Dorso-lateral Onlay Buccal Mucosal Graft in management of Long Anterior Uretheral Stricture

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Abstract

Management of long anterior urethral strictures is complex and requires careful evaluation. End to end anastomosis is not feasible in reconstruction of long anterior urethra so augmentation urethroplasty is mandatory. Augmentation urethroplasty can be obtained by either flaps or grafts. Graft-augmented urethroplasty requires a healthy recipient bed and adequate urethral plate width. Flap-augmented urethroplasty requires sufficient healthy penile skin.

KeyWords: Graft, Flap Urethroplasty, Long Anterior Uretheral Stricture..

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Introduction.

The flaps used in urethroplasty are random island flaps of penile or scrotal skin based on a dartos pedicle, because there is no specific artery supplying them, thus to keep the skin viable, a large dartos pedicle must be created. Thedisadvantage of using a flap in repair is the long time consumed to harvest the flap and the extensive dissection which is needed. This leads to scarring and loss of the normal shape of the penis when its dartos layer has been redistributed from part or its entire circumference (1).

Grafts are theoretically less reliable because they need to be revascularized. On the other hand, they are easier to harvest and deploy with less time needed for grafting process. (1).

There are multiple short-term and mid-term follow-up series of both grafts and flaps which show no great difference between flaps and grafts regarding restricture rate and therefore unless there is an indication or contraindication for one or the other, the simplicity and speed by which a graft can be harvested and deployed means that the graft urethroplasty is the procedure of choice as far as possible (2).

Indications that prefere use of a flap more than a graft include some conditions of revision surgery; any condition of local devascularization such as radiotherapy or severe peripheral vascular disease; and local infection. All of previous conditions interfere with the ability of a graft to take (1).

The Principles of Grafting:

Graft take occurs in two phases, called imbibition and inosculation, each of which takes about 2 days. The first phase is imbibition in which the graft is kept alive by absorbing nutrients from the plasma oozed from the graft bed. The second phase is inosculation in which the exposed microvasculature of the bed of the graft connects with the microvasculature of the graft undersurface. The process leading to inosculation begins during the imbibition phase, but for the viability of the graft the two phases are separate. By the 5th day after grafting, the graft either shows successful take or sloughs off. For successful take of the graft, it must be kept in close contact with the graft bed, and not exposed to either excessive pressure or hematoma and free of infection (1).

The ideal graft is that which has a dense plexus on its undersurface, to facilitate inosculation. The other advantage of the ideal graft is not to be too thick, to be kept alive during the phases of imbibition and inosculation. Because of these reasons, split-thickness grafts is better than full-thickness grafts. A split-thickness graft is thin and depends for its take on the dense intradermal plexus, which is exposed on its undersurface, while a full-thickness graft is thicker and depends for its inosculation on the sparse subdermal plexus (1).

On the other hand, a split-thickness graft tends to contract because of deficiency of dermal collagen while a full-thickness graft, does not contract because of presence of a normal amount of dermal collagen which inhibits graft contraction. Therefore, if a take is secure, a fullthickness graft is better than a split-thickness graft because it does not contract and thus regains its natural characteristics (1).

Contrary to full-thickness grafts which have a sparse subdermal plexus, genital skin and skin from above the jaw line have dense subdermal plexus. Full thickness grafts from previous sites are also having another advantage being thin when compared with skin from other sites. Therefore skin from above the jaw line or from the genitalia does well as a full-thickness skin graft. The skin from behind the ears (the post auricular graft), buccal mucosa (as a full-thickness graft), and full-thickness grafts of penile and preputial skin have expendable amount within the required limits. (1).

It's better for graft take to be applied as patches to the recipient graft bed while it is difficult to apply graft as a tube because of difficult support of all around the circumference of the tube by the recipient area, leading to compromised graft take (Figure 1). Therefore the re-stricture rate of tube grafts is three times the re-stricture rate of patch grafts at 1–3 years of follow-up. (3)

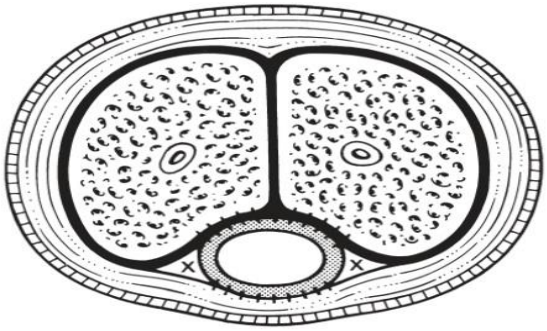

Figure 1: Dorsally and ventrally (hatched areas) of graft are well supported but laterally on each side (X) support is poor (4).

II- Indications for the Use of Oral Mucosa for Urethroplasty (OMU)

Filipas et al, (5) traced the use of oral mucosa as a substitute material in other medical areas to its development and application in urology. In (1993) El-Kasaby et al. (6) reported, for the first time, that the oral mucosal graft from the lower lip was used for treatment of anterior urethral strictures in adult patients without hypospadias. In (1996), Morey and McAninch (7) reported indications, operative technique, and outcome in 13 adult patients with complex urethral strictures in which oral mucosa was used as onlay graft for bulbar urethroplasty. Since that time, oral mucosa has become a popular graft tissue for anterior urethroplasty, done in single or multiple stages(8).

