

Trauma/Reconstruction/Diversion

BULBAR URETHROPLASTY USING BUCCAL MUCOSA GRAFTS PLACED ON THE VENTRAL, DORSAL OR LATERAL SURFACE OF THE URETHRA: ARE RESULTS AFFECTED BY THE SURGICAL TECHNIQUE?

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ABSTRACT

Purpose: The use of buccal mucosa graft onlay urethroplasty represents the most widespread method of bulbar urethral stricture repair. The graft may be placed on the ventral or dorsal urethral surface according to surgeon experience and preference. We investigated whether the results are affected by the surgical technique by comparing the outcome of 3 types of bulbar urethroplasty using buccal mucosa graft.

Material and Methods: We repaired 50 bulbar urethral strictures with buccal mucosa grafts from 1997 to 2002. Mean patient age was 42 years. The etiology of stricture was ischemia in 12 cases, trauma in 6, instrumentation in 4 and unknown in 28. Patients with lichen sclerosus, failed hypospadias or urethroplasty and stricture extending into the penile urethra were not included. A total of 47 patients (94%) had undergone previous urethrotomy or dilation. The buccal mucosa graft was always harvested from the cheek using a 2 team approach. Mean graft length was 4.2 cm. The graft was placed on the ventral, dorsal and lateral bulbar urethral surface in 17, 27 and 6 cases, respectively. Clinical outcome was considered a success or failure at the time that any postoperative procedure was needed, including dilation. Mean followup was 42 months (range 12 to 76).

Results: Of 50 cases 42 (84%) were successful and 8 (16%) failed. The 17 ventral grafts provided success in 14 cases (83%) and failure in 3 (17%). The 27 dorsal grafts provided success in 23 cases (85%) and failure in 4 (15%). The 6 lateral grafts provided success in 5 cases (83%) and failure in 1 (17%). No surgical complications were observed. Failures involved the anastomotic site (distal in 2 and proximal in 3) and the whole grafted area in 3 cases. They were treated with urethrotomy in 5 cases and 2-stage urethroplasty in 3.

Conclusions: In our experience the placement of buccal mucosa grafts into the ventral, dorsal or lateral surface of the bulbar urethra showed the same success rates (83% to 85%) and the outcome was not affected by the surgical technique. Moreover, stricture recurrence was uniformly distributed in all patients.

KEY WORDS: mouth mucosa, transplants, urethra, urethral stricture

Buccal mucosa graft onlay urethroplasty represents 1 of the most widespread methods for the repair of strictures in the bulbar urethra because of its thick and highly vascular spongiosum tissue.¹ Recently the location of the patch has become a contentious issue² since we described our original techniques of dorsal onlay graft urethroplasty.³ The design rationale for this approach was based on the concept that the corporeal body remains a healthy host for receiving a free skin or buccal mucosa graft.^{2,4} Moreover, graft fixation by suture onto a defined surface may decrease graft shrinkage and sacculation.^{2,4} Success with buccal mucosa grafts for repairing bulbar urethral strictures has generally been high

with dorsal or ventral onlay grafts.¹⁻⁹ We performed a retrospective outcome analysis of 50 patients who underwent 3 types of urethroplasty with the buccal mucosal graft placed on the ventral, dorsal or lateral surface of the bulbar urethra.

PATIENTS AND METHODS

A total of 50 patients with an average age of 42 years (range 17 to 79) underwent buccal mucosa graft urethroplasty between January 1997 and December 2002 for bulbar urethral strictures. Patients with lichen sclerosus, failed hypospadias repair, previous failed open urethroplasty and strictures extending into the penile urethra (panurethral disease) were not included. In all patients the stricture was longitudinally opened through its length and a buccal mucosa patch was inserted to restore urethral caliber to normal. Patients who underwent combined procedures, that is end-

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to-end anastomosis with graft or penile flap graft urethroplasty, were excluded from study. The grafts were placed on the ventral, dorsal and lateral bulbar urethral surface in 17, 27 and 6 patients, respectively. The surgical technique was selected according to the site and length of the stricture within the bulbar urethra. All surgical procedures were performed by the same urologist (GB). There were no significant differences in the 3 groups in respect to mean patient age, mean stricture length, etiology or mean graft length.

