al in 2009, published their study on buccal mucosal urethroplasty, the stricture was in penile urethra in 5, bulbar in 25, penile and bulbar in 12 and panurethral in 3 patients. So, compared with Andrich and Mundy, stricture at penile as well as bulbar area was observed [18-21].

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In the present study, dorsal onlay buccal mucosal urethroplasty was done in 35 patients for long segment anterior urethral strictures. The overall success rate was 77% after an average follow-up of 21 months (range 6-56). Barbagli et al (1998) in their initial series of six patients of stricture length between 2.5 to 11.2 cm reported no recurrence of stricture after an initial mean follow up of 13.5 months. Subsequently in 2005, he reported a success rate of 85% in 27 patients who underwent dorsal onlay BM grafts [22].

With the extended follow-up, the success rate decreased to 77.3% which is comparable to our results. In 2001, Andrich and Mundy in their series of 42 patients reported success rate of 95% after a follow up of five years. Pansadaro et al in 2003 published their study on 56 patients who underwent dorsal onlay BMGU. After a median follow up of 41 months only 1 patient developed restructure. In 2007, Dubey et al published their results of dorsal onlay BMGU in 27 patients. They reported a success rate of 89.9 % after a median follow up of 22.6 months [23, 24].

In the present study, patients with stricture length upto 6 cm, the success rate was 73.7% with a mean follow up of 21 months. Dubey et al in 2002, published their results of 16 patients with mean stricture length of 6.9 cm who underwent dorsal onlay BMG. After a mean follow up of 22 months the success rate was 87%. So our results of BMG substitution urethroplasty in stricture of this range have comparable results.

In the present study, patients with stricture of length 7 cm or more, failure rate was 18.3% after a mean follow up of 21 months. In 2002, Andrich and Mundy published a series of 52 patients with pan-urethral stricture and reported a failure rate of 23% after a mean follow up of 32 months which is comparable with our results.

In the present study, 5 patients with pan-urethral stricture have underwent two stage urethroplasty with closure after six months. There was failure in 1 (20%) out of 5 patients. This failure in the present study was because of meatal narrowing at proximal urethral opening. Dubey et al in 2005, published a series of 92 patients underwent dorsal onlay BM urethroplasty, 75 single-staged and 17 two-staged.

The follow-up was shorter for two stage reconstruction compared to one-stage, 24.2 and 34 months respectively. They reported success rates of 90% for single staged and 88.2% for two staged procedures.

In the present study, the overall success rate was 77 % after a mean follow up of 21 months (range 6-56) which is lower as compared to other studies because of the inclusion of the long segment strictures. In the present study, the average stricture length was 7.6 (range 3-15) cm as compared to 4.6 cm in Barbagli et al and 6.2 cm in Dubey et al.

In the present study, in 6 cases almost tube was formed and in those cases success rate was 50%. In the present study, the success rate was inferior in patients who underwent almost tube BM urethroplasty (50%) as compared to 80% in patch buccal mucosal urethroplasty. Almost tube BM urethroplasty has poor outcome as compared to patch BM urethroplasty.

Venn et al in 1998 published their results of 39 patients (aged 23-59 years) underwent one-stage urethroplasty using buccal mucosa, 28 as a patch and 11 patients as tube grafts. The failure rate was 3% in the group with a patch urethroplasty as compared to 45% with tube grafts. Again in 2000, they reviewed the results and experience with urethroplasty using buccal mucosal graft in 128 patients. The re-stricture rate was 11% for patch grafts and 45% for tube grafts.

In the present study, 8 patients had long segment urethral stricture (average 10.7 cm) associated with BXO. The success rate was lower in BXO associated long segment strictures (75%) as compared to strictures not associated with BXO (87%). In 2000, Kulkarni et al reported a 91% success rate on a preliminary series of 36 patients with panurethral strictures caused by BXO. Dubey et al in their initial series of 25 patients with panurethral strictures caused by BXO, reported 88% success rate but after a longer follow up, they reported a success rate of 78.6% [21].

