

MULTI-INSTITUTIONAL EXPERIENCE WITH BUCCAL MUCOSA ONLAY URETHROPLASTY FOR BULBAR URETHRAL RECONSTRUCTION

CHRISTOPHER J. KANE,*† GREGORY J. TARMAN, DUNCAN J. SUMMERTON,
CRAIG E. BUCHMANN, JOHN F. WARD, KEITH J. O'REILLY, HENRY RUIZ,
J. BRANTLEY THRASHER,‡ BURK ZORN, CAROLYN SMITH AND ALLEN F. MOREY

From the Departments of Urology and Oral and Maxillofacial Surgery, Naval Medical Center, San Diego, San Diego, California, Department of Surgery, Urology Service, Madigan Army Medical Center, Tacoma, Washington, Department of Surgery, Urology Service, Brooke Army Medical Center, San Antonio, Texas, and Department of Surgery, Urology Service, Walter Reed Army Medical Center, Washington, D.C.

ABSTRACT

Purpose: Buccal mucosa has been advocated as an ideal graft material for urethral reconstruction. We report our multicenter experience with buccal mucosa ventral onlay urethroplasty for complex bulbar urethral reconstruction in adults.

Materials and Methods: A retrospective analysis of patients who had undergone buccal onlay urethroplasty at 4 military medical treatment facilities participating in the Uniformed Services Urology Research Group was performed. The database generated included demographic data, genitourinary history, preoperative symptoms (American Urological Association symptom score), preoperative urinary flow rate, stricture length and operative statistics. Postoperative followup data included symptom score, flow rate, retrograde urethrograms results, and complications.

Results: A total of 53 patients (average age 32 years, range 17 to 64) underwent buccal mucosa graft urethroplasty between January, 1996 and March, 1998 for refractory strictures. Sixteen patients had undergone an average of 2.2 prior endoscopic procedures (range 1 to 7). Average stricture length was 3.6 plus or minus standard deviation 1.8 cm. (range 2 to 7.5) as measured on preoperative retrograde urethrograms. Followup averaged 25 months (range 11 to 40 months). Average symptom scores decreased from 21.2 (range 14 to 33) preoperatively to 5.4 (range 3 to 8) postoperatively ($p < 0.001$). Average peak urinary flow rates increased from 7.9 preoperatively to 30.1 ml. per second postoperatively ($p < 0.001$). Postoperative retrograde urethrograms were available for 34 patients and were normal in 24. The overall complication rate was 5.4%. Three patients required endoscopic incisions. One patient has a recurrent narrowing and treatment is considered a failure. There were 4 sacculations (7.5%) and 6 narrowings, 3 of which required further treatment. Of the patients 50 required no additional procedures (94.3%).

Conclusions: Buccal mucosa grafts used as a ventral onlay for bulbar urethral reconstruction yield reproducibly excellent results with minimal morbidity and low complication rates. Longer followup will be required to confirm the durability of our results.

KEY WORDS: urethra; obstruction, urethral; mucus membrane; urethral stricture; transplants

The treatment of urethral strictures varies according to location and severity of stenosis. Endoscopic management may be appropriate for short annular strictures, although it is associated with high recurrence rates.¹ Short strictures, especially of the bulbar urethra, are successfully managed with simple excision and anastomotic urethroplasty. However, bulbar urethral strictures longer than 2 cm. are frequently not amenable to repair by excision and simple reanastomosis.²

Urethral substitution may be accomplished in a variety of

ways. Reconstructive options include genital skin flaps and grafts of genital or extra genital tissue. Genital skin pedicled flaps are not ideal because of the extensive penile and scrotal dissection necessary to bring the vascularized flap to the deep perineum.³ Penile scarring and torsion are also associated with this technique.⁴ Extra genital skin has not been particularly successful,⁵ although postauricular full-thickness free grafts have been associated with better results,⁴ perhaps due to their dense subdermal plexus. Bladder mucosa grafts and split-thickness skin grafts are no longer widely used for urethral reconstruction.

Buccal mucosa has emerged as a reliable and popular graft choice for patch urethroplasty when placed ventrally^{6,7} and dorsally.^{8,9} It possesses a myriad of favorable physical characteristics, including a thick epithelium and relatively thin, highly vascular lamina propria that facilitates graft vascularization (inosculation). Additionally, the thickness of buccal mucosa makes it easy to handle intraoperatively and leads to little postoperative contraction.

Although numerous single center experiences with buccal mucosa for urethral reconstruction have been reported, many series are heterogeneous and describe buccal mucosa for hypospadias, distal strictures, and dorsal graft application.

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* Requests for reprints: University of California San Francisco, U575, Box 0738, San Francisco, California 94121-0738.

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We evaluate the outcomes in men undergoing bulbar urethral reconstruction with ventrally applied buccal mucosa onlay grafts exclusively, using a series of patients treated by numerous surgeons at 4 institutions.

METHODS

After Institutional Review Board approval, a retrospective review was performed at 4 different military hospitals participating in the Uniformed Services Urology Research Group of the buccal mucosa bulbar urethroplasty in adults between October 1996 and March 1998. All consecutive cases during the period of review were included. A database was generated with 27 data points per patient. The investigators at each site queried their operating room database, obtained inpatient and outpatient records on each patient, and obtained genitourinary radiographs. If there was no documented visit within the last 6 months, then followup was pursued by telephone to ensure that the patients had not undergone additional urological procedures or complications. The principal investigator then compiled the completed data.

The surgical procedure, ventrally applied bulbar urethral graft application, was performed similarly at each of the centers. A 2-team approach was used at each center except Brooke Army Medical Center, which used a 1-team approach. In the 2-team approach 1 team (typically led by oral-maxillofacial surgeons) harvested the buccal mucosa graft while the urology team exposed and prepared the urethra. In the single team approach the procedure was performed consecutively by urologists.

The technique of graft harvest is similar to that described by Morey and McAninch.¹⁰ Briefly, nasotracheal intubation is preferable but not imperative. The patient receives perioperative intravenous penicillin G to provide prophylaxis against oral flora. A retractor is placed into the mouth stretching the buccal mucosa. The desired graft size is marked with a pen. Lidocaine with epinephrine is injected into the edges of the graft to assist with hemostasis. Stay sutures are placed into the corners and the graft is harvested taking care to avoid injury to Stensen's duct. Hemostasis is obtained and the donor site is closed with 3-zero chromic gut suture taking care to not cause a contracture at the edges of the mouth. The graft is then defatted using microsurgical instruments on a vein board and, if there is a time delay until placement, it is kept in sterile saline.

The urethral procedure proceeds with the patient in an exaggerated lithotomy position. Through a midline or lambda incision, the bulbocavernosus muscle is divided exposing the corpus spongiosum of the bulbar urethra. The stricture is identified using a urethral catheter or flexible cystoscope. The ventral portion of the stricture is incised exposing the entire stricture, extending proximally and distally 1 cm. into normal urethra. In the 2-team approach, the urologist then tells the oral team the exact desired graft size, although the oral team initiates graft harvest based on the known length of the stricture by preoperative imaging. The junction with normal urethra is calibrated to 28Fr. The prepared graft is then tailored and sewn into position, mucosa facing the lumen, with fine monofilament running sutures over a 16 or 18Fr. silicone catheter. The patients are maintained on oral antibiotics (usually nitrofurantoin) until the catheter is removed 2 to 3 weeks postoperatively. At 3 months after catheter removal, urinary flow rates, symptom scores and retrograde urethrograms are performed to establish a baseline. Most patients were seen 6 months to a year later for flow rates and urinary symptom scores, with other tests reserved for clinical suspicion of complications. A successful outcome is defined as normal voiding without the need for subsequent instrumentation.

Statistical analysis was performed with the Wilcoxon sign-rank test, with $p < 0.05$ considered significant.

RESULTS

A total of 53 patients (average age 32 years, range 17 to 64) underwent buccal graft urethroplasty for bulbar strictures between October 1996 and March 1998. The number of cases contributed by each institution was 20 from Naval Medical Center San Diego, 12 from Madigan Army Medical Center, 11 from Brooke Army Medical Center and 10 from Walter Reed Army Medical Center. All but 2 patients were active duty members of the United States Armed Forces. Prior surgery data were available for 43 patients and 16 had a total of 34 prior urethral endoscopic procedures (average 2.1 per patient). Of the strictures 55% were idiopathic in origin, 36% were traumatic, 5% were infectious and 4% were iatrogenic. Average stricture length, as measured by preoperative retrograde urethrograms was 3.64 ± 1.75 cm. (range 2 to 7.5).

Operative time in 45 cases was 197 ± 55 minutes (range 110 to 360) and there was no difference in operative time between the sites. Estimated blood loss in 48 cases was 313 ± 214 ml. (range 20 to 1,000). Hospitalization averaged 3.2 days (range 2 to 6). There were no intraoperative or postoperative blood transfusions. American Urological Association (AUA) symptom scores decreased from an average of 21.2 preoperatively in 26 cases to 4.3 postoperatively in 18 ($p < 0.001$). Peak urinary flow rates improved from an average of 7.9 ml. per second preoperatively in 37 cases to 30.9 ml. per second postoperatively in 32 ($p < 0.001$).

There were 3 postoperative complications (5.6%). A buccal hematoma required evacuation, 1 patient suffered postoperative rhabdomyolysis and 1 had a postoperative febrile urinary tract infection. All 3 patients made a full recovery. Retrograde urethrograms were available in 34 patients and assessed as normal in 24. Most retrograde urethrograms were performed within 6 months of the date of surgery. There were 4 sacculations and 6 narrowings 3 of which required treatment. The patients with sacculations had an average postoperative AUA symptom score of 3.7 (3) and flow rate of 28.0 ml. per second (4). Sacculaton or narrowing was determined by the responsible surgeon and radiologist. Radiographs were not independently reviewed. At an average followup of 25 months (range 11 to 40) 3 patients (5.7%) required additional procedures, including balloon dilation 3 months postoperatively in 1, internal urethrotomy 6 months postoperatively in 1 and 2 internal urethrotomies for a recurrent stricture in 1. The other 50 patients (94.3%) have not required any further procedures.

DISCUSSION

There are many published series of buccal mucosal graft urethroplasty and most report a high degree of success (between 54% and 100%, see table). Unfortunately, most series are heterogeneous, and include pendulous urethral strictures, tubularized grafts, augmented roof-strip procedures, 2 stage procedures, hypospadias applications and dorsal graft applications in addition to ventral bulbar applications. We believe that ventral bulbar application is ideal, and to our knowledge our study is the largest focused series addressing the outcomes of this surgical method exclusively.

All previously reported series are from single institutions and, often include the same senior author.^{3,8,9,11-15} We recognize that the success of a certain procedure may be largely attributable to the experience of the senior surgeon. Our aim was to assess the reproducibility of favorable results among various surgeons at different centers. Although some technical variation undoubtedly exists between different surgeons, the fundamental surgical method evaluated was essentially uniform at the 4 participating centers in this study.

The trend of dorsal onlay over ventral graft patch placement was popularized by Barbagli et al in 1998, partly in response to concerns over the urethral sacculaton sometimes seen on postoperative urethrograms following ventral onlay.⁸

Review of buccal mucosa urethroplasty literature

References	No. Pts. (total 239)	Condition	Site	Mos. Followup (range 11-36)	% Outcome (range 89-94)
Burger et al ⁶	6	Hypospadias	Cheek	9	100
Dessanti et al ¹³	8	Hypospadias	Lip	12	88
El-Kasaby et al ¹⁴	12	Pendulous stricture	Lip	-	90
	8	Bulbar stricture			
Baskin and Duckett ¹⁶	14	Hypospadias	Cheek	-	88
	3	Epispadias			
	1	Bulbar stricture			-
Morey and McAninch ³	13	Bulbar stricture	Cheek	18	100
Caldamone et al ¹⁷	18	Hypospadias	Cheek/lip	-	59
		Bulbar stricture			-
Barbagli et al ⁸	6	Bulbar stricture	Cheek	13.5	100
Martinez-Pinciro et al ¹⁵	9	Hypospadias	Cheek/lip	17.8	77
	8	Bulbar stricture			100
Venn and Mundy ⁷	28	Patch/anterior stricture	Cheek	-	97
	11	Tube/anterior stricture	Cheek		54
Szulezewski et al ¹⁸	12	Bulbar stricture	Cheek	11	-
Pansadoro et al ⁹	30	Bulbar stricture	Lip	20	96
Andrich and Mundy ¹¹	77	Bulbar stricture	Cheek	36	89
	41	Penile stricture			
Present study	53	Bulbar stricture	Cheek	25	94
		Patch/bulbar stricture			

