Buccal mucosa urethroplasty for adult urethral strictures

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ABSTRACT

Urethral strictures are difficult to manage. Some treatment modalities for urethral strictures are fraught with high patient morbidity and stricture recurrence rates; however, an extremely useful tool in the armamentarium of the Reconstructive Urologist is buccal mucosal urethroplasty. We like buccal mucosa grafts because of its excellent short and long-term results, low post-operative complication rate, and relative ease of use. We utilize it for most our bulbar urethral stricture repairs and some pendulous urethral stricture repairs, usually in conjunction with a first-stage Johanson repair. In this report, we discuss multiple surgical techniques for repair of urethral stricture disease. Diagnosis, evaluation of candidacy, surgical techniques, post-operative care, and complications are included. The goal is to raise awareness of buccal mucosa grafting for the management urethral stricture disease.

Key words: Buccal mucosa, graft, urethral strictures, urethroplasty

INTRODUCTION

Buccal mucosa graft (BMG) was first described for urethral reconstruction by Humby in 1941.[1] It has become an ideal urethral substitute because of ease of harvest, surgical handling characteristics, hairlessness, compatibility in a wet environment, and its early in-growth and graft survival. Because of these unique characteristics, buccal mucosa has endeared itself to the realm of reconstructive urology. Standard bulbar urethroplasties using buccal grafts should have a lifetime success rate approaching 92%.[2,3]

We tend to use buccal grafts in two places. Most commonly, we use it for ventral-onlay buccal urethroplasty for bulbar stricture. We less commonly use buccal grafts to augment an inadequate urethral plate during first stage Johanson urethroplasty, usually for penile stricture. We have found a buccal-augmented Johanson urethroplasty especially useful in patients with lichen sclerosis and strictures after childhood hypospadias repair.

Of note, while we acknowledge that some researchers have used alternate free graft sources such as posterior auricular skin, full thickness hairless abdominal wall skin, and bladder mucosa, the overwhelming majority of cases are most easily treated with buccal grafts. Rarely, we will perform a "double graft" urethroplasty by adding a dorsal full thickness skin graft to our standard ventral-onlay buccal mucosa bulbar. This is done in cases of very long bulbar stricture, or when the risk of recurrence is considered to be very high. But, planet-wide the overwhelming majority of patients are treated with standard buccal grafts.

DIAGNOSIS OF STRICTURE

In most cases, patients with urethral stricture disease are referred to the urologist because of lower urinary tract symptoms. Urethral strictures are obstructive and can include symptoms of hesitancy, intermittent urine stream, decreased caliber of urine stream, incomplete bladder emptying, nocturia, pain with voiding, or even urinary retention. Alternatively, the stricture is sometimes identified at the time of failed urinary catheter placement.

While we attempt to identify causation, e.g. previous urethral trauma, infections, or previous instrumentation, we do not believe that the etiology of the stricture is

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important when formulating a treatment plan for most bulbar strictures. In contrast, with penile strictures it is useful to understand at least if the patient has an underlying lichen sclerosis (LS) or previous hypospadias repair.

Lichen sclerosis as an etiology of urethral stricture disease may involve the fossa navicularis, pendulous urethra, and bulbar urethra, and can result in a pan-urethral stricture.[4-8] LS patients may do best with buccal grafts (which are theoretically not affected by the disease) placed during a first stage Johanson urethroplasty to augment the distal urethral plate. Also, adults with stricture after previous hypospadias repair have notoriously poor results with one stage surgery and might do best with two stage (Johanson) urethroplasty, with buccal grafts in the first stage, especially if there is not enough distal penile skin to affect closure in the second stage. This is the principal advocated by Bracka first in the 1970s.[9]

Initial patient work-up of the stricture includes a urinary symptom review, uroflowmetry, and post-void residual measurement. Urinalysis to rule out infection is also helpful. Once urethral stricture is suspected, a single gentle pass with a urethral catheter can rule a stricture in or out. Once strongly suspected, the most useful information comes from a retrograde urethrogram (RUG). This study, when performed correctly, i.e. penis on stretch and with oblique views, effectively identifies the location, number, and length of the stricture.

Other imaging modalities can be used, but we seldom if ever need them. Sonourethrography can be done preoperatively in the clinic setting or intra-operatively just prior to the surgical repair, if desired. The procedure is usually well tolerated by the patient and provides a precise and accurate urethral stricture length.[10] Benefits of sonourethrography include portability of the ultrasound unit and less radiation. However, the assessment of both posterior and distal anterior urethral strictures is limited. Computerized tomography (CT) voiding urethrography and virtual urethroscopy have also been reported, but limited data exist and thus should be considered experimental.[11]

CANDIDATES FOR URETHROPLASTY: BULBAR

We tend to perform buccal mucosal urethroplasty even for short stricture and have all but abandoned the anastomotic urethroplasty. This is because we had higher success rates with the buccal technique and lower complication rates over identical observation periods. Particularly, we are eager to avoid a small but real chance of new impotence after anastomotic urethroplasty [Table 1].

Age limit is not a restriction, but overall comorbidities and health status are considered. If the patient cannot

Table 1: Overview of urethral stricture management

Urethral stricture type	Surgical management
Bulbar	Ventral or dorsal buccal mucosa onlay urethroplasty
Penile	First-stage Johanson with or without buccal grafts in first stage. Alternatively, dorsal onlay buccal urethroplasty
Pan	First-stage Johanson with or without buccal grafts in first stage. Alternatively, double dorsal buccal onlay urethroplasty versus mixed techniques of buccal and fasciocutaneous urethroplasty

tolerate even the reasonable mild stressors of a 2 h bulbar urethroplasty, then repeat urethrotomy (even though recurrence after each one is expected) or even suprapubic tube diversion may be required.

CANDIDATES FOR URETHROPLASTY: PENDULOUS

In patients with pendulous urethral strictures, we rely heavily on the Johanson urethroplasty, especially in cases of previous hypospadias repair or LS. Most of our patients with pendulous stricture have LS or previous hypospadias repair, so most of them are treated with first-stage Johanson urethroplasty, with or without buccal grafts, followed by a second-stage Johanson later. However, we might consider treating certain penile strictures with one-stage urethroplasty, perhaps with a dorsal buccal graft. Or treating fossa navicularis strictures with any number of possible treatments such as Horton-Devine urethroplasty or fasciocutaneous flap, in selected cases.

The challenge arises when the penile tissue has been damaged by previous surgeries (e.g. hypospadias repair) or an inflammatory change (e.g. lichen sclerosis). In this setting, one should consider the addition of BMG and a multi-step repair Johanson-type urethroplasty. During the first-stage Johanson, we add BMG as a dorsal onlay if the urethral plate and penile skin is inadequate, and we do not feel we can obtain a 3 cm urethral plate for tubularization in the second stage. We evaluate the patient 5 months after primary urethroplasty, and if the there is enough penile skin/urethral plate, i.e. ≥ 3.0 cm, we proceed with retubularization in the second-stage Johanson. If at 6 months there is inadequate tissue and if we did not add BMG at first operation, we proceed with BMG dorsal onlay with or without urethral closure. If there is poor "take" of the BMG and an adequate urethral plate is still not present, we may consider a "three-stage" operation and place a second BMG before proceeding to the second-stage closure.

When operating on the penile urethra either with a one- or two-stage repair, complications may occur and include scarring, poor cosmesis, hematoma formation, fistula, and

sexual dysfunction.[12,13] BMG may offer advantages over genital skin, with fewer cases of penile scarring, penile/glans torsion, and chordee. BMG also may offer an inherent resistance to LS[7,14-16] [Table 1].

CONTROVERSIES AND CONSENSUS

There is controversy as to whether BMG should be placed dorsally or ventrally. In the penile urethra, most experts would place it dorsally. In the bulbar urethra, many experts place it ventrally, or mix ventral, dorsal and even lateral placement as the clinical situation warrants.[4] Multiple studies have shown that both dorsal and ventral-onlay BMG has good blood supply and mechanical support. The success rate for dorsal onlay is reported between 85 and 100%.[17-21] Ventral-onlay BMG graft placement have shown comparable success rates of 84 to 100%.[17,22-25] Barbagli *et al.* showed that success rates are equal between dorsal and ventral BMG.[17]

When LS occurs in the urethral plate, foreskin and penile skin may be affected so severely that reconstruction may have to be performed in multiple stages.[4,26,27] If the urethral plate is minimally involved, then a one-stage repair is reasonable. In our experience, our patients usually have extensive LS involvement of the urethral plate, and thus, we perform a BMG dorsal onlay placement for pendulous strictures as part of a first-stage Johanson. This is consistent with the experience of other authors.[25,27]

Pan-urethral stricture management is a difficult entity to manage. Patients generally must be managed with a combination of flaps and/or grafts, or the Johanson technique. In our institution, we generally manage pan-urethral strictures with a first-stage and second-stage Johanson urethroplasty, with or without buccal grafts in the first stage. This ensures a quality urethral plate before closure. Multiple other authors recommend a staged procedure as the disease process is usually extensive.[16,26,28,29]

Kulkarani *et al.* described a full length pan urethral repair using BMG with a 91-100% success rate in patients with LS.[16,27,30] This success rates has been further replicated by Dubey reporting 88% and Datta reporting 93% success utilizing the Kulkarni approach.[28,29] The single-stage procedure is not appropriate for everyone, and poor patient selection can decrease success rates considerably. In patients afflicted with LS, Kulkarni proposed several criteria for determining the appropriate surgical approach: one-stage repair patients should be under the age of 70 years with a clinical status of decreased urinary flow. Additional criteria are slight to moderate LS should be seen on histology and only focal involvement of the glans, penile skin, and meatus. Finally, a visible/salvageable urethral plate is mandatory.[16] Otherwise, all other patients should undergo a two-stage repair.

The decision to use flaps and BMG to augment pan-urethral stricture repair lies with the individual surgeon. We have generally found these approaches less satisfactory than the Johanson technique, but we acknowledge that this can be done successfully and at times using a single procedure[22,31,32] [Table 1].

SURGICAL TECHNIQUE: BUCCAL HARVEST

The buccal substitution urethroplasty is typically performed with a two team approach: as one team harvests the buccal mucosal graft, the other team performs the perineal dissection. In our institution, urologists perform both harvest and grafting.

Buccal grafts may be placed either ventrally, dorsally, or laterally. In the overwhelming majority of patients, we place them ventrally. However, we do not hesitate to place them dorsally when required.

Buccal graft harvest is typically performed using the following method: the face and cheek are prepped and draped in the usual sterile fashion. Three 3-O silk sutures are placed through the lip to provide traction. A Denhardt mouth gag and "baby" sweetheart retractor are used to facilitate exposure. Using a marking pen, the graft is outlined [Figure 1] 2.5 cm wide and as long as is required. Bupivacaine 0.5% with epinephrine is injected underneath the graft for good preemptive analgesia and intraoperative hemostasis. The graft is then incised and dissected off of the buccinator muscle, while avoiding Stensen's duct [Figure 2]. Some urologists close the defect with an absorbable suture [Figure 3]. However, it may be left open to close by secondary intention. The graft is pinned out and defatted/thinned on the back table. It is kept in saline until the time implantation [Figure 4].

MANAGEMENT OF THE HARVEST SITE

Opinion varies greatly when managing the buccinator fossa after graft harvest. The main question is to close the harvest site or not. Wood *et al.* reported that closure of the harvest site was associated with worse pain and suggested that this may be improved by not closing.[33] Although Dublin *et al.* reported that patients did well with closure of the mouth, but 16% and 32% had long-term complaints of numbness and mouth tightness respectively.[34] Overall, the inner cheek harvest site for BMG regardless of management appears to heal without complications.[35-37]

SURGICAL TECHNIQUE: BUCCAL URETHROPLASTY

The urethroplasty is performed in the high lithotomy position. Great care is taken to ensure the patient is properly padded and secured. Subsequently, the patient's perineum is prepped and draped in normal sterile fashion. A 22 French red rubber catheter is used to delineate the urethral contour,
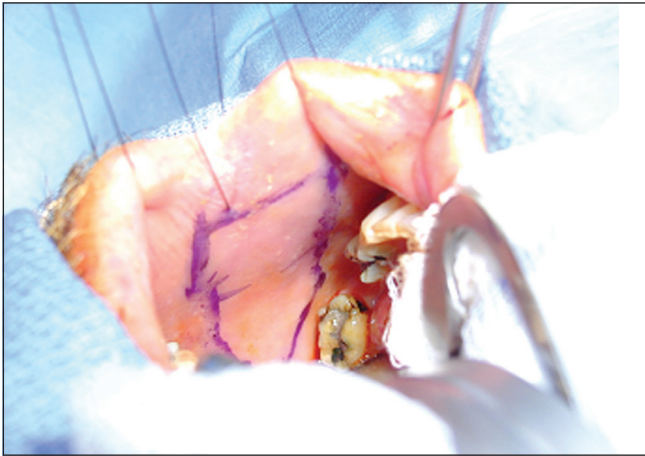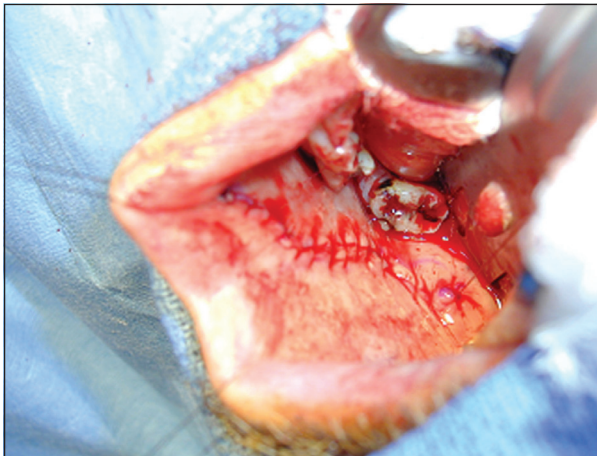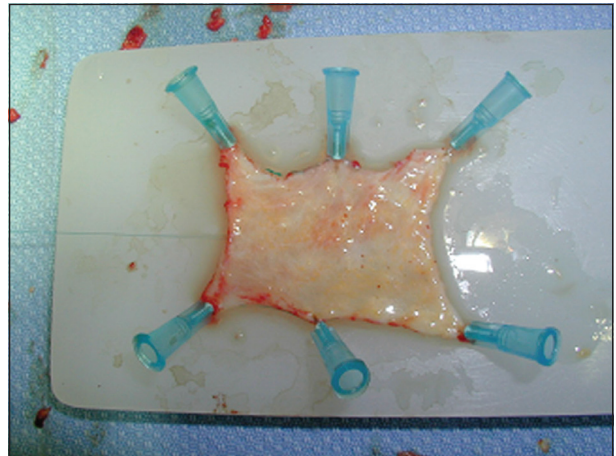
Figure 1: The mouth is marked about 1 cm proximal to lip border. Subsequently, incised with a 15 blade scalpel and dissected off of the buccinator muscle
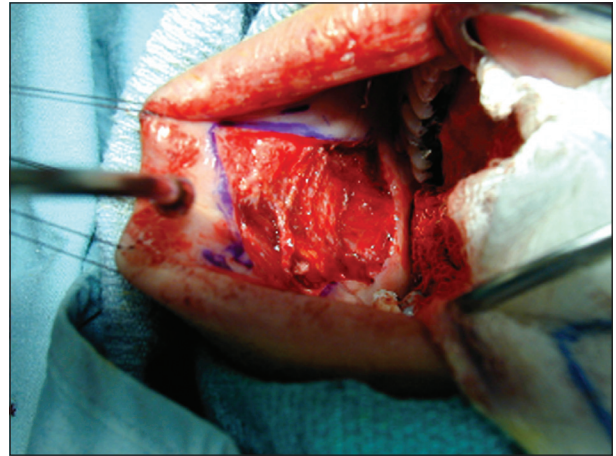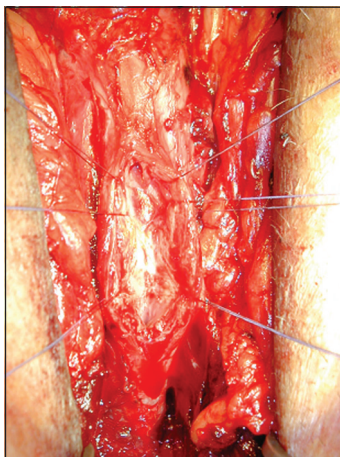