Barbagli and Kulkarni et al (2009) published a series of 215 patients with Lichen Sclerosis treated by various surgical techniques. Of 15 patients who underwent two-stage buccal mucosal urethroplasty, 11 (73.3%) were successful and 4 (26.7%) were failures at the average follow-up of 46 months. In the present study, in patients with BXO related strictures, the disease was extensive involving the long segment of urethra, there was full involvement of the glans and even penile skin and the urethral plate was scarred and narrow. In the present study, in 75% of patients, submucosal fibrosis was seen in buccal mucosa because most of the patients belong to low socio-economic group and had poor oral hygiene and most of the patients (80%) were paan or betal nut chewer [23, 27].

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Site of restructure: In the present study, 7 (20%) patients developed anastomotic strictures and 1 (3%) patients developed long segment stricture. In 5 cases, anastomosis stricture was present at the site of proximal anastomosis and in 2 patients at distal site. Dubey et al in 2005, published their study in 17 patients who underwent dorsal onlay BM bulbar urethroplasty.

Over a mean follow-up of 36.2 months, 1 had complete graft loss, 5 had stomal revision after stage 1 and 2 developed restructure. In the present study, only 1 patient developed restructure. In 2006, Barbagli et al also reported the similar pattern of stricture recurrence. In their study after a mean follow-up of 74 months of 107 patients, 12 patients (11%) developed stricture involving the whole grafted area and in 10 (9%) at the anastomotic site, which was distal and proximal in 5 each. [14, 23, 26].

Causes of anastomotic stricture especially at proximal end are difficult dissection in proximal bulbar area, difficulty in taking stitches there, difficulty in find out proper healthy proximal urethra along with decreased blood supply to the bed may contribute to stricture at this site.

Post-operative complications: In the present study, 6 (17%) patients had wound infection and 1 (3%) patient developed restructure. In all these 7 cases (20%) per urethral catheter was kept for more than 21 days. In the present study, 75% patients developed post micturition dribbling after urethroplasty but troublesome in none. Only 1 patient had complained of pyuria which was resolved after antibiotics treatment as per urine culture and sensitivity. None of the patients with minor post-operative complications had developed re-structure. Andrich and Mundy in 2001 reported post voiding dribbling in almost all cases and troublesome in 17% of cases. In subsequent series of 52 patients in 2002, they reported troublesome post voiding dribbling in 15 % of patients, 2 patients developed wound infection and 1 patient developed fistula [23, 24].

Dubey et al in 2007 published their results of 27 patients who underwent BMGU. Hematoma and minor wound infection were present in 3 patients. One patient had mild extravasation of dye on voiding cystourethrogram at 3 weeks after surgery and required an additional week of catheterization.

Barbagli et al in 2008, published their study in 128 patients who underwent one-stage bulbar urethroplasty using buccal mucosal grafts. Out of 128 patients, 38

patients (29.7%) developed post-operative complications like fistula formation in 11 (8.6%), wound dehiscence in 6 (4.7%), wound hematoma in 5 (3.9%), urethrorrhagia in 5 (3.9%), epididymitis in 4 (3.2%). They concluded that occurrence of minor post-operative complications does not influence the final outcome [25 - 31].

Limitations

1. Small sample size
2. Chances of bias
3. Single center trial

Conclusion

Reconstructing the urethra continues to be challenging for the reconstructive surgeon; buccal mucosa gives good and viable option for substitution urethroplasty for long segment stricture. It is easy to harvest and handle, is resilient to infections and accustomed to a wet environment. As of date, it provides good material for substitution for treating all types of strictures with fairly good results and fewer complications.

What this study adds to existing knowledge?

Buccal mucosal free grafts have been used because they give a better cure rate for the stricture, easier and quicker to harvest and leave no visible scars.

In addition, buccal mucosal grafts seem particularly resistant to infection and having better outcome in stricture associated with skin diseases such as BXO and are easy to work with, being a tough, resilient material to handle and less fastidious than full-thickness skin grafts.

Author's contribution

Dr. Atul Kumar: Concept and data collection

Dr. Praveen Singh Baghel: Data analysis and discussion

Dr. Shabbir Hussain: Study design

Dr. Fanindra Singh Solanki: Study design and manuscript preparation

Dr. Deepti Bala Sharma: Data analysis and manuscript preparation

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