Oral mucosa gained popularity in the field of reconstructive urology as it is available in all patients and easily harvested from the inner side of the cheek with a hidden donor site scar with low postoperative complications and high patient satisfaction. Moreover, oral mucosa is hairless, has a thick epithelium rich in elastin which makes it strong enough to handle, and has a thin and highly vascular lamina propria which enhances imbibitions and inosculation (9).

Surgical treatment of anterior urethral strictures shows a great progress, and significant changes were introduced as dorsal onlay technique known as the Barbagli procedure (10).

The indications are urethral reconstruction for lichen sclerosus (LS) reconstruction of distal penile strictures with involvement of the fossa

navicularis, bulbar urethral strictures not suitable for an end-to-end anastomosis and middle and proximal hypospadias. (11).

Kulkarni described a new approach which is applicable for both bulbar and penile urethra that involve corpus spongiosum dissectin only at one side and preserving lateral supply and which has equal results with better sexual function results (12, 13).

Buccal Mucosal Graft Harvest

Up to 2006, the oral mucosal grafts were harvested from the inner cheek or from the lip. Buccal mucosa is the preferred extragenital donor site used by urologists who perform urethroplasty and gives excellent outcome. The majority of studies in the literature reported the urethroplasty functional results and harvesting techniques with few data about morbidity at the donor site. (14)

Buccal mucosal graft harvesting is an excellent procedure, but it results in long-term oral complications, which are infrequent. The main long-term donor site complications are bleeding, difficulty in opening the mouth, persistent perioral numbness, salivary changes, scarring, and lip deviation or retraction. (15).

The buccal mucosal graft may be used alone or in combination with a tongue mucosal graft or graft from the mucosa of the lip when very long grafts are required. Studies show that harvesting two small grafts from different sites is better than a single long graft from one site regarding donor site's complications (15).

A- The Biology of the oral mucosa:

The depth of oral mucosa is about 500 micrometer. (16). There is a direct association between mucosal thickness and male gender and indirect association with age. (17).

Oral mucosa shows properties of both skin and gastrointestinal tract, as it consists of thick non-keratinized stratified squamous avascular epithelium and slightly vascular underlying lamina propria. (18)

Oral epithelial cells can withstand infection. This is due to the intracellular suppressive activity mediated by polymicrobial flora, production of antimicrobial peptides by the epithelium (e.g. cytokines, defensins, etc) In addition mucosal epithelial cells of the oral cavity decrease colonization of microflora by continued epithelial exfoliation and by a specialized immune system ,called, mucosa-associated lymphoid tissue (MALT). (19)

The lamina propria of a well-defatted oral mucosa graft can be considered a secondary barrier preventing penetration of adjacent tissue layers by microorganisms and has antimicrobial cells including lymphocytes, plasma cells, polymorphonuclear neutrophils, macrophages and mast cells. (18)

Sebaceous glands are located in the lamina propria and are more predominant in labial than buccal mucosa. Immunohistochemical staining reveals that blood vessels and nerve fibers in the submucosa penetrate into the lamina propria and thus provide a mechanism for angiogenesis and revascularization of the tissue when grafting improving raft take. (18)

Oral mucosa is tough and frequently exposed to compression, stretching, and shearing forces. This can be attributed to increase the surface area of the epithelial-lamina propria interface by extensive projections of connective tissue from lamina propria into the epithelial layer, and providing the oral mucosa the ability to resist overlying forces. (18)

The oral mucosa has no muscularis mucosae layer between its epithelium and lamina propria layers. Minor salivary glands, found in the submucosa, and have mucous secreting function and more commonly found in the labial mucosa. (18)

The oral mucosa is architecturally similar to the stratified squamous epithelium of the penile and glanular urethra, making it exceptionally adaptable for urethral substitution. (18)

B- Site conditions contraindicating oral mucosa harvest:

There are several conditions in the oral cavity that would contraindicate oral mucosa harvest

(leukemia , pemphigus vulgaris, mucous membrane pemphigoid, erythema multiform, oral lichen planus and recurrent aphthous stomatitis and mucositis associated with head and neck radiation, chemotherapy or cancer surgery (20). History of heavy smoking indicates careful examination of the oral mucosa for dysplastic change because smoking is highly associated with malignancy. (21)

The condition of oral mucosa can be affected by medication, herbal supplements, or vitamins. Patients on NSAIDs, anticoagulants, antithrombotic therapy, and herbal supplements such as ginger and garlic are at risk for increased bleeding at the harvest site. Medications directly affecting the oral mucosa causing lichenoid lesions or erythema multiforme include clindamycin, Ibuprofen, barbiturates, and Captopril. In addition, ACE inhibitors, angiotensin receptor blockers, and NSAIDs are associated with angioedema of the oral mucosa. These conditions contraindicate oral mucosa harvest. (21)

C- Surgical Technique for oral mucosa harvest:

It's better to have two teams of surgeons for concurrent oral mucosal graft harvesting and urethroplasty. A two-team approