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ORIGINAL ARTICLE

Augmented perineal urethrostomy using a dorsal buccal mucosal graft, bi-institutional study

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Abstract
Purpose To present our technique and outcomes for perineal urethrostomy augmented with a dorsal onlay buccal mucosa graft (BMG). Results from initial series and collaboration from an international center are included.
Methods A retrospective chart review of all adult patients who underwent urethral reconstruction with perineal urethrostomy utilizing a buccal mucosal graft between January 1, 2002 and January 1, 2013 was performed. All surgeries were performed by three surgeons using the same technique (GHJ, KAM, and RV). Success was defined as no need for additional treatment following definitive surgery.
Results A total of 44 patients met inclusion criteria. Mean patient age was 60 (range 44–81) years. All strictures were pananterior. Etiologies included unknown in 16 (36%), failed hypospadias repair in six (14%), lichen sclerosus in ten (23%), iatrogenic in seven (16%), Fournier's in three (7%), urethral cancer in one (2%) and penile cancer in one (2%). Mean follow-up was 45 (range 6–136) months. Overall success was 80%. Nine patients recurred, of which four had a successful revision, two are awaiting potential revision, and three are being managed with periodic dilations.
Conclusions BMG perineal urethrostomy is a valid alternative for complex urethral strictures due to lichen sclerosus, previous failed reconstructions or hypospadias cripples. Midterm results are encouraging for this novel technique.

Keywords Perineal urethrostomy · Urethral stricture · Oral mucosa graft · Lichen sclerosis

Introduction

Genitourinary reconstructive surgeons in the modern era have the opportunity to effectively treat a wide variety of urethral stricture diseases. For short strictures in the proximal bulbar urethra, excision and primary anastomosis is the gold standard, with success rates as high as 98% [1–5]. Longer defects with extension to a more distal aspect of the urethra, or combined strictures, require substitution urethroplasty in one or more stages. These procedures have also achieved respectable outcomes depending on the location and nature of the stricture [6, 7]. Since first introduced in 1992 [8], the buccal mucosa graft (BMG) has become the tissue of choice in almost every reconstructive center worldwide. In addition, other oral mucosal grafts, such as labial [9] or lingual [10], have been utilized with good results.

Complex urethral strictures due to lichen sclerosus (LS), previous failed reconstructions or failed hypospadias repairs are among the most challenging problems, requiring surgical expertise and good clinical judgment to select the appropriate intervention [11, 12]. These patients usually present with a long history of multiple urethral instrumentations, urethral reconstructions or both. Particularly those patients with multiple failed hypospadias repairs or LS [13, 14] can be emotionally devastated; sexual function is diminished and quality of life is negatively affected. Referral to reconstructive centers often occurs after many

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options have been exhausted, and appropriate procedure selection is paramount.

Pananterior urethral reconstruction with multiple grafts, in one or more stages, is technically feasible and has fair success rates [15], but may not be the optimal solution for these patients. Additionally, in elderly patients with significant comorbidities and high surgical risk, a complex and prolonged reconstructive surgery may not be indicated. Even for healthy and/or young patients, staged reconstruction might not represent the best option, as success rates are decreased in this group with multiple failed urethroplasties [11]. For those patients a simpler and more effective urethral procedure such as perineal urethrostomy (PU) may be appropriate. The creation of a perineal urinary diversion is simple and effective [16, 17].

A challenging group of patients is those that have stricture disease that continues into the proximal bulbar and/or the membranous urethra. In these instances, traditional PU cannot be successfully performed. In addition, patients with prior pelvic radiation [11] and history of LS [13] have a higher rate of restricture at the PU. Perineal urethrostomy creation using BMG is an alternative for these patients. This technique allows the surgeon to bring the urethrostomy to the surface of the perineum instead of burying the skin to the urethral opening. In addition, by inserting tissue into the neomeatus, it decreases the probability of circumferential scarring of the urethrostomy [18]. Our group, in abstract form, previously described this method in 2008 [19], however no reports of this technique for definitive PU have been published. This study aims to present our technique and results from two institutions that share homogeneous criteria.

Methods

Institutional Review Board (IRB) approval was obtained from both institutions: Devine-Jordan Center for Reconstructive Surgery and Pelvic Health, a division of Urology of Virginia, Urology Department, Eastern Virginia Medical School (EVMS), Norfolk Virginia, USA, and Urology Section, Centro de Educación Medica e Investigaciones Clínicas "Dr. Norberto Quirno" (CEMIC), Buenos Aires Argentina. Retrospective chart review was performed for those patients undergoing perineal urethrostomy utilizing BMG between January 1, 2002 and January 1, 2013. This procedure was offered to patients who had long-segment, small-lumen or obliterative strictures, the majority of whom had failed multiple previous procedures. All surgeries were performed by three surgeons (GHJ, KAM, and RV) using the technique described below. All surgeries were performed as the definitive procedure, not as part of a staged urethroplasty. Patients were excluded if they did not have at least one postoperative follow-up. Basic demographic information, stricture characteristics, perioperative and postoperative data were collected and analyzed.

