Graft Use in Bulbar Urethroplasty

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KEYWORDS

• Buccal graft • Urethroplasty • Ventral onlay • Dorsal onlay • Urethral stricture

KEY POINTS

- Buccal mucosa is the preferred tissue for bulbar urethral stricture repair for strictures greater than 2 cm.
- Techniques for buccal mucosal placement include dorsal onlay, ventral onlay, lateral onlay, dorsal inlay, and a combined ventral onlay and dorsal inlay.
- Outcomes for the different graft locations are similar, approximately 90%.
- Location of the graft for bulbar stricture repair should be guided by surgeon experience and preference.

INTRODUCTION

The gold standard for bulbar urethroplasty has been excision and primary anastomosis (EPA), which involves excision of the strictured urethra and suturing of the healthy ends together. This method is durable and has a well-documented success rate of greater than 90%.[1,2] EPA is accepted as superior to less invasive approaches to treatment, such as urethral dilation and direct visualization and internal urethrotomy.[3] Application of this approach is generally limited to strictures that are 2 cm or less in the bulbar urethra due to potential penile shortening. Strictures greater than 2 cm are successfully treated with augmentation urethroplasty wherein the narrowed segment is not excised but widened with the use of a skin flap or, more commonly, a tissue graft.

Common modes of treatment of bulbar stricture include the following:

1. Urethral dilation
2. Direct visualization and internal urethrotomy
3. Urethroplasty
   a. EPA
   b. Augmented with tissue graft
      i. Dorsal onlay
      ii. Ventral onlay
      iii. Lateral onlay
      iv. Dorsal inlay
      v. Dorsal inlay, ventral onlay

GRAFTS: WHAT ARE THEY AND WHAT IS THEIR PURPOSE?

A graft is tissue that is isolated for the intended purpose of relocation and repair of a damaged recipient site. Once relocated, the site of interest must provide an environment amenable to acceptance of the transfer. A graft does not have an intrinsic blood supply and relies on a robust, nutrient-rich tissue bed for imbibition of nutrients during the first 48 hours, after which inosculation of new capillaries occurs.[4]

TYPES OF GRAFTS

There are 2 types of tissue grafts used in urethral reconstruction; they are differentiated by the amount of tissue transferred. A split-thickness

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graft is limited to the epidermis and superficial dermal plexus. This plexus contains a plethora of small blood vessels making it favorable for graft–recipient site neovascularization. Conversely, the physical properties of this tissue are not well maintained; as a result, these grafts tend to contract and are less durable. Full-thickness skin grafts include the epidermis, the superficial dermal plexus, and the deep dermis. Given that the entire dermis is included, the tissue is relatively durable, with less propensity for contraction. Unlike the superficial dermal plexus, the deep dermis is sparsely populated with blood vessels making its acceptance of neovascularization from a donor bed potentially more challenging. One should avoid using hair-bearing skin for a full-thickness skin graft because the hair follicles are in the deep dermis and will result in inflammation, stone formation, and infection in the reconstructed urethra. This issue is not a concern with split-thickness grafts. An additional type of graft commonly used in reconstructive surgery is full-thickness mucosa. Mucosal tissue differs from skin in that it has the lamina propria as a subepidermal layer. This layer contains primarily connective tissue but also small blood vessels and lymphatics. The thinner this layer is, the easier neovascularization can transpire.[5–8]

HISTORY BEHIND GRAFT USE IN URETHRAL RECONSTRUCTION

There have been a myriad of different types of tissue used for the purpose of graft tissue transfer in urethral reconstructive surgery; some have been more successful than others. A favorable tissue type would include the following characteristics: easy to access and harvest, hairless, durable, viable in a wet environment, and a structure that facilitates neovascularization.[5–8]

Types of tissues attempted for urethroplasty grafts are as follows:

1. Split-thickness skin
2. Full-thickness skin
3. Bladder epithelium
4. Bowel mucosa
5. Oral mucosa

Split-thickness grafts have limited success when used for urethral stricture repair. This limited success is likely due to their higher rates of contracture, resulting in restricture, unsatisfactory cosmesis, diverticulum formation, postvoid dribbling, and ejaculatory dysfunction.[9,10] Full-thickness skin grafts from postauricular skin and the lateral abdominal wall have been described. Although no direct comparison exists and results are mixed, the full-thickness graft seems to be superior to the split-thickness graft. In comparison with mucosal grafts, some have reported higher rates of recurrence,[11] whereas other groups have reported similar rates.[12,13] The use of bladder epithelium was first described by Memmelaar[14] and in the modern era by Ransley and colleagues.[15] Colonic mucosal grafts have been described using both rectum and sigmoid mucosa.[16,17] Because of higher rates of recurrence and sacculation as well as a relatively invasive procurement, this type of tissue is not widely used.

Oral mucosa possesses many of the ideal graft characteristics for urethral reconstruction. From a technical standpoint, it is easily harvested with minimal morbidity. Additionally, its native environment is wet, similar to the urethra. Relative to bladder, rectum, and skin, it has a thick epithelium making it relatively durable and perhaps less prone to contracture or sacculation and has a thin lamina propria making it more receptive to expeditious neovasvularization.[5,6,8]

ORAL MUCOSAL GRAFTS

Target sites of oral mucosal graft include the cheek (buccal), lip (labial), and the tongue (lingual). Of these, buccal mucosa has the largest accessible surface area. Although it is involved in mastication and speaking, it is not as essential as the lip or tongue. Likely as a result, when compared with buccal grafts, labial and lingual have resulted in higher graft site morbidity.[18–20] In addition to favorable postoperative morbidity, the buccal graft contains the following features, making it an ideal candidate for graft tissue:

1. Easy to access and harvest
2. Hairless
3. Durable: full-thickness graft
4. Viable in a wet environment: native environment is the mouth
5. Structure that facilitates neovascularization: thin lamina propria

EVOLUTION OF THE USE OF ORAL MUCOSAL GRAFTS

Although many attribute British surgeon Graham Humby as the first to successfully use buccal mucosa for urethral reconstruction, it was initially described by the Russian urologist Kirill Sapezhko[21] in 1894.[22] Then in 1941, Humby[23] described a technique using buccal mucosa for hypospadias repair. The technique did not gain wide acceptance until the 1980s and 1990s. Although he did not use graft material, Monseur developed a technique in 1980 that laid the