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Original Article

Initial experience with lingual mucosal graft urethroplasty for anterior urethral strictures

Col Anand Srivastava^{a,*}, Lt Col A. Dutta^b, Brig D.K. Jain^c^a Senior Advisor (Surgery & Urology), Army Hospital (R&R), Delhi Cantt, India^b Classified Specialist (Surgery and Urology), Military Hospital, Jalandhar Cantt, India^c Consultant (Surgery and Urology), Command Hospital (SC), Pune, India

ARTICLE INFO

Article history:

Received 15 July 2011

Accepted 17 May 2012

Available online 30 November 2012

Keywords:

Stricture urethra

Urethroplasty

Lingual mucosa

ABSTRACT

Background: To present the feasibility of lingual mucosal graft urethroplasty in anterior urethral strictures and appraisal of donor site morbidity.

Methods: From November 2007 to December 2010, 14 patients underwent dorsal onlay lingual mucosal graft urethroplasty for anterior urethral strictures. Lingual mucosal graft was harvested from the lateral and undersurface of the tongue. Check micturating cystourethrograms were done 2 weeks after catheter removal and uroflowmetry after 3 months. Success was defined as normal uroflowmetry rates at 3 months in the absence of any postoperative instrumentation. Tongue was assessed for any residual pain, taste disturbances or restricted movement at 3 months.

Results: Four patients had submucosal fibrosis of the oral cavity and their buccal mucosa was unfit for grafting. Mean (range) stricture length was 5 (3–16) cm and the operation time 170 (140–210) min. Graft width averaged 1.6 cm. Average length of harvested graft was 6.5 cm. Mean duration of follow-up was 12.8 months. Two patients developed stricture at the proximal anastomotic site. There were no donor site complications.

Conclusions: Lingual mucosal graft harvesting is simple, gives graft lengths comparable to buccal mucosa and is associated with negligible donor site morbidity.

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Introduction

Short (<2 cm) anterior urethral strictures are either treated by visual internal urethrotomy or resection and end-to-end anastomosis whereas long strictures (>2 cm) require tissue transfer. Urethral reconstruction by means of tissue transfer most commonly involves use of penile or preputial skin.¹ A number of techniques have been promoted as alternatives when local skin is either unsuitable due to the presence of Balanitis Xerotica Obliterans or deficient due to previous

penile surgery and when excessive length of urethral deficiency needs to be bridged.²

Use of autologous buccal mucosa (BM) as a urethral substitute was initially described in 1992.³ Since then BM graft has been used successfully for treating all types of urethral strictures and has become the recommended source for tissue substitution during urethral reconstruction.¹ Indications for BM graft urethroplasty have included complex and recurrent hypospadias repairs and anterior urethral strictures.^{3–6} BM graft is harvested from the inside of the cheek and may be

* Corresponding author. Tel.: +91 1123338061, +91 8527662444.

E-mail address: anandsrivastava1@gmail.com (A. Srivastava).

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<http://dx.doi.org/10.1016/j.mjafi.2012.05.006>

associated with donor site morbidity like mental nerve neuropathy and damage to Stensen's duct. In addition it may not be available in patients with oral submucosal fibrosis. Furthermore in a few patients requiring near total urethral reconstruction additional tissue may be required.

The mucosa covering the lateral and undersurface of the tongue is identical in structure with that lining the rest of the oral cavity and has recently begun to be explored for urethral reconstruction with promising results.⁷

The aim of this study was to evaluate lingual mucosal (LM) graft for urethral substitution with emphasis on the technique of graft harvesting and donor site morbidity.

Material and methods

From November 2007 to Dec 2010, a total of fourteen patients with long anterior urethral strictures underwent single stage substitution urethroplasty with dorsal onlay patch LM graft. In one of these patients a combination of LM and BM graft was used to bridge an exceptionally long urethral defect. Five patients had nasal endotracheal tube while 9 had oral endotracheal tube. Urethra was approached by a midline perineal incision. Penis was everted to bring the stricture into the surgical field. Urethra was circumferentially dissected and rotated to bring the dorsal surface into view. It was opened dorsally in the midline over the stricture, extending to normal areas both proximally and distally and the length of the stricture assessed. Next the oral cavity of the patient was accessed and stay suture taken from the tip of the tongue. LM graft was harvested from the lateral and undersurface of the tongue (Fig. 1). Unlike BM graft, submucosal infiltration with saline or dilute adrenaline was not done. Graft harvesting was begun near the posterior free edge of the tongue on the left side by a right handed surgeon standing on the right side of the patient. It was continued across the tip of the tongue to the other side depending on the length of the graft required. The edges of the defect were closed with interrupted 4-0 polyglactin suture (Fig. 2). No ice packs were applied to the tongue. Graft was pinned to a wooden board and thinned. It was then applied to the tunica albuginea of the corpora cavernosa in the

