Penile Urethral Stricture Reconstruction—Flap or Graft?

GRAFT

In 1953 the use of the free preputial skin graft for reconstruction of the bulbar urethra was first described.[1] In 1963 Devine et al, after successfully using the preputial skin for 1-stage hypospadias repair, widely popularized the use of the free skin graft for repair of anterior urethral strictures.[1] For many years, substitution urethroplasty with a preputial skin flap or graft was considered the gold standard for urethral reconstruction, using different surgical techniques. In the last 20 years the use of oral mucosa as a donor site for the graft and "inlay" placement of the graft between the 2 wings of the longitudinally incised urethral plate were introduced.[2,3]

In 1993 El-Kasaby et al used oral mucosal graft from the lip for the management of anterior urethral strictures, including penile urethroplasty in 12 patients.[2] In 1994 Snodgrass suggested incision of the urethral plate for distal hypospadias repair, and in 1999 Hayes and Malone recommended laying an oral mucosal graft into the longitudinally incised urethral plate in patients when hypospadias repair failed.[1] In 2001 Asopa et al introduced a new era in reconstructive urethral surgery by the use of free graft techniques, mainly for the repair of penile urethral strictures.[3] We currently use oral mucosal or preputial skin graft for 1-stage urethroplasty.

Methylene blue is injected into the urethra to better define the urethral mucosa. The distal site of the stricture is identified and outlined by inserting a Nélaton 16Fr catheter through the external urinary meatus. In patients with stricture on the distal part of the penis the penile urethra is approached using a circular sub-coronal incision and then degloving the penis. In patients with strictures involving the proximal part of the penis the penile urethra is approached using a midline perineal incision. The urethra is then opened along its ventral surface, the urethral mucosal plate is longitudinally incised along the midline down to the albuginea of the corpora and the wings of the urethral plate are laterally mobilized to create a wide bed for graft location. The graft (penile skin or oral mucosa) is sutured and quilted onto the bed of the dorsal urethrotomy using interrupted 6-zero polyglactin sutures. The oral mucosal graft is harvested from the cheek and the skin graft is harvested from the prepuce during circumcision. The urethra is tubularized up to the glans over a Foley 14Fr grooved silicone catheter. The prepuce and penile skin are closed.

The primary advantages of this technique are 1) minimally invasive approach using circumcision or perineal incision, thus reducing the risk of fistula formation and improving esthetic outcome; 2) respect for the penile shaft components; 3) flexibility to use oral mucosa or preputial skin graft; 4) does not require extensive training in reconstructive tissue transfer procedures; 5) may be used in select patients after failed hypospadias repair; and 6) can be used in select patients with strictures caused by lichen sclerosus. We do not recommend this technique for patients with a narrow and fibrous urethral plate.

In our experience oral mucosa seems to be better than skin graft but the difference is so slight (82% vs 78%) that it does not justify the use of oral mucosa as first choice.[1] The choice of substitute material (oral mucosa vs preputial skin) should be based primarily on surgeon preference and background, since we are not certain in which cases oral mucosa graft has a better chance of success than skin graft. Identification and use of specific criteria to more carefully select the procedure most appropriate for the patient may determine whether an oral graft is preferable to preputial skin, based on the characteristics of the vascular and mechanical tissues used to support the original urethral mucosal plate.

However, the future is just outside the door, as tissue engineered material for urethral reconstruction is already available. How do we use this new grafting material for 1-stage anterior urethroplasty? For the aforementioned inlay graft technique, a bed is designed between 2 strips of original urethral mucosa into which the engineered tissue material (oral or urethral mucosa) is closely placed, allowing for easier and faster incorporation, re-epithelialization and transformation of the transplant tissue into the urethral mucosa according to the historic principle of the buried strip of intact epithelium.[4]

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This principle, designed 137 years ago, is still applicable when we use the new tissue engineered material for urethral reconstruction.

In conclusion, there are many differences in surgical techniques of penile urethroplasty, including its complications as well as surgeon training and experience. The most important difference is that the use of the graft today may help the surgeon become familiar with the technique and, thus, ease into adopting the new engineered tissue material in the near future. For a century, the use of vascularized flaps was considered the gold standard in urethral reconstruction. However, today the laboratory is ready to enter the operating room. Although urethral surgery has gained a high success rate and low complication rate, there is concern for cases of failed hypospadias repair, lichen sclerosus and complex urethral strictures. It is for these patients that we await advances in urethral reconstruction with the hope that we might grow individually customized biological urethra replacements in the laboratory.

