Reconstruction of Distal Urethral Strictures Confined to the Glans With Circular Buccal Mucosa Graft

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OBJECTIVE To report our results with 1-stage reconstruction in short distal urethral strictures using circular buccal mucosa graft (cBMG).

METHODS The data of 19 patients (median age 41.8 years, range 25-58) operated between 2001 and 2010 were reviewed. Patients were evaluated with American Urological Association (AUA) symptom score, uroflowmetry, voiding cystourethrography (VCUG), and intraoperative urethroscopy. Stricture was limited to the glanular urethra (≤2 cm.) in all cases and 16 patients had lichen sclerosus. Strictured urethra was resected 0.5 cm proximal to the healthy urethra and a rectangular BMG with 4-cm length and 1.5- to 2.5-cm width (depending on the length of the defect) was rolled on a 24-Fr sound that calibrated the urethra. Proximal and distal edges of the cBMG were anastomosed circumferentially to the healthy mucosa and meatus, respectively. Foley catheter was removed within 10-14 days. Voiding symptoms, uroflowmetric parameters, and cosmesis were assessed at 1, 3, and 6 months, and yearly thereafter.

RESULTS With a median follow-up of 38 months (range 12-96), 16 (84.2%) patients were cured. One patient developed early graft loss, and 2 patients developed stricture at proximal anastomotic site. Mean Q_{max} (mL/s) increased from 7.8 ± 5.4 preoperatively to 21.8 ± 9.2 postoperatively ($P = .001$), and mean AUA score decreased from 26.7 ± 3.9 preoperatively to 7.3 ± 3.8 postoperatively ($P < .001$).

CONCLUSION Our results suggest cBMG as a feasible alternative in 1-stage reconstruction of distal strictures confined to the glanular urethra because the glans penis has a good blood supply, providing an efficient circumferential graft take. UROLOGY 79: 1158–1162, 2012. © 2012 Elsevier Inc.

Urethral strictures involving the fossa navicularis and external meatus are common in adult men because of susceptibility of the distal urethra to trauma, infection, and inflammatory diseases, such as lichen sclerosus (LS).[1] Reconstruction of glanular urethral strictures requires a particular attention for creating a functional urethral outlet as well as a cosmetic outcome. Although various graft and flap-based repairs have been defined with considerable success rates,[1-6] the ideal management of distal urethral stricture disease remains unclear. The choice of reconstructive technique further depends on other complicating factors, such as the condition of the urethral plate and the presence of LS, which may necessitate excision of the strictured urethra and substitution with extragenital tissue grafts. This generally requires a multistage approach, which may not be desirable to most adult men. In this study, we report our results with circular buccal mucosa graft (cBMG) in single-stage reconstruction of distal urethral strictures.

MATERIAL AND METHODS

We retrospectively reviewed the data of 19 men (median age 41.8 years, Table 1) with distal urethral strictures who underwent single-stage reconstruction using cBMG between 2001 and 2010. The study was approved by our institutional review board. Evaluation of patients with urethral stricture included medical history, subjective assessment of voiding symptoms with American Urological Association (AUA) symptom score, and uroflowmetry test with ultrasound assessment of postvoid residual (PVR) urine volume. To define the extent of the stricture and rule out any coexisting proximal urethral strictures, a combined retrograde urethrography (RUG)/voiding cystourethrography (VCUG) and urethrocystoscopy using a thin, 6.5-Fr ureterorenoscope were obtained whenever the urethral lumen allowed the passage. When retrograde meatal intubation was precluded by severe stenosis, antegrade (via the cystostomy tube) or excretory VCUG was performed. In all patients included in this cohort, the stricture was confined to the distal

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Table 1. Patient characteristics (n = 19)

Characteristic	Median	Range
Age (y)	41.8	25-58
Stricture length (cm)	1.5	1-2
cBMG length (cm) used for substitution	2	1.5-2.5
Preoperative $Q_{max.}$ (mL/s)	7.3	0-9
Postoperative $Q_{max.}$ (mL/s)	21	12-31
Follow-up (months)	38	12-96

$Q_{max.}$ = peak urinary flow rate.

urethra (ie, within 2 cm from the external meatus) and its caliber was <7 Fr, indicating an inadequate urethral plate for 1-stage augmentation. Patients with a follow-up of <12 months and patients who had prior hypospadias repairs or who had longer strictures managed with other flap/graft-based techniques were excluded from the study. The identified causes of strictures were LS in 16 cases (84%) as evidenced by preoperative or intraoperative biopsy, and multiple instrumentations for urethral stone removal or bladder tumor surveillance in 3 cases (16%). Thirteen (81.25%) patients with LS had previous instrumentations and dilatations. Full written informed consent was obtained from each patient after explanation of all the available techniques for male distal urethral reconstruction.

cBMG Urethroplasty

Under general anesthesia, the patient was positioned supine on the operating table. Through a circum-meatal incision, the urethral meatus and distal strictured urethra were dissected from the healthy glans tissue (Fig. 1A, 1B). During proximal dissection, stay sutures were placed at the healthy paraurethral tissues to aid in retraction. The fibrotic segment was sectioned at a location, including about 5 mm of the proximal healthy urethra (Fig. 1C), and then patency of the proximal urethra was assessed with a 24-Fr sound (Fig. 1D).

In 9 cases where retraction of paraurethral stay sutures could not provide sufficient exposure of the proximal healthy urethra, an additional transverse subcoronal skin incision on the ventrum of the penis was required for proximal anastomosis (Fig. 1D and Fig. 2A). A ventral urethrotomy was made proximally, and a 22- to 24-Fr sound was advanced from this incision to pass through the site of stricture excision and exit from the meatus (Fig. 2B). This maneuver, together with simultaneous retraction of the paraurethral stay sutures, enabled the surgeon to efficiently control both the proximal and distal site of cBMG anastomosis. A rectangular BMG with an approximate length of 4 cm and width of 1.5-2.5 cm (depending on the length of the defect) was harvested and defatted. The BMG was then rolled on the urethral sound with its mucosa facing inward and its long edge sutured circumferentially to the healthy proximal urethral mucosa using fine polyglactin sutures (Fig. 2C). Once the proximal anastomosis of the cBMG was completed, the urethral sound was removed and a 20- to 22-Fr silicone Foley catheter was introduced inside the cBMG and advanced to the bladder. Neomeatus was then reconstructed with distal anastomosis of the cBMG circumferentially to the initial circum-meatal incision (Fig. 2D). Gauze soaked in antibiotic ointment was placed around the meatus, and the Foley catheter was taped and fixed to the abdomen for 1 week to immobilize the cBMG during graft take.

The Foley catheter was generally kept in place for 2 weeks. The urinary pattern was assessed after its removal in our facility. In patients with a preoperative suprapubic tube in place, the tube was clamped and removed a few days later if successful voiding was achieved. Postoperative data were prospectively recorded during an initial visit 7 days after urethral catheter removal and at 1, 3, and 6 months, and then annually thereafter. During each visit, patients underwent subjective assessment of voiding symptoms with AUA symptom score and objective calibration of the distal urethra with an 18-Fr catheter, as well as uroflowmetric studies with PVR determination. All patients were followed for urinary pattern changes and/or irritative symptoms and reassessed with VCUG and urethrocystoscopy in the case of recurrent symptoms. A successful outcome was defined as subjective and objective improvement in urinary flow with maintenance of glanular shape, and the absence of any need for further urethral instrumentation during follow-up. Preoperative AUA symptom score and Q_{max} measurements were compared with postoperative values obtained at the last follow-up using the Wilcoxon sign test for which a P value <.05 was considered statistically significant.

RESULTS

With a median follow-up of 38 months (range 12-96), success was achieved in 16 (84.2%) patients. One patient with LS developed early graft loss within the first month and was regarded as failure. Two other patients developed stricture at the site of the proximal anastomosis and were managed with urethrotomy followed by intermittent self-catheterization. The substituted urethral defects after resection measured 2 and 2.5 cm in the latter patients. A cosmetic and functional distal urethra was obtained in the remaining cases (Fig. 3). At the last follow-up, the mean Q_{max} (mL/s) increased from 7.8 ± 5.4 preoperatively to 21.8 ± 9.2 postoperatively (P = .001), and the mean AUA score decreased from 26.7 ± 3.9 preoperatively to 7.3 ± 3.8 postoperatively (P < .001). Mild splaying of the urinary stream was noted in almost all cases but subsided within 6 months.