Fig. 2 – Tongue sutured after harvesting the mucosa.

region of the stricture and fixed with a few sutures. Urethral edges were then sutured to the graft margins and tunica albuginea over a sixteen Fr silicone catheter. Skin incision was closed in the usual fashion. Pericatheter contrast study was done between 21 and 28 days postoperatively and catheter removed thereafter if there was no leak. Patients were started on fluid diet on the first postoperative day and soft diet on the third (Fig. 3). Check micturating cystourethrograms were done 2 weeks after catheter removal and uroflowmetry after 3 months. Success was defined as normal for age uroflowmetry rates at 3 months in the absence of any postoperative instrumentation. Tongue was assessed for any residual pain, taste disturbances or restricted movement in the post-operative period and at 3 months.

Results

Four patients had submucous fibrosis of the oral cavity and their buccal mucosa was not fit for grafting.

Fig. 1 – Lingual mucosa harvest in progress.

Fig. 3 – Postoperative, day 3 showing excellent and rapid healing of tongue.

The mean length (range) of the stricture was 5 (3–16) cm and the operation time 170 (140–210) min. Graft width averaged 1.6 (1.3–1.9) cm. Average length of harvested graft was 6.5 (3.5–9.5) cm. Five grafts were harvested across the tip of the tongue. A combination of LM graft and BM graft was used in one patient with 16 cm long panurethral stricture.

Mean harvesting and tongue defect closure time was 25 min. There was no bleeding or oozing after closure. All patients had pain at the donor site and slurring of speech for 48 h. By third postoperative day all except two were free of pain and none had slurring. All the patients were able to resume oral fluid within 24 h, eat soft solid diet in the next 24 h and return to normal diet 3–4 days after surgery. Mouth opening was not restricted in any patient. There were no salivation disturbances, peri-oral numbness or difficulty in protrusion of tongue at any time after surgery.

Mean duration of follow-up was 12.8 months. Two patients (14.28%) developed stricture near the proximal anastomotic site with poor urinary stream and post-void dribbling and required internal urethrotomy. Both of them are on weekly self-dilatation. None of the patients developed fistula or diverticulum. Uroflowmetry at three months showed normal flow rates in all.

Discussion

The quest for a model urethral substitute continues. Ideally any anterior urethral stricture longer than 2 cm should be treated with substitution urethroplasty and a variety of tissues have been used for the same. In 1976 Devine first described the use of a full thickness skin graft.⁸ The disadvantages of vascularized local skin flaps are ballooning and diverticulum formation leading to urinary stasis and skin excoriation.⁹ The concept of free graft reconstruction of the urethra was popularized with the use of tubularized skin from various donor sites, predominantly upper arm and penis.¹⁰ Complications of free skin grafts to the urethra include graft shrinkage and stricture formation and they have lost their popularity.¹¹

Bladder mucosal free grafts have been used as tubes or patches for reconstruction of difficult hypospadias and urethral stricture disease.¹² Bladder mucosa may be well suited for urethroplasty, since long-term exposure to urine is native to it. The slimness of the tissue would promote imbibition and inosculation.¹² However, harvesting requires an additional suprapubic incision, bladder dissection, and cystotomy which increase the morbidity significantly. The overall complication rate for bladder mucosal grafts approaches 40%.¹¹ Meatal problems arise in a significant number of patients. The most common meatal complication is mucosal exuberance causing irritation with many cases requiring meatal revision.¹³

Barbagli et al described the technique of dorsal free graft urethroplasty where a free full thickness skin graft was applied to the dorsally incised urethra.¹⁴ They claimed that the graft is mechanically supported by the corpora cavernosa, has a better blood supply and is thus less prone to sacculation.

In the last decade BM has gained popularity as an excellent substitute for urethral reconstruction both in strictures and

complex hypospadias.^{15,16} Access is easier as compared to bladder mucosal graft. The tissue is 'wet' and resistant to infection and trauma. Physical characteristics of the BM graft that facilitate its use in urethral reconstruction include its thickness and elasticity, which prevent contraction and promote graft acceptance.^{3,4,6} Histological comparisons show that the epithelial layer of buccal mucosal is thick with abundant elastin fibers, allowing for increased mechanical durability and handling ease and the lamina propria is thin and richer in vascular structures, promoting imbibition and inosculation.¹¹ Harvesting is easier than other free grafts or pedicled flaps. Lengths upto 15 cm can be harvested. Harvest sites have included the upper lip, lower lip, and cheeks either alone or concomitantly.^{3–6} BM may be used as a tubularized, folded tube, or onlay graft.^{3–6} BM urethroplasty results in success rates of over 90% as reported by various authors.^{5,14,17}