Patients were followed at regular intervals in our clinic. If there was suspicion for recurrence based on symptoms of decreased force of stream, hematuria, hesitancy or increased post void residual, further evaluation was undertaken. Failure was defined as need for any procedure postoperatively, including dilation. Patients who underwent surgery in Argentina were called at regular intervals to obtain follow up data after 2012.

Surgical technique

Buccal mucosa graft harvesting

Technique for BMG harvesting has been previously described [20], therefore only the salient steps will be described here. The graft is taken in a rectangular shape, and the donor site is generally left open. Left with squared off corners, one can truly spatulate the proximal interface with the urethra. We have found recurrence rates to be much lower than when the graft is elliptical.

Urethral reconstruction

The patient is repositioned into high lithotomy. The lower abdomen, genitalia and perineum are prepped with betadine solution and draped in the usual fashion. An inverted U incision is created, deepened, and the bulbospongiosus muscle is identified and divided in the midline (Fig. 1a). Corpus spongiosum is freed from the triangular ligament proximally and from the corpora cavernosa distally. Once the necessary mobilization is achieved, the corpus spongiosum is transected transversely and a dorsal urethrotomy is made until healthy mucosa is encountered. Adequate mobilization allows healthy ventral urethra to be brought out to perineal skin rather than creating a channel comprised of inwardly mobilized skin. Normal urethral mucosa is visualized, and proximal calibration of the lumen is determined with bougie à-boule to 30 French. The distal urethra is closed and allowed to retract.

The graft is sutured dorsally and tailored into the urethrostomy defect. The graft is sutured to the urethral margins with 4/0 Vicryl suture, taking care to include graft, corpora, and mucosa in each throw. It is quilted to the bed with 6/0 Vicryl suture. At the cutaneous margins we use 4/0 Vicryl suture (Fig. 1b, graft shown dorsally with ventral urethra below). Each successive stitch brings the ventral urethral plate outwards, joining it with the dorsally fixed buccal graft (Fig. 1c). We use a 14 Fr silicone urethral catheter through the neomeatus for diversion, which is maintained for 10 days (Fig. 1d, final appearance). Wound

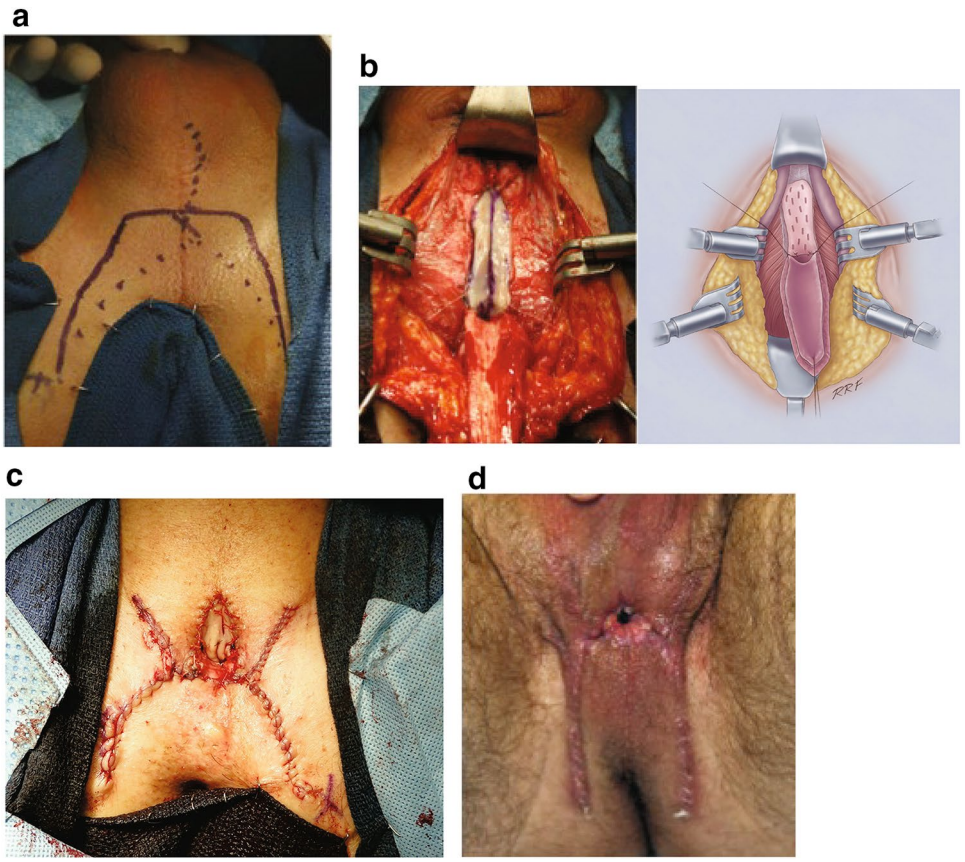

Fig. 1 **a** Perineal incision, **b** placement of buccal graft, **c** wound closure, **d** meatus widely patent at follow-up

is closed in layers, and placement of a short-term drain is optional.

Results

Forty-four patients met inclusion criteria for the study. All procedures were performed due to complex stricture disease involving the proximal bulbous and/or membranous urethra. Demographic data, as well as stricture characteristics, are noted in Table 1. Of the 44 patients, 41 (93%) had undergone at least one previous procedure, typically multiple, ranging from DVIU or dilation to substitution urethroplasty. All patients had devastated anterior urethras. Mean patient age at surgery was 60 (range 44–81) years. All patients had at least six months follow-up (mean 45, range 6–136 months). Four patients had a single postoperative UTI that resolved with antibiotics. There were no major complications.

Of 44 cases, 35 (80%) were successful (Table 2). Of the failures, four patients underwent revision perineal urethroplasty with additional oral mucosa graft and are now without recurrence. Three were managed with intermittent dilation and two are awaiting reoperation (Table 3). Patients were asked about sexual function as well as overall quality

Table 1 Patient demographics and stricture characteristics

	n (range, %)
Patient age, years	60 (44–81)
Stricture etiology	
Unknown	16 (36%)
Lichen sclerosis	10 (23%)
Failed hypospadias repair	6 (14%)
Iatrogenic	7 (16%)
Fournier's	3 (7%)
Urethral cancer	1 (2%)
Penile cancer and lichen sclerosis	1 (2%)
Procedure performed	
Dorsal onlay perineal urethrostomy	42 (95%)
Dorsal and ventral onlay perineal urethrostomy	2 (5%)
Mean follow up, months	45 (6–136)

Table 2 Outcomes

	Success (%)
Technique	
Dorsal onlay perineal urethrostomy	33/42 (79%)
Dorsal and ventral onlay perineal urethrostomy	2/2 (100%)
Overall	35/44 (80%)

Table 3 Failures

	n
Additional procedures	
Dilation	3
Revision urethroplasty	4
Awaiting definitive treatment	2
Etiology of stricture in failed repairs	
Lichen sclerosus	2
Unknown	2
Fournier's	2
Iatrogenic	2
Failed hypospadias repair	1

of life following surgery, of the 35 successful patients all reported qualitative improvement in these parameters.

Discussion

Definitive perineal urethrostomy remains an important procedure in the reconstructive urologist's arsenal. Management of patients with complex strictures is an area of much discussion. Multiple reconstructive options are available, ranging from a single or staged substitution urethroplasty to PU. For patients with advanced age or multiple comorbidities, multiple failed procedures or hypospadias cripples, PU should be offered [21].

Data regarding long-term outcomes of substitution urethroplasty are lacking. In their report, Andrich et al. reported a 58% restricture rate at 15 years for patients undergoing substitution urethroplasty for strictures of varying length and etiology. Their dataset begins in 1981, however, and all cases in the substitution group underwent a 1-stage flap technique [3]. Likely, these results would be improved with current techniques utilizing oral BMG. Kessler et al. found a 56% success rate for substitution urethroplasty at 6.5 years, although the cohort was small. In their multivariate analysis of 238 patients undergoing various urethroplasties, the risk of failure was increased in patients with previous urethral stents (HR 3.69, 95% CI 1.27–10.8) and two or more urethrotomies (HR 2.25, 95% CI 1.05–4.8) [22]. Clearly, complex patients with multiple previous procedures and long strictures represent a challenging group of patients with a high rate of recurrence regardless of approach.

Patients in these situations are often already sitting to void, and want the most straightforward procedure with the best chance of success in a single operation. Patient satisfaction is high in this group with definitive PU [23, 24]. Further, if stricture continues into the proximal bulbar urethra or membranous urethra, PU with BMG is a viable option.

Traditional PU success rates range from 70 to 88% [11, 24]. In his work, Barbagli et al. demonstrated a decreased success rate for PU in patients with panurethral stricture disease (68% success), as well as those patients who underwent multiple previous procedures (43% success). Previous repairs likely contribute to increased failure by disrupting blood supply and increased scarring resulting in poor tissue quality. Additionally, flap PU may fail, as the blood supply for the flap is not reliable or robust. Alternatively, transection and mobilization is an option [17]. Transection disrupts retrograde blood flow and some believe may decrease success.

Preoperative counseling is important as these patients may continue to need further procedures, generally dilation or DVIU. Several techniques have been utilized for traditional PU. A lengthy longitudinal urethrotomy with advancement flaps [11] is based on an initial technique popularized by Johanson and Blandy [25, 26] that preserves the longitudinal blood flow. Success with this technique is around 80%.

Our results show an 80% success rate in a complex group of patients. We attribute this success to use of BMG, providing healthy substitution tissue. With our technique, healthy urethra is mobilized and in combination with an onlay BMG, is brought out to the perineum. This is a key difference: there is no lengthy skin tunnel, which is more likely to stricture down. Instead healthy tissue is brought to skin surface, tension-free, and BMG onlay provides a wide diameter neomeatus. Strictures occurring just distal to the external sphincter can be especially problematic, and our technique helps to address this issue.

Two patients in this series underwent combined dorsal and ventral graft PU. One of these patients had undergone multiple previous reconstructive attempts at repair and both had devastated urethras. Urethral lumen was augmented with ventral graft onlay in addition to the dorsal onlay, as urethra quality was poor enough that circumferential grafting was necessary. Both of these patients have done well without recurrence.

Strictures due to LS

In strictures due to LS, complex one or two stage repairs using buccal mucosa are necessary [15, 27]. Success rates for one or two staged panurethral stricture repairs are reported variably in the literature, and are generally lower than for patients without the condition. Similarly, traditional PU in LS patients is associated with a higher failure rate and need for revision.

Management of extensive LS remains a challenging problem, and has been treated with both one and two staged techniques [13, 15, 28]. In our cohort, 23% of patients had panurethral stricture due to LS. Forty seven of 215 (22%) of patients in Kulkarni's work [13], underwent definitive PU as treatment for stricture due to LS, with a 72% success rate at 52 months follow-up. They developed a simple set of criteria for procedure selection: those who were older, had previous failed repairs, infection, severe disease, or scarring of the urethral plate were counseled towards staged repair or definitive PU (done without transection). Similar to our study, no QOL assessment was used. Our higher success can be explained by the use of BMG that maintains urethral lumen and allows for a site that should not be affected by LS [21].

Strictures due to failed hypospadias repair

Recurrent urethral stricture is common in men who underwent previous hypospadias repairs [29]. Myers et al. analyzed a cohort of 50 men with failed hypospadias repairs, 36 of whom (72%) presented with recurrent urethral stricture. In this group, primary success rate was only 52% for one-stage repairs; this is likely due to a scarred, immobile penis with hypovascularity [14, 29], and poor vascularization of the wound bed [21]. Flaps are unreliable due to unpredictable vascularity, and thus should generally be avoided. This is also true in Fournier's, where tissue planes are obliterated and vascularity is irregular and poor.

In our series, six patients (14%) underwent definitive PU with BMG due to failed hypospadias repair. In this group, we had an 83% primary success rate; one recurrence was treated with dilation and meatal revision for a short stricture.

This study represents a small group of patients who have complex urethral stricture disease extending into the proximal bulbar urethra and/or membranous urethra. It should be noted that the use of buccal graft onlay is reserved for this subset of patients in whom adequate lumen is not achievable without substitution urethroplasty.

This study has several limitations. It is retrospective, and therefore susceptible to selection bias. We did not use validated questionnaires to assess quality of life and patient satisfaction following definitive PU, although it has been shown that patient satisfaction is high with this procedure [24]. Subjectively, patients who underwent successful BMG PU reported improvements in quality of life. In future, definition of success would include both objective and validated subjective data. Selection of procedure was not governed by a set of criteria; rather, it was done on a case-by-case basis.

Nonetheless, it represents the largest series to our knowledge that utilizes buccal mucosa for dorsal onlay augmented PU. With encouraging midterm results, it is a good option for patients with panurethral stricture disease that extends into the proximal bulbous urethra.

Conclusions

Complex anterior urethral strictures involving the proximal bulbous urethra represent a challenging problem. BMG perineal urethrostomy is a reproducible, viable alternative in appropriately selected patients, with encouraging midterm results.

Compliance with ethical standards

Ethical statement All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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