

LONG-TERM FOLLOWUP OF THE VENTRALLY PLACED BUCCAL MUCOSA ONLAY GRAFT IN BULBAR URETHRAL RECONSTRUCTION

SEAN P. ELLIOTT, MICHAEL J. METRO AND JACK W. McANINCH*

From the Department of Urology, University of California School of Medicine and San Francisco General Hospital, San Francisco, California

ABSTRACT

Purpose: We investigate whether the short-term success rate (greater than 90%) of buccal mucosa free grafts in the bulbar urethra is sustained in the long term.

Materials and Methods: In 60 patients a ventrally placed buccal mucosa graft was used for repair of bulbar urethral strictures. Of these patients 49 had undergone previous attempt at repair (urethroplasty in 4, internal urethrotomy in 45). Mean graft length was 4.8 cm. In 9 patients a distal penile fasciocutaneous flap was also used for repair of concomitant penile urethral stricture. In 8 of the 9 patients the buccal mucosa graft was combined with end-to-end urethroplasty and 2 buccal mucosa grafts were used in tandem in 1. Followup was at least 1 year in all cases (mean 47 months, range 12 to 107). Failure was defined as an obstructive voiding pattern with radiographic or cystoscopic evidence of recurrent stricture.

Results: Bulbar stricture repair was successful in 54 patients (90%) and 4 of the remaining 6 responded to 1 internal urethrotomy for a long-term success rate of 97%. Preoperative clinical characteristics were not significantly different between those who experienced success or failure.

Conclusions: Long-term outcome analysis of ventrally placed buccal mucosa onlay grafts for bulbar urethral strictures demonstrates a durable success rate of 90%. This rate can be improved (97%) with the judicious use of internal urethrotomy.

KEY WORDS: urethral stricture, month mucosa, transplants, tissues

Short anterior urethral strictures (less than 2.0 cm.) are generally repaired with excision and end-to-end anastomosis with excellent results. Although repair of uncomplicated longer strictures is less uniform, the greatest success has been with penile flaps in the pendulous urethra and grafts in the bulbar urethra.¹ For the latter repair the preferred donor tissue has been buccal mucosa. Its advantages, compared with local skin flaps, include a cosmetically superior incision and decreased operative time, it is superior to bladder mucosa and genital skin because its harvest has low morbidity, and the graft characteristics ensure improved viability. Buccal mucosa has a thick epithelium and a thin lamina propria, which are believed to encourage graft imbibition and inosculation.²

Initial success with the buccal mucosa graft to repair bulbar urethral strictures has been high (average 92%).³⁻⁷ However, followup in most series has been short and techniques have varied, with series reporting ventral and dorsal onlay grafts.^{3,5} We report our long-term followup of the ventrally placed buccal mucosa onlay graft in bulbar urethral reconstruction.

PATIENTS AND METHODS

Between June 1993 and May 2001 we repaired 60 bulbar urethral strictures with a buccal mucosa graft. Mean patient age was 41 years (range 17 to 81). The cause of stricture formation was urethritis in 7 cases, trauma in 7, prior instrumentation in 5, failed hypospadias repair in 3, radiation therapy in 1 and unknown in 37. Of the 60 patients 49 had undergone previous stricture repair or intervention (internal

urethrotomy or dilation in 45 and urethroplasty in 4). Preoperative evaluation included history, physical examination, retrograde urethrography (fig. 1) and sonourethrography.