The current opinion is that the most prevalent graft for urethroplasty is probably the BM. However oral complications can occur both at the time of surgery and also cause long-term problems. These include peri-oral numbness, salivatory changes and difficulty opening the mouth.⁷ Pansadoro reported bleeding from the cheek after graft harvesting.¹⁷ Barbagli has reported Stensen's duct damage, intraoperative bleeding, facial hematoma, infection, subjective local disturbances, neural damage (paresthesia from "lungobuccale" or "mentoniero" nerve), retraction from scar (lip/cheek distortion) and limited mouth opening.¹⁸ Stefan reported that BM graft harvesting from the lower lip and the inner cheek are both feasible, but harvesting from the lower lip resulted in a significantly greater long-term morbidity, which resulted in a lower proportion of satisfied patients. They hypothesized that it seems to be due to a long-lasting neuropathy of the mental nerve.¹⁹ In one series 57% of patients developed numbness in the cheek after surgery which persisted for 1 year after surgery.²⁰ Caldamone reported two patients who developed scar contracture.²¹ Dubey reported bleeding requiring surgical intervention.²²

Oral use of betel leaf, betel nut and chewing tobacco are very common in South East Asia and are implicated in the causation of submucous fibrosis of the oral cavity.²³ BM is stiff, unhealthy and not a suitable graft in such patients. While BM may be unhealthy in these patients, the tongue usually remains healthy and exploitable.

Simonato et al published a pilot study in 2006, examining the functional results of urethroplasty utilizing LM with special attention to complications of the donor site on 8 patients.⁷ Stricture length averaged 3.3 cm. Graft length was as long as 7 cm in one case. At 3 months of follow-up, 7 of 8 cases were considered successful. Five patients were available for 12 month follow-up and 4 out of 5 cases were considered successful. Donor site morbidity was minor. Slight oral discomfort was reported for only 2–3 days postoperatively. All patients were able to resume eating a regular diet after one week. No long-term donor site complications were noted.⁷ They have recently updated their experience with similar results.²⁴

As compared to Simonato's series⁷ stricture length was longer in our series and the maximum length of LM graft harvested was also longer. Our success rate compares favorably with those of other series using LM grafts (Table 1)^{7,24–28}

Table 1 – Results of lingual mucosal graft urethroplasty in various series.

Series	N	Stricture length, cm	Graft placement	Follow-up, months	Success rate, %
Das et al ²⁵	30	10.2	Dorsal	9	83.3
Kumar et al ²⁶	28	6.5	Dorsal	4.2	—
Barbagli et al ²⁷	10	4.5	Dorsal/ventral	5	90
Simonato et al ²⁴	29	3.6	Dorsal	17.7	79.3
Kumar et al ²⁸	30	8.4	Dorsal	3.8	—
Simonato et al ⁷	8	1.5–4.5	Dorsal	18	87.5
Current	14	5	Dorsal	12.8	85.71

and also to studies using BM grafts.^{3–6} Donor site morbidity was minimum and limited to immediate postop period. There were no lasting effects on the tongue. The only other study that has focused on the complications of LM graft donor site has also confirmed minimal donor site morbidity.²⁵

Conclusion

In conclusion our study seems to confirm evidence that another area of harvest for graft urethroplasty is at hand. LM graft harvesting is simple, gives graft lengths comparable to buccal mucosa and is associated with negligible donor site morbidity. It is easier to harvest than BM as the tongue can be effortlessly withdrawn from the oral cavity using a stay suture even in patients who have restricted mouth opening such as those suffering from submucosal fibrosis of the oral cavity. It is also easily accomplished even with an oral endotracheal tube as compared to BM harvesting. This site could prove handy for primary urethroplasties, re-do urethroplasties in failed buccal mucosa graft onlays, or when a large amount of graft tissue needs to be harvested for exceptionally long strictures. It may be the only mucosal graft available in patients with extensive oral submucous fibrosis. Lengthy urethral defects in men are a challenge to the reconstructive urologist. Lingual mucosal grafts are a viable alternative for long urethral reconstruction either alone or in combination with buccal mucosa.

Intellectual contribution

Study concept: Col A. Srivastava.

Drafting & manuscript revision: Col A. Srivastava & Brig D.K. Jain.

Statistical analysis and study supervision: Col A. Srivastava & Lt Col A. Dutta.

Conflicts of interest

All authors have none to declare.

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