COMMENT

Strictures involving distal urethra are particularly challenging because successful reconstruction requires the creation of a functional urethral conduit as well as maintaining a cosmetically appealing glans penis. Onlay urethroplasty using transverse island ventral penile skin flap has revolutionized the management of distal strictures.[2-4] The dependable blood supply, absence of hair follicles, and excellent applicability has made it the preferred method for reconstruction of most resistant strictures of the fossa navicularis and urethral meatus.[4,7] When there is a need for urethral substitution caused by an obliterative process, however, this represents a more complex reconstructive challenge. Management of these strictures mandates a tailored approach, taking into account the length and etiology of the stricture, patient expectations, and surgeon's experience. For example, strictures associated with LS may require excision of the diseased urethra and substitution with a multistage approach,[8-10] which would not appeal to most adult men. The psychological

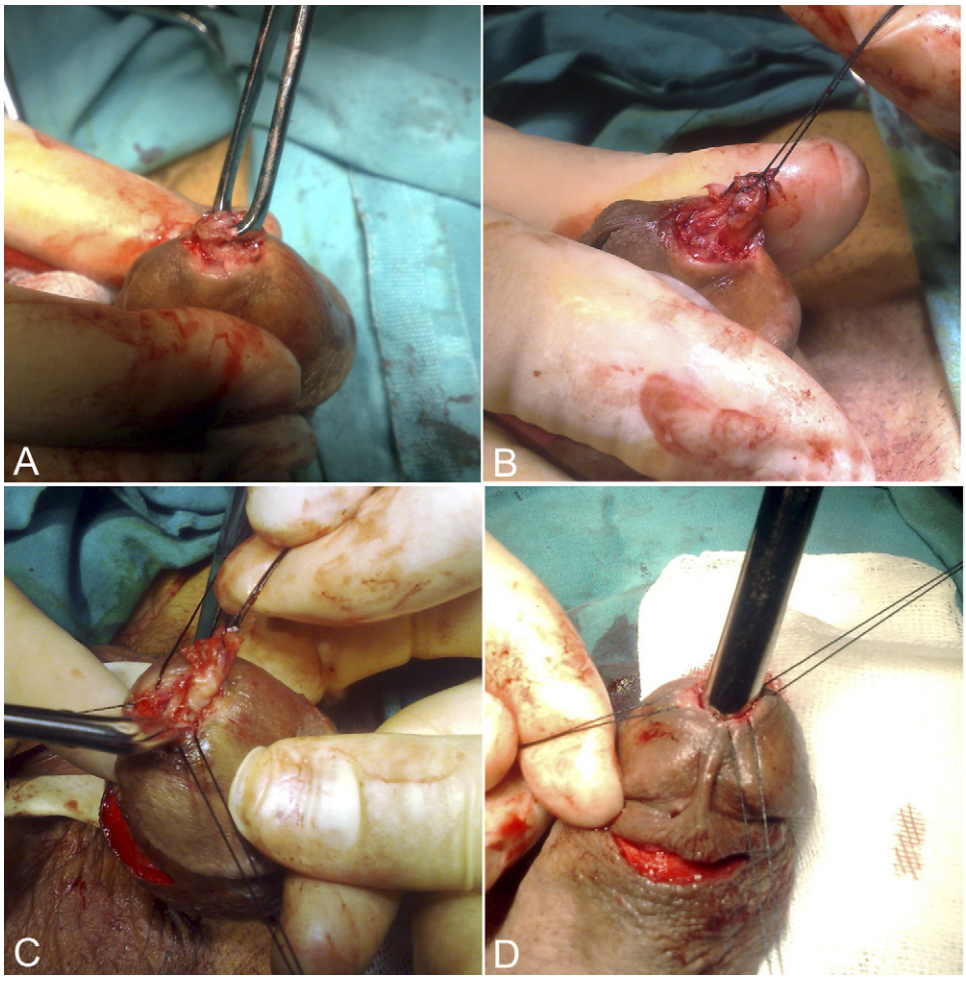

Figure 1. (A) The strictured distal urethra has been outlined through a circum-meatal incision. **(B)** Dissection of the strictured segment from the healthy glans tissue. **(C)** With the aid of stay sutures placed in healthy paraurethral tissues, proximal dissection is completed and strictured urethra mobilized. The proximal end of the obliterated segment is amputated, involving about 5 mm of the proximal healthy urethra. **(D)** Patency of the proximal urethra is then assessed with a 24-Fr sound.

distress of multiple procedures, loss of work, and the inability to stand during voiding until the final repair may outweigh the benefits of 2-stage repairs.

Our results suggest that cBMG is a viable 1-stage reconstruction alternative in the management of short (≤2 cm) distal urethral strictures confined to the glans. Most of our patients had LS, possibly because of previous instrumentations. LS involvement of the urethra ranges from isolated meatal stenosis to panurethral disease. In most instances, the most severe inflammatory reaction in LS is seen at the meatus and distal urethra, which compromises a successful stricture repair because of the recalcitrant nature of this disease.[9,10] Therefore, excision of the diseased urethra and 2-stage urethroplasty using extragenital tissue grafts has been advocated in patients with LS.[8,10] In our present cohort, we excised the diseased urethra in all cases because of severe stenosis. However, more proximal urethral involvement is often associated with lesser scarring and a wider caliber urethra. We have thus adopted a more flexible approach to LS-related strictures that is based on the condition of the urethral plate and length of the diseased urethra,[9,11] as assessed with preoperative VCUG and intraoperative urethroscopy. If the strictured urethra permits the passage of a 6.5-Fr ureterorenoscope, we prefer to use BMG as 1-stage dorsal onlay, in a similar fashion to Dubey et al and Kulkarni et al.[9,11] When the urethral plate is severely stenosed, BMG in its circular form still renders a 1-stage reconstruction possible in the case of glanular urethral strictures. The outcome is also cosmetically appealing. Nevertheless, cBMG reconstruction may not be suitable in longer strictures and in patients with a ventrally displaced external meatus because of previous operations (such as meatotomy and hypospadias repairs). Also, exposure to the healthy proximal mucosa for anastomosis through the circum-meatal incision may be difficult in some cases, where an additional ventral subcoronal skin incision is required for proximal cBMG anastomosis.

The use of BMG as a circumferential graft has been approached with caution in the literature because of its high overall failure rates compared with onlay or 2-stage techniques.[12-14] In contrast, other reports revealed high

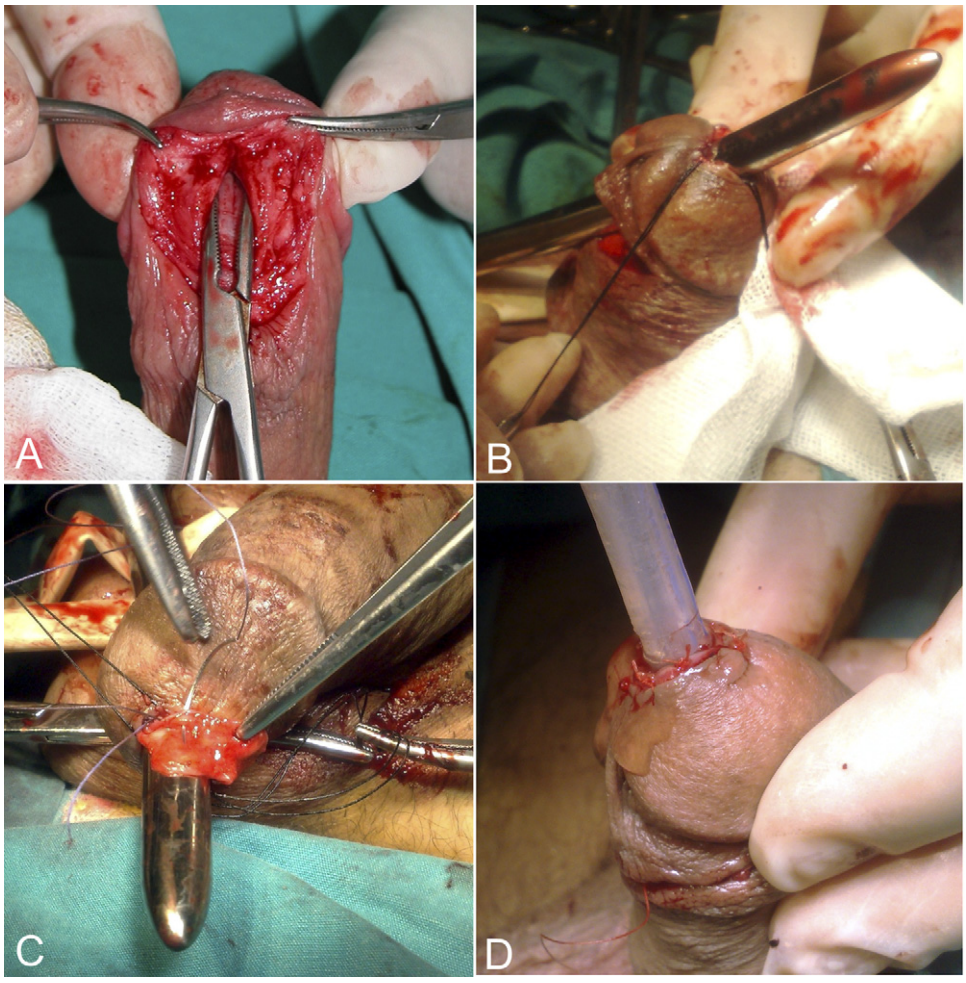

Figure 2. **(A)** When adequate exposure of the healthy proximal urethra cannot be achieved with retraction of paraurethral stay sutures through the circum-meatal incision, an additional transverse subcoronal skin incision on the ventrum of the penis is made to facilitate the proximal cBMG anastomosis. **(B)** A ventral urethrotomy has been made proximally, and a 24-Fr sound is advanced from this incision to exit distally from the location of urethral excision and meatus. **(C)** The BMG has then been rolled on the urethral sound with its mucosa facing inward, and its long edge sutured circumferentially to the healthy proximal urethral mucosa using 4-5/0 polyglactin sutures. **(D)** Once the proximal anastomosis has been completed, the urethral sound is removed and a 22-Fr silicone Foley catheter is introduced inside the cBMG. The neomeatus is reconstructed with distal anastomosis of the cBMG circumferentially to the initial circum-meatal incision.

success rates with cBMG for urethral substitution.[15,16] However, most of these series are restricted by their retrospective nature, the number of patients included, and heterogeneity of the population (ie, patients with different etiologies, different stricture lengths, and different locations) in which the outcomes of a particular technique are analyzed. Thus, it is not clear from the literature which subset of patients may benefit from 1-stage urethral reconstruction using circumferential BMG, if any. The data presented by Barbagli et al suggests that cBMG may be a feasible option in the management of bulbar urethral strictures because of good vascularity in this area.[16] They treated 5 patients with bulbar strictures (2-4.5 cm in length) with cBMG and reported no complications with a mean follow-up of 38 months. Likewise, we successfully used cBMG for 1-stage reconstruction of glanular urethral strictures because the glans penis has a good blood supply, providing an efficient circumferential graft take. In a recent study, Gelman and Sohn presented their experience with 1-stage reconstruction of obliterative distal urethral strictures with combined BMG urethral plate reconstruction and onlay penile skin flap.[6] They reported no urinary obstructions in 12 patients treated with this technique with a mean follow-up of 39 months. Despite presenting an attractive 1-stage alternative to tube flaps and grafts, these authors did not report the incidence of LS in their series.

Several limitations of the present study deserve mention. Our study was limited in size, includes a single-institution setting, and is retrospective in nature. Because it is a descriptive series, a control group is lacking. A comparative study analyzing both anatomical and patient-reported quality-of-life outcomes between cBMG and 1-stage combined flap-graft or 2-stage reconstructions would have better addressed the advantages of this

Figure 3. Final cosmetic appearance of the wide neo-meatus 3 months after surgery.

approach. Furthermore, we did not take into account the extended meatotomy, which offers a successful 1-stage salvage option for selected, challenging distal urethral strictures,[17] assuming that the resultant glans cosmesis and the possibility of urinary spraying with requirement for seated voiding would not be acceptable to adult men. Our second concern is that although all patients had at least 1-year follow-up, the median follow-up duration of 38 months may not be sufficient to evaluate the long-term outcomes of cBMG urethroplasty in this cohort composed predominantly of patients with LS. A larger patient population with a longer follow-up could have better assessed the efficacy of this technique for specific causes of strictures (ie, traumatic vs LS); nevertheless, we decided to report our experience based on the relative paucity of information regarding the management of distal urethral strictures. The armamentarium of the reconstructive urethral surgeon is a continuously evolving process and requires familiarity with new concepts and concerns.[16]

CONCLUSIONS

Our results suggest cBMG as a feasible alternative in 1-stage reconstruction of short distal urethral strictures confined to the glanular urethra. However, we do not advocate cBMG urethral substitution in longer strictures that may best be treated with 2-stage or combined graft/flap-based techniques. Larger scale and long-term studies are necessary to determine the optimum reconstructive approach for the individual setting.

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