Preoperative evaluation. Preoperative evaluation included clinical history, physical examination, urine culture, residual urine measurement, uroflowmetry, and retrograde and voiding cystourethrography. Sono urethrography was performed in all patients since 1998. A total of 35 patients (70%) underwent preoperative urethroscopy using a flexible instrument. The etiology of stricture was ischemia in 12 cases, trauma in 6, instrumentation in 4 and unknown in 28. Average stricture length was 4 cm (range 2.5 to 7.5). Of the patients 47 (94%) had undergone an average of 2.5 prior urethrotomies and/or dilations (range 1 to 11).

Surgical techniques. The urethral procedure was done with the patient in the normal lithotomy position. Through a midline or λ incision the bulbocavernosus muscles were divided, exposing the bulbar urethra.

In 17 patients with strictures located in the proximal part of the bulbar urethra a longitudinal, ventral urethrotomy was made to open the strictured tract, extending 2 cm into normal urethra, to calibrate the distal and proximal lumina to at least 24Fr. The buccal mucosa graft was harvested from the cheek using a 2 team approach with the donor site closed with 4-zero polyglactin interrupted sutures. The buccal mucosa graft was defatted and tailored according to the length of the urethral opening by limiting graft width to 2.5 cm. Mean graft length was 4.2 cm. Three interrupted sutures were placed at the apex of the distal and proximal anastomosis to avoid narrowing at these precarious sites. The graft was then sutured laterally to the left side of the urethral mucosa in running fashion using 6-zero polyglactin. A 14Fr silicone Foley catheter was inserted at this point. The graft was rotated and sutured laterally to the right side of the urethral mucosa in running fashion. Spongiosum tissue was closed over the graft using 4-zero polyglactin interrupted sutures.

In 27 patients with strictures located in the distal part of the bulbar urethra the urethra was dissected from the corpora cavernosa and rotated 180 degrees. The dorsal urethral surface was exposed and fully opened. The distal and proximal lumina were calibrated. The buccal mucosa graft was sutured, splayed and quilted over the corpora cavernosa using 5-zero polyglactin interrupted sutures without limiting graft width (3.5 cm). The left side of the urethral mucosa was sutured to the graft using 5-zero polyglactin interrupted sutures. A 14Fr silicone Foley catheter was inserted at this point. The urethra was rotated back to its original position and sutured laterally to the right side of the graft. At the end of the procedure the graft was completely covered by the urethra.

In 6 patients with a full-sized urethral bulb the ventral urethral opening may create serious bleeding from particularly thick and highly vascular spongy tissue, and the dorsal approach to the urethra may damage erectile function when dissecting the urethra from the corpora cavernosa more proximally.⁴ In these patients the urethra was opened without bleeding along its lateral surface, where the spongy tissue is thinner, and the buccal mucosa graft was tailored and sutured in ventral fashion. The corpus spongiosum was closed over the graft and the suture line was dorsally rotated to avoid the overlapping suture line. In all patients perineal suction drainage and suprapubic cystostomy were unnecessary and the catheter was left in place for 3 weeks.

Postoperative management. Patients were discharged home 3 days after surgery. Voiding cystourethrography was

performed when the catheter was removed 3 weeks after surgery. If contrast extravasation was present, a 12Fr Foley catheter was reinserted and maintained for an additional 2 weeks.

The clinical outcome was considered a success or a failure at the time that any postoperative procedure was needed, including dilation. Uroflowmetry and urine cultures were repeated every 4 months in year 1 and annually thereafter. When symptoms of decreased force of stream were present and uroflowmetry was less than 14 ml per second, retrograde and voiding urethrography, and urethroscopy were repeated. Average followup was 42 months (range 12 to 76). A total of 37 patients with followup longer than 24 months were clinically investigated to detect post-void dribbling and semen sequestration after ejaculation.