Figure 2: Buccal harvest site following removal of the graft. Care is taken to avoid Stensen's duct during dissection

Figure 3: Closure of buccal harvest site with a running 3-O chromic stitch

Figure 4: Buccal mucosa graft is prepared by removing excess fat and muscle prior to implantation

Figure 5: The native urethra is incised the entire length of the stricture and prepared to accept the buccal mucosa graft

and to determine the exact location of the distal portion of the stricture. After urethral exposure, a #15 blade scalpel is used to incise the urethra over the urethral catheter and the urethral stricture is opened completely [Figure 5]. The lumen of the stricture is usually intubated with either an 8

French feeding tube or with a 0.035 inch guide wire, and the stricture is incised until normal urethra is identified. Both proximal and distal urethral stumps are bougied to ensure they are wide open to 30 French.

The buccal mucosa is then sewn onto the ventral defect using a running 5-O polydioxanone suture, locking every third stitch for a watertight seal [Figure 6]. A 16 French silicone catheter is placed through the urethra. The tunic of the spongiosum is closed over the graft for a well vascularized bed [Figure 7]. The bulbospongiosus muscle is closed with a running 3-O polyglactin suture. The Dartos fascia is closed with a running 2-O polyglactin and the skin is closed with multiple vertical mattress stitches using 2-O chromic suture. Prior to skin closure, the wound is anesthetized using 0.5% bupivacaine to augment pain control.

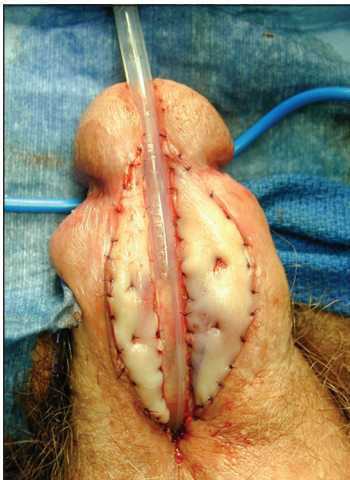## SURGICAL TECHNIQUE: PENDULOUS URETHROPLASTY

Pendulous urethral strictures have been treated with multiple
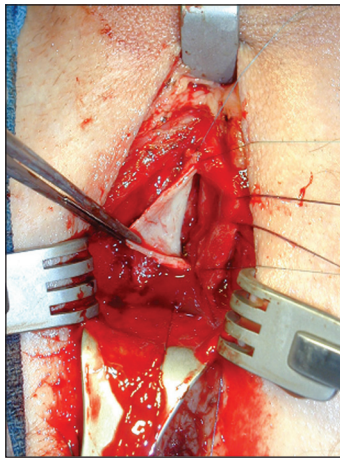
Figure 6: Buccal graft being sewn to urethral plate using a 5-O polydioxanone suture locking every third stitch for a watertight closure
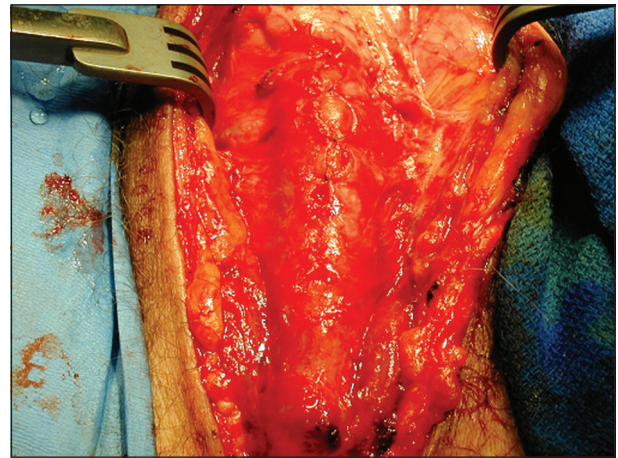
Figure 7: Closure of bulbocavernsous muscle with a running 3-O polyglactin suture