We are aware of no conclusive evidence linking the appearance of sacculation to an increased severity of postoperative dribbling or other untoward symptoms. Our study shows that sacculation results infrequently after ventral bulbar grafting, and that no demonstrable correlation exists between the presence of sacculation and a poorer postoperative outcome. We believe sacculation can usually be avoided by simply tailoring the graft to approximate the size of the urethral defect at the time of surgery. Furthermore, we believe that ventral application is technically more efficient and that complete spongioplasty produces a secure ventral graft. The clinical significance of sacculation on postoperative urethrogram, if any, is unclear. Our patients with sacculation had favorable symptom scores and high flow rates, supporting the argument that sacculation is of little clinical significance.

Although dorsal onlay undoubtedly produces good results, it is apparent that buccal mucosa as an onlay in the bulbar urethra produces excellent results in either position when sound reconstructive principles are used. Results of 89% to 94% with 11 to 34 months of mean followup have been reported for buccal onlay procedures in the bulbar urethra, (see table). When buccal mucosa is used as an onlay graft in the penile urethra or as a tubularized graft, the results are significantly worse.^{11, 19}

Use of the AUA symptom score to assess outcomes after urethroplasty is somewhat novel. The AUA symptom score was developed to analyze outcomes for treatments of benign prostatic hyperplasia and was validated in large cohorts of patients with benign prostatic hyperplasia and normal controls.²⁰ It has been used previously to assess urethroplasty outcomes.³ In a cohort of 50 men who completed the AUA symptom index and had urinary flow rates measured after urethroplasty a statistically significant inverse correlation was found between flow rates and AUA symptom scores,²¹ suggesting the value of the symptom scores for urethroplasty followup. Our study demonstrates a highly significant difference between the preoperative and postoperative symptom scores, giving further support to its use for urethroplasty followup.

The perioperative morbidity of the procedure at each of our sites was low. Operative times were not significantly different at each site and are reasonable when considering that each institution is a resident training center. Complications of buccal mucosa harvest are rare. The buccal hematoma was recognized in the immediate postoperative period and required repeat anesthesia for evacuation. The oral-maxillofacial surgeon harvesting the graft believed that it may have been too thick, increasing the risk of buccinator

bleeding. There were no long-term sequelae. Although not objectively measured, a number of patients complained of oral tightness upon mouth opening immediately after surgery, which typically resolved within 1 or 2 months postoperatively.

The fact that most of our patients were maintained on oral antibiotics while the catheter was in place was common practice at our institutions. There is no evidence that this is necessary and, in fact, it may theoretically contribute to the development of resistant organisms. It is recommended to treat catheter related bladder colonization with a short course of antibiotics around the time of catheter removal. A unique aspect of our study group is patient age (average 32 years). Therefore, our results may be superior and our complications may be lower to what would be expected in a cohort of older patients. A weakness of our study is relatively short followup. Although patients were asked to return for followup yearly, many patients left military service or moved to different locations due to military obligations and, if asymptomatic, failed to return beyond the mean of 25 months. Although the average length of time from urethroplasty to manuscript preparation is 48 months, (range 34 to 63 months), followup was recorded only for office visits which could be verified or was established by telephone contact. Urethroplasty failures may continue beyond 5 years,²² and so continued evaluation of results is necessary.

CONCLUSIONS

Ventral onlay buccal mucosa graft patch urethroplasty is a satisfactory and reproducible technique for the treatment of adult bulbar urethral stricture disease. The morbidity and complications are low and outcomes are excellent. Longer followup is needed to confirm the durability of these results.

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