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FLAP

During the last 10 years it appears that the use of graft tissue has evolved as the most popular augmentation option for anterior urethral stricture reconstruction. A meta-analysis between 2000 and 2008 revealed that 64% of all articles related to urethral reconstruction for stricture disease were about some form of substitution urethroplasty. Fasciocutaneous genital skin flap (FGF) was described in 3% of those articles, which was in stark contrast to the number of published reports on the use of buccal mucosa (44%) or penile skin grafts (27%).[1] Although baseline data before this time are unknown and actual practice patterns may differ somewhat from the reported literature, the favored use of graft over FGF in this meta-analysis is most likely reflective of current trends. Based on these data it is clear that a selection bias exists for graft tissue over FGF for substitution urethroplasty. However what is not clear is why or how this bias evolved since existing data do not decisively prove that one augmentation tissue source is superior to the other for the management of penile urethral stricture disease.

The ability to robustly answer the question of whether FGF or graft is superior for single stage reconstruction of penile urethral stricture disease is significantly limited. The existing literature is largely a collection of retrospective case series and meta-analyses with varying definitions of recurrence and successful outcomes. Furthermore, analysis of these studies reveals roughly comparable results with the use of both augmentation tissue sources in a single stage repair. The use of FGF for substitution anterior urethroplasty, and specifically penile urethroplasty, reveals durable 5 and 10-year estimated stricture-free survival rates of 84% and 79%, respectively, in properly selected patients.[2] Similarly, meta-analyses on the use of graft tissue for penile urethral stricture disease reveal an average recurrence-free success rate of 76% to 82% at 3 to 5 years of followup.[3,4] These data show that acceptable outcomes with the use of graft or FGF for penile urethral stricture reconstruction are possible in experienced hands. However due to the inherent study design weaknesses of these retrospective case series and meta-analyses, it does not appear feasible to advocate the use of one tissue source over another.

The best opportunity to answer this question may reside with results from 2 randomized, prospective studies focused on the direct comparison of FGF and graft tissue for anterior urethral stricture disease. Dubey et al designed a trial involving the outcomes of 55 patients with anterior urethral strictures.[4] Of this group 9 men had pure pendulous strictures and 30 had strictures that traversed the pendulous and bulbar urethra. Although study limitations existed, including small patient numbers, a limited number of strictures purely confined to the penile urethra and relatively short followup, the

authors concluded that the recurrence-free success of FGF was similar to that of oral mucosal graft repair. They appropriately excluded men with lichen sclerosus and performed a standardized dorsal onlay repair in all men to control for these variables.

Similarily Hussein et al prospectively randomized 37 men with no significant differences in subgroup demographics or disease characteristics into FGF and penile skin graft groups.[5] Urethral strictures were defined as bulbo-penile and were on average 14 to 15 cm long. The authors placed all FGFs and grafts in ventral onlay fashion and excluded strictures with lichen sclerosus. With relatively long term followup of just more than 36 months, they reported no difference in the recurrence-free success rate between the FGF and penile skin graft groups.

In the study by Dubey et al complications were higher with FGF and mostly related to superficial skin necrosis and post-void dribbling. In contrast, Hussein et al reported that local skin complications and post-void dribbling were limited and not significantly different between the FGF and graft groups at short or long-term followup. Of interest in comparison of these 2 prospective studies was the higher reported rate of post-void dribbling in the FGF group when dorsal onlay of tissue was used[4] compared to the limited amount of post-void dribbling when ventral onlay of tissue was used.[5] Dubey et al reported lower patient satisfaction with use of FGF vs graft but these data may be limited due to lack of a sub-analysis of a purely penile stricture group and the relatively short followup. Finally, although mean operative times were longer with FGF augmentation in both studies, when recurrence-free outcomes with FGF were found to be similar to those of graft use in both studies, the relevance of increased length of surgical time is debatable.

The most important considerations for the successful management of penile urethral stricture disease are surgeon experience and ability to recognize complex urethral stricture disease defined as the presence of lichen sclerosus, severe scarring from previous urethroplasty or failed hypospadias repair and deficient genital skin. These patients may best be served with a multi-staged approach using graft tissue.[3] However in the absence of these specific risk factors for recurrence, outcomes of substitution urethroplasty with the use of FGF appear to be comparable to those of oral mucosa or genital based skin grafts in single stage repair of penile urethral stricture disease.

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