Figure 8: First-stage Johanson with buccal mucosa augmentation

Figure 9: First-stage Johanson following buccal mucosa graft and 6 months of healing

different modalities. We most often use the Johanson technique, although we do not hesitate to perform a one-stage dorsal onlay BMG if appropriate. The use of BMG in pendulous stricture management is well documented.[29,38-41]

During the first-stage technically, the urethra is split open until normal urethra is encountered, and the urethral plate is sewn to the skin edges. If there is not enough penile skin to allow creation of a 2.3-3.0 cm urethral plate at the second stage, then we place buccal grafts in the first stage [Figure 8]. This usually heals well and provides an excellent urethral plate for the second stage [Figure 9]. During the second stage, we incise the urethral plate and then retubularize the plate. We close in multiple layers with at least two layers using Dartos fascia and skin. We purposely leave a "megameatus" instead of a small slit like distal urethral meatus because recurrence at the fossa navicularis can be disturbingly common.

POST-OPERATIVE CARE

The patient is typically observed overnight in the hospital;

however, patients can be discharged home safely from the post-anesthesia care unit if desired. We suggest a number of post-operative treatments for the patient's comfort, but we have no clinical evidence that they are absolutely necessary. Ice is applied intermittently to the mouth and perineum to augment pain control. Chlorhexidine gluconate swish and spit mouthwash is used four times daily after meals. Diet is reinstituted on postoperative day zero with clear liquids, followed by full liquid postoperative day 1, and then resuming regular diet. We keep the patient on antibiotics, usually nitrofurantoin, until the Foley catheter is removed. We place bupivicaine in the perineal wound just before skin closure to augment post-operative pain control. We add to the typical narcotic-based pain control post-operatively by giving the nonsteroidal anti-inflammatory agent celecoxib (400 mg) in the recovery room when the patient is awake. Platelet function is not disturbed by celecoxib so increased postoperative bleeding is not an issue.

The patient returns for follow-up for voiding

cystourethrogram (VCUG) and urinary catheter removal, usually after 7 days to 2 weeks. If no extravasation occurs, the catheter will remain out. If extravasation is found, a 14 or 16 French coudé catheter is gently replaced, and the VCUG will be repeated in another week. The patient will return for clinic follow-up at 4, 8, and 12 months. Office follow-up consists of patient questioning for obstructive voiding symptoms, uroflow, and a post-void residual measurement.

COMPLICATIONS

In general, complications are rare after buccal urethroplasty. Post-operative complications can occur in two areas, the site of harvest and the site of urethral stricture repair.[14] Potential buccal harvest site complications include hemorrhage, pain, facial swelling, damage to Stensen's duct, lip paresthesia, and restriction in mouth opening. We have never had a Stensen's duct injury or paresthesia complication in over 450 cases. Facial swelling and restrictions in mouth opening are common, but are self-limiting and will resolve within the first 3 months.[2,24,37,42]

Perineal complications are similarly rare. Wounds infections, hematomas, skin anesthesia/paresthesia, and other local infections do sometimes occur, but in our experience have been rare. Note that we never place drains in the perineal wound, and our low complication rate confirms that drains are seldom if ever necessary.

SUMMARY

Buccal repair of bulbar urethral strictures have gained popularity and has replaced the anastomotic urethroplasty in our hands, even for short strictures. With its ease of technical performance, reliability, and overall high success rate, it is our procedure of choice in management of most bulbar urethral strictures. Buccal free grafts are also very useful to augment the urethral plate during first stage Johanson urethroplasty, in order to ensure a successful second-stage urethroplasty.

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