RESULTS

Of 50 cases 42 (84%) were considered success and 8 (16%) were considered failures. The 17 ventral grafts provided success in 14 cases (83%) and failure in 3 (17%). The 27 dorsal grafts provided success in 23 cases (85%) and failure in 4 (15%). The 6 lateral grafts provided success in 5 cases (83%) and failure in 1 (17%). There were no early postoperative complications, such as wound infections, hematomas, bleeding requiring transfusion or neuronal injuries. No fistulas were evident at the first radiological investigation. In patients with stricture recurrence the endoscopic evaluation provided useful information about disease extension.

The 8 failures involved the anastomotic site in 5 patients, including 2 in the ventral, 2 in the dorsal and 1 in the lateral group, and the whole grafted area in 3, including 2 in the dorsal and 1 in the ventral group. Three patients with restri-cture involving the entire grafted area were initially treated with perineal urethrostomy. Subsequently all patients underwent successful perineal urethrostomy closure using a new buccal mucosa graft according to our original technique.¹⁰ Two failures occurred at the distal graft anastomosis and 3 occurred at the proximal graft anastomosis. These 5 patients were successfully treated with internal urethrotomy. Of the 8 initial failures all patients had a satisfactory final outcome.

Eight of 37 patients (21.6%) with followup greater than 24 months showed clinical symptoms due to urethral saccul-ation. Six patients underwent a ventral onlay with a graft length of more than 4.5 cm, 1 received a lateral onlay and 1 received a dorsal onlay. Retrograde urethrography failed to demonstrate urethrocele in all 8 cases. On the contrary, voiding cystourethrography revealed urethral saccul-ation of the grafted area in 6 cases but it was normal in 2, which present with post-void dribbling. No patients required sur-gery for urethrocele correction.

DISCUSSION

The use of buccal mucosa in bulbar urethroplasty should be modulated according to the exact stricture location and its characteristics. Placement of the graft on the dorsal urethral surface is simpler and safer in the distal part of the bulbar urethra, whereas ventral placement of the graft is more efficacious in the proximal part of the bulbar urethra, where the spongiosum tissue is thicker and better vascularized. Finally, in patients with long urethral strictures located in a full-sized urethral bulb, the lateral opening of the urethral surface can avoid the pitfall of ventral or dorsal urethrotomy.

Studies of the surgical treatment of anterior urethral stric-ture disease have focused on short-term and long-term re-sults. Technical surgical problems involved in recurrent strictures are rarely discussed. Stricture can recur even in well selected patients and despite meticulous technique.⁷

In our series of patients recurrent stricture was uniformly

distributed in ventral, dorsal and lateral grafts urethroplasties, occurring in 5 patients (10%) as a white fibrous ring not more than 1 cm long at the distal or proximal anastomotic sites. Other groups have found these rings, causing stricture recurrence,^{4,7} and recently we described the same feature in patients with re-stricture after dorsal skin graft urethroplasty.¹¹ Guralnick and Webster reported 2 recurrent strictures at the proximal and distal limit of repair in 29 patients who underwent augmented anastomotic urethroplasty, which were successfully treated with dilation and optical urethrotomy.¹² Graft failure at the distal anastomosis, where the corpus spongiosum is less vascular, may represent poor inosculation due to poor graft bed vascularity.⁷ On the contrary, graft failure at the proximal anastomosis is currently attributed to under staging disease during surgery.⁷ Moreover, the proximal anastomosis is deep in the bulb, which is a more difficult site technically in which to ensure epithelium-to-urothelium placement.⁷ Further study is necessary to clarify the true etiology of this kind of repeat stricturing (ischemia, suture line or suture material), which affects any kind of substitution urethroplasty using skin or buccal mucosa graft onlay. Unfortunately graft failure at the anastomotic sites significantly contributes to the deterioration of the final outcome of these bulbar urethroplasties. In the current series of patients, excluding failures due to anastomotic rings, the success rate increased from 84% to 94%. Elliot et al reported a 90% success rate after bulbar buccal mucosa grafts,⁷ suggesting that this rate can be improved (97%) with internal urethrotomy for the management of anastomotic ring failures.