Our technique of buccal mucosa urethroplasty has been previously described.⁸ All patients receive perioperative broad-spectrum antibiotics including either 4 million u. penicillin G or 1 gm. vancomycin and a single dose of 5 mg./kg. gentamicin. Preoperative sonourethrography is performed with the patient supine, which helps determine a more precise stricture measurement and defines anatomy at the time of reconstruction to aid in selection of repair technique. For bulbar strictures less than 2.0 cm. primary anastomotic urethroplasty is generally selected, and for penile strictures a circular penile fasciocutaneous onlay flap is used. Buccal

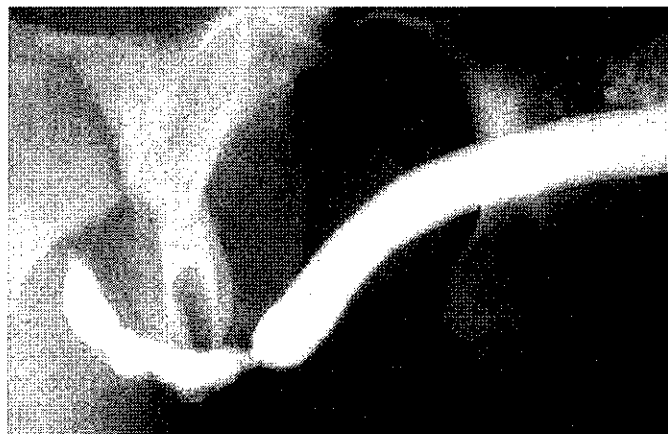


FIG. 1. Representative preoperative retrograde urethrogram demonstrates bulbar urethral stricture amenable to buccal mucosa ventral onlay graft reconstruction.

Accepted for publication November 27, 2002.

* Financial interest and/or other relationship with Bayer Corp.

Editor's Note: This article is the fourth of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 1854 and 1855.

mucosa grafts are reserved for bulbar strictures longer than 2.0 cm. We believe that only in the bulbar urethra is the spongiosum hearty enough to provide vascularization adequate for graft viability. We use a 2-team approach, with 1 team of urologists harvesting the buccal mucosa graft while the second team exposes the stricture. We initially preferred nasotracheal intubation but have found that this results in more postoperative discomfort and no greater access to the inner cheek. The orotracheal tube is taped over to the contralateral side and a Steinhauser buccal mucosa retractor is used, providing excellent inner cheek exposure.

A 20 mm. wide graft is harvested, unless the preserved dorsal plate of the urethra is narrow. In cases of near or complete obliteration of the urethra a 25 mm. wide graft is used. The graft is tailored to the size of the defect after stricture identification and incision. The stricture is incised ventrally and extended at least 0.5 cm. into normal-appearing proximal and distal urethra, and the defect is measured. The urethra is then calibrated proximally and distally with a bougie-à-boule to at least 24 to 26Fr to ensure complete stricture incision. A ventral onlay anastomosis is performed with 2 continuous running 6-zero monofilament absorbable sutures, making certain to approximate graft epithelium to urothelium. A 16Fr silicone urethral catheter is placed after 1 side of the anastomosis is complete. A suprapubic catheter is generally not used unless the patient presented with one. In these cases it is changed and the new catheter is left in place until the urethral catheter is removed. The adventitia of the corpus spongiosum is then closed over the graft with interrupted absorbable 6-zero sutures (fig. 2). This spongioplasty provides vascularity to the graft and gives mechanical support to prevent future sacculatation.

The patient is given nitrofurantoin for 3 weeks. After retrograde filling of the bladder through the existing urethral catheter, a voiding cystourethrogram is obtained and the catheter is removed. Followup consists of a retrograde urethrogram at 3, 6 and 12 months. Additional imaging studies are obtained when symptoms of decreased force of stream are present.

RESULTS

Of the 60 patients 54 (90%) experienced initial success (fig. 3) and 4 of the remaining 6 responded to 1 internal urethrotomy (97%). Isolated bulbar strictures patients were repaired with a single buccal mucosa ventral patch graft in 42 patients and 9 also underwent simultaneous repair of pendulous urethral strictures using circular penile skin flaps. Of those 9 patients 8 underwent concomitant end-to-end urethroplasty and 1 had 2 buccal mucosa grafts placed serially during the same procedure. Mean operative time was 5.4 hours (range 1.8 to 10.5). Estimated mean blood loss was 570 ml. and no patient required a transfusion. There were no intraoperative or postoperative complications, or any anastomotic leaks, sacculations, diverticuli or fistulas (fig. 3). Followup has been at least 1 year in all cases (mean 47 months, range 12 to 107).

Overall mean stricture length including those in the pendulous urethra was 5.3 cm. (range 1.5 to 24). Mean length of buccal mucosa grafts used only in the bulbar urethra was 4.7 cm. (range 2.5 to 8). Preoperative stricture length in the 6 initial failures, while not assessed statistically because of the low number, was longer than that in the 54 initial successes (5.8 versus 5.2 cm., respectively). The 2 groups differed little in age (44 and 40 years, respectively). Of the 6 recurrences 4 were at the distal graft anastomosis, and 4 occurred within the first 3 months and 2 at 24 months.

We have found internal urethrotomy useful for the management of recurrent strictures after buccal mucosa reconstruction. Indeed, 4 of the 6 patients are now asymptomatic

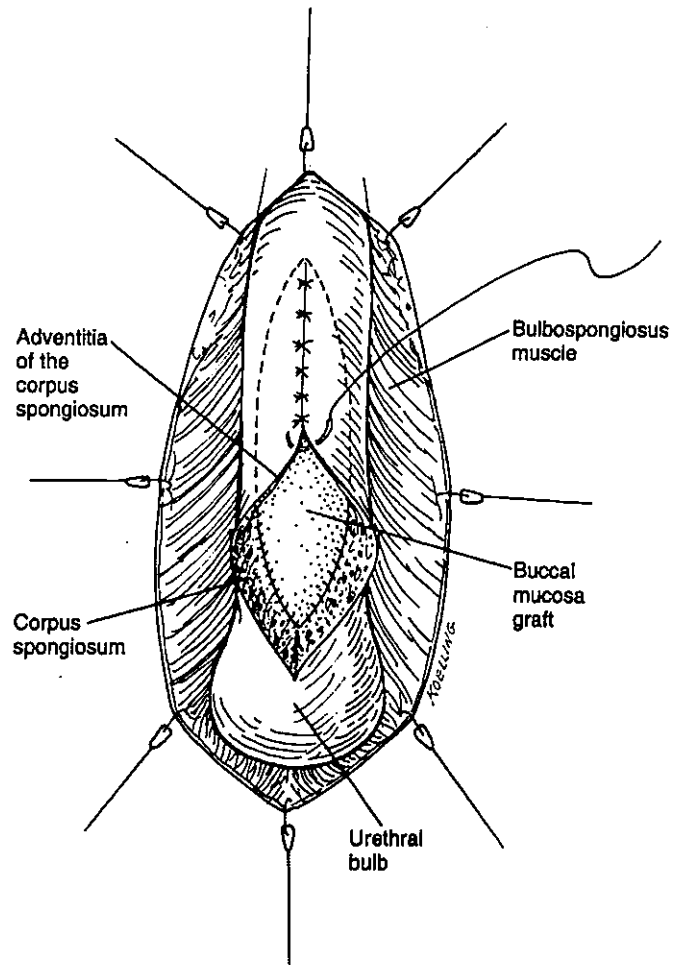


FIG. 2. Spongioplasty in which adventitia of corpus spongiosum is closed over underlying buccal mucosa graft, which provides mechanical support and ample blood supply to graft.



FIG. 3. Representative postoperative voiding cystourethrogram demonstrates excellent result after buccal mucosa ventral onlay graft reconstruction.

with a favorable urethrogram 18 to 45 months after only 1 procedure. The usually well vascularized graft typically has a short stricture, which responds better to incision than do primary strictures. (The latter, surrounded by significant scar tissue and spongiofibrosis, tends to re-stricture.) We use a pediatric urethrotome and perform radial urethrotomies, as opposed to a single deep incision in the spongiosal tissue,

to limit inflammatory reaction and consequent scar tissue formation.

