The Evolution of Urethroplasty for Bulbar Urethral Stricture Disease: Lessons Learned from a Single Center Experience

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Abbreviations and Acronyms

AAR = augmented anastomotic urethroplasty

EPA = excision and primary anastomosis

RUG = retrograde urethrogram

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Purpose: We reviewed the evolution of repairs for bulbar urethral stricture disease and analyzed changes in outcomes.

Materials and Methods: We retrospectively reviewed the records of 429 men who underwent urethroplasty for bulbar urethral stricture disease from January 1996 to September 2011. Patient demographics, stricture related details, and intraoperative and postoperative information were collected. We used 1-way ANOVA for differences in age and stricture length, the Fisher exact test for differences in recurrence rates, and the t-test and chi-square test with the Bonferroni correction for subgroup analysis.

Results: Of the 429 men 384 (90%) had followup data available. Buccal mucosa surpassed penile skin as our preferred tissue for augmented anastomotic repairs by 1999. It was accompanied by an improved recurrence rate (21.6% vs 5.8%, $p = 0.002$). The average length of strictures treated with excision and primary anastomosis increased after 2004 (1.29 vs 1.54 cm, $p = 0.05$) but this was not associated with a significant change in the recurrence rate (3.0% vs 6.9%, $p = 0.27$).

Conclusions: The transition from penile skin to buccal mucosa for augmented anastomotic repair was relatively abrupt. We have become more aggressive when performing excision and primary anastomosis with respect to stricture length. These changes resulted in improved outcomes. Continuing review of our practices, awareness of results reported by others and intuition contributed to our changes but prospective analysis will be the best way to continually improve outcomes.

Key Words: urethral stricture, physician's practice patterns, mouth mucosa, skin transplantation, penis

BULBAR urethral stricture disease is common and may result from trauma, infection, instrumentation and ischemia. Formal operative reconstruction options for bulbar urethral stricture disease include EPA, onlay repair without stricture excision, stricture excision with AAR, flap based repairs, staged repairs and perineal urethrostomy. Materials for augmented repair include grafts or flaps of penile/scrotal skin, full-thickness grafts from sources such as the thigh and postauricular areas, bladder mucosa, buccal mucosa grafts, lingual grafting[1] and more recently tissue engineered materials.[2] Even split-thickness grafts (sometimes meshed) have been used but with poor long-term results.

Urethral reconstruction was first described in 1914 by Russell.[3] Since

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then, options for reconstructing the anterior urethra have evolved significantly. The surgical options, type of graft and location of graft placement as well as changes in perioperative management continue to progress tremendously. Some changes were based on careful followup studies while others were based on subjective data and anecdotal experience. Indeed, 35 years ago one of us (GDW) most commonly performed 2-stage scrotal inlay repairs for bulbar strictures, which ultimately evolved into penile skin flap based repairs when the outcomes were deemed to be better. When full-thickness skin graft repairs became popular using the materials noted, they were often performed, many with good short-term results. However, when followed at length all of these techniques had an unacceptable failure rate with recurrent stricture in up to 40% of patients for patch grafts and 56% for tube grafts.[4] A major advancement in urethral reconstruction was rediscovery of the buccal mucosal graft for urethral reconstruction in 1992 after first being described in 1886 by Suprechko.[5]

All of these factors have influenced the evolution of urethral reconstruction preferences and techniques during the last 2 decades. We reviewed the recent evolution in preferred repair choices and discuss our current treatment rationale. We also analyzed changes in outcomes in these patients as related to the evolution of these procedures with time.

MATERIALS AND METHODS

We performed an institutional review board approved, retrospective chart review of the urethroplasty database at our institution for patients who underwent urethroplasty for bulbar urethral stricture disease, as performed by 2 surgeons (GDW and ACP). This review was performed from January 1996 to September 2011 because of limitations to the electronic medical record system at our facility. We recorded patient demographics, stricture related information such as etiology, and operative stricture length and location, repair type and any postoperative complications or recurrent stricture disease. Each of us individually reviewed all primary retrograde urethrograms as part of our analysis. All stricture lengths were measured intraoperatively using a 20Fr catheter to define the distal portion of the stricture. Transection was performed on the tip of this catheter and measurements were made in the operating room using a ruler to define stricture length with the help of methylene blue dye. We also examined the length of the spongiofibrosis after spatulation.

Before 2010 our followup protocol included a clinic visit 3 weeks postoperatively, when pericatheter RUG was performed. If RUG results were satisfactory, the Foley catheter was removed and a voiding trial was done. Three months postoperatively patients returned for a second followup visit, when uroflowmetry and RUG were routinely performed. If there was concern for urethral stricture on RUG, cystoscopy was done in all patients. Patients were routinely followed at 12 or 18 months with a final postoperative clinic appointment, when uroflowmetry was performed. Uroflowmetry results were not readily available in our electronic medical records and, thus, they were not included in analysis. Since 2010, we have routinely used the AUA-SI (American Urological Association symptom index), uroflowmetry and cystoscopy as indicated for followup. Recurrent stricture was defined as the need for an additional surgical procedure or dilation.

We used 1-way ANOVA to determine differences in age and stricture length, the Fisher exact test to determine differences in recurrence rates, and the t-test and chi-square test with the Bonferroni correction for subgroup analysis. All statistical tests were done with JMP® Pro 10.

RESULTS

We limited our review to patients treated with urethroplasty for bulbar urethral stricture from January 1996 to September 2011. We identified 429 men available for review, of whom 384 (90%) had followup data available. Average age was 43.2 years (range 15 to 85) and average stricture length was 2.0 cm (range 0.2 to 10). Stricture etiology varied. The most common etiology was idiopathic (233 cases or 54.31%). Other etiologies included trauma in 97 patients (22.6%), an iatrogenic cause in 60 (14.0%), infection in 22 (5.1%), prior hypospadias repair(s) in 7 (1.6%), radiation in 7 (1.6%) and lichen sclerosis in 3 (0.7%).

EPA urethroplasty was performed most commonly (202 cases or 52.6%) followed by AAR with buccal mucosa (103 or 26.8%) (see table). Other repair types included AAR with penile skin in 37 patients (9.6%), dorsal onlay repair in 20 (5.2%), perineal-scrotal flap inlay to create a perineal urethrostomy in 16 (4.2%), flap based repair in 4 (1%) and staged repair in 2 (0.5%). As the tissue source, we used buccal mucosa in 14 of the 20 dorsal onlay repairs and penile skin in 6.

There was a significant change in procedure selection for the period reviewed, specifically in the change from routine use of penile skin to buccal mucosa for AAR (fig. 1). This trend toward using buccal mucosa was first noted in 1996 and by 1999 it had surpassed penile skin as our preferred tissue for augmented anastomotic repairs (fig. 1). This transition from penile skin to buccal mucosa was accompanied by a significantly improved recurrence rate (5.8% vs 21.6%, $p = 0.002$).

During the period reviewed the mean stricture length in patients treated with EPA was 1.4 cm (range 0.2 to 4.5). However, with time we noted a significant increase in the average length of strictures treated with EPA. This change was