Urethrocele with post-void dribbling and semen sequestration are common problems after any kind of unsupported substitution urethroplasty.^{2,4,8,9} In our series we observed clinical symptoms due to urethrocele in 8 patients but radiological evidence of urethral weakening was evident in only 6. Mechanical urethral weakening was clinically detected in patients with followup longer than 24 months, with a graft length of more than 4.5 cm and on voiding cystourethrography because retrograde urethrography failed to show urethral sacculation. Moreover, we also observed the clinical presence or post-void dribbling in 2 patients in whom voiding cystourethrography was normal. Recently Yucl and Baskin reported that perineal nerves innervate the bulbospongiosus muscles and send fine branches to penetrate the corpus spongiosum, mainly in the bulbar area, by piercing the junction of 2 bulbospongiosus muscles in the midline.¹³ Rhythmic contractions of the bulbospongiosus muscles and other perineal muscles expel semen from the urethra¹³ and probably have an important role in expelling urine, avoiding urine sequestration in the large urethral bulb. Further studies are necessary to clarify if during bulbar urethroplasty surgical damage to the branches of the perineal nerves may have a role in determining a loss of efficient bulbar urethral contraction, causing difficulties in expelling semen and urine, and temporary or permanent sexual dysfunction.¹³

Our followup technique, including subjective symptoms of a decreased urinary stream and a maximum flow rate of less than 14 ml per second, could miss some recurrent strictures, and urethrography and/or flexible cystoscopy should be performed periodically until 2 years after urethroplasty. We decided to avoid such invasive diagnostic tools because many of patients with urethral stricture underwent repeat urethral manipulations and/or invasive radiological test before surgery. Patients prefer clinical and noninvasive followup to improve quality of life after urethroplasty.^{1,11} Furthermore, in our experience abnormal urethrography, which should be suggestive of recurrent stricture, did not affect patient clinical status. It is important to remember that despite metic-

ulous technique all urethroplasty procedures have the potential to fail or deteriorate with time and consequently lifelong followup is mandatory.^{1,11,14}

We realize that the study could have some weaknesses. The main bias is that the study was retrospective. Certainly to better compare these 3 techniques a prospective, randomized, controlled trial would be welcome.

CONCLUSIONS

In the bulbar urethra buccal mucosa onlay grafts provide a satisfactory result. The different position of the grafts showed no difference in the success rate. Currently the best technique is probably the one with which the urological reconstructive surgeon is most comfortable. No single technique is appropriate in all situations and the successful surgeon will have a repertoire of methods from which to choose. Further studies are necessary to clarify the etiology of disease recurrence at the apexes of the proximal and/or distal anastomoses between the urethra and grafts to improve our success rate.

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EDITORIAL COMMENT

In this retrospective review of 50 carefully selected patients the authors evaluated 3 separate reconstructive techniques for bulbar urethral stricture disease. Similar success was reported for each reconstructive technique with no perioperative complications. Post-void dribbling occurred more often in patients with ventral buccal

mucosa placement, an outcome that may be multifactorial in origin and not purely related to graft position.

Although selection bias was introduced based on the location of the stricture, the authors present the most complete series to date critically evaluating the different approaches to bulbar urethral stricture reconstruction with buccal mucosa. We have seen similar success with each type of repair and yet have experienced less bleeding and better visualization with techniques involving the dorsal inlay of buccal mucosa. A randomized, prospective trial is needed to confirm

these observations and yet the success rate for bulbar urethral reconstruction with buccal mucosa does not appear to be related to the specific graft positioning technique.

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