In our series concomitant penile skin flap or end-to-end urethroplasty was not associated with any increased risk of failure (1 of 9 in the former and 1 of 8 in the latter group). The patient with 2 grafts remains free of stricture recurrence at 107 months. Of the 2 patients with long-term failure 1 had a history of balanitis xerotica obliterans and required a complex urethral reconstruction that included a buccal mucosa graft and a fasciocutaneous flap, totaling 15 cm. The recurrent stricture is in the proximal portion of the vascularized flap and may represent balanitis xerotica obliterans recurrence rather than graft failure. The second patient, a 55-year-old man, had an idiopathic 4 cm. stricture managed with a single ventral onlay buccal mucosa graft. He was otherwise healthy and had no risk factors for failure. However, despite an uncomplicated reconstruction, he has required 2 postoperative internal urethrotomies and 1 dilation for the management of recurrent stricture.

DISCUSSION

Humby is credited with the first use of buccal mucosa for urethral reconstruction when in 1941 he reported a series of 1-stage hypospadias repairs.⁹ Before widespread antibiotic use initial success rates were low. A resurgence in the technique occurred in the late 1980s when Duckett reported using the buccal mucosa graft in an epispadias repair¹⁰ and, subsequently, complex hypospadias revisions and urethral stricture repairs were performed with buccal mucosa.^{2,11} In the pediatric and adult literature success has been poor in the pendulous urethra,^{1,2} and for this reason we continue to use penile skin flaps at that location. However, in the bulbar urethra the high success rate of the buccal mucosa graft has made it the treatment of choice.

A review of the literature reveals few reports on the bulbar urethra alone (see table). Many series include cases in which buccal mucosa grafts were used in the pendulous urethra or in which the surgical technique was not standardized (many series shifted from a ventral onlay to a dorsal onlay technique). Our results (90% initial success rate) compare favorably with the average success rate (92%). Furthermore, our low re-stricture rate and the absence of any sacculations or diverticuli in the graft emphasize the appropriateness of the ventral onlay technique as long as the graft is tailored appropriately. Similar results were recently published by Kane et al on 53 patients who underwent ventral onlay of a buccal mucosa graft in the bulbar urethra with 94% requiring no further procedures at short-term followup.⁷ Furthermore, although sacculations developed in 4 patients, all were asymptomatic.

In our 6 patients who experienced initial failure stricture recurred during the first 3 postoperative months in 4 and at 2 years in 2. A graft such as buccal mucosa carries no blood supply of its own. Its survival depends on the absorption of nutrients from a well vascularized recipient bed (imbibition phase) and, later, on the ingrowth of capillaries from the recipient bed to the graft (inosculation phase).² Early failure of a free graft can result from inadequacy of either phase and frequently reflects a poorly vascularized recipient bed, infec-

tion or hematoma. Late re-stricture may owe to progression of the original disease.

Of our 6 failures 4 occurred at the distal anastomosis, despite the fact that the proximal anastomosis was deep in the bulb and is the more difficult site technically in which to ensure epithelium-to-urothelium placement. We have modified our technique slightly in that we now place several interrupted simple sutures in the apices of the anastomosis before running the rest of the anastomosis. This modification optimizes our ability to ensure good epithelium-to-urothelium apposition. We have previously shown that grafts fare poorly in the pendulous urethra where the corpus spongiosum is less vascular.¹ Likewise, graft failure at the distal anastomosis may represent poor inosculation owing to poor graft bed vascularity. In addition, it is important to incise the urethra well into normal tissue proximally and distally to ensure complete stricture incision. The preoperative sonourethrogram delineates the degree of scarring of the corpus spongiosum better than a urethrogram and is a useful guide when planning the extent of stricture incision.

This technique is relatively new, with the longest followup reported by Andrich et al⁵ and the present series. Our experience, spanning almost a decade, has allowed us to draw several conclusions about the buccal mucosa graft. Sacculations are uncommon and rarely symptomatic with proper tailoring of the ventral onlay graft and adequate spongioplasty. The latter is an important yet often neglected step. By performing an epithelium-to-urothelium anastomosis in which the spongiosum is avoided, the adventitia of the corpus spongiosum is available for closure over the graft. This technique allows the percolating blood of the spongiosum to provide vascularity to the graft and also adds a backing of support, which prevents any outpouching or sacculation. When stricture disease extends beyond the bulbar urethra, we combine the buccal mucosa graft repair with either a circular penile skin flap or end-to-end urethroplasty. In our series neither a longer stricture nor the need for additional reconstructive procedures was associated with any change in the success rate.

Whether applied as a ventral or a dorsal onlay, the buccal mucosa graft yields a success rate of greater than 90% in the bulbar urethra. The high short-term rate has proved durable through our extended followup. The 1 long-term true graft failure is a reminder that stricture can recur even in well selected patients and despite meticulous technique. Close followup is imperative. Finally, in most cases initial failure can be converted to long-term success with a single internal urethrotomy.

CONCLUSIONS

Long-term outcome analysis of ventrally placed buccal mucosa onlay grafts for the treatment of bulbar urethral strictures demonstrates a durable success rate of 90%. Long-term success can be improved to 97% with the judicious use of internal urethrotomy. With proper graft tailoring and an adequate spongioplasty, the ventral only technique produces excellent results.

Reported success rates with buccal mucosa onlay grafts in the bulbar urethra

References	No. Pts.	Mos. Followup (mean)	Ventral or Dorsal Onlay	% Success
Andrich et al ⁵	71	60-?	Ventral/dorsal	89
Barbagli et al ³	6	13-14 (13.5)	Dorsal	100
Kane et al ⁷	53	11-40 (25)	Ventral	94
Morey and McAninch ^{6,*}	13	2-33 (18)	Ventral	100
Pansadoro et al ⁴	30	3-50 (20)	Ventral/dorsal	96
Present study	60	12-107 (47)	Ventral	90 (Av. 92*)

* These 13 cases represent the first 13 in the present study, and only the updated results were used in calculation of the average success rate.

REFERENCES

1. Wessells, H. and McAninch, J. W.: Use of free grafts in urethral stricture reconstruction. *J Urol*, **155**: 1912, 1996
2. Baskin, L. S. and Duckett, J. W.: Buccal mucosa grafts in hypospadias surgery. *Br J Urol*, suppl., **76**: 23, 1995
3. Barbagli, G., Palminteri, E. and Rizzo, M.: Dorsal onlay graft urethroplasty using penile skin or buccal mucosa in adult bulbourethral strictures. *J Urol*, **160**: 1307, 1998
4. Pansadoro, V., Emiliozzi, P., Gaffi, M. and Scarpone, P.: Buccal mucosa urethroplasty for the treatment of bulbar urethral strictures. *J Urol*, **161**: 1501, 1999
5. Andrich, D. E., Leach, C. J. and Mundy, A. R.: The Barbagli procedure gives the best results for patch urethroplasty of the bulbar urethra. *BJU Int*, **88**: 385, 2001
6. Morey, A. F. and McAninch, J. W.: When and how to use buccal mucosal grafts in adult bulbar urethroplasty. *Urology*, **48**: 194, 1996
7. Kane, C. J., Tarman, G. J., Summerton, D. J., Buchmann, C. E., Ward, J. F., O'Reilly, K. J. et al: Multi-institutional experience with buccal mucosa onlay urethroplasty for bulbar urethral reconstruction. *J Urol*, **167**: 1314, 2002
8. Morey, A. F. and McAninch, J. W.: Technique of harvesting buccal mucosa for urethral reconstruction. *J Urol*, **155**: 1696, 1996
9. Humby, G.: A one-stage operation for hypospadias. *Br J Surg*, **29**: 84, 1941
10. Duckett, J. W.: The use of buccal mucosa graft in epispadias. Southampton, United Kingdom: Society of Paediatric Urological Surgeons, 1986
11. Metro, M. J., Wu, H.-Y., Snyder, H. M., III, Zderic, S. A. and Canning, D. A.: Buccal mucosa grafts: lessons learned from an 8-year experience. *J Urol*, **166**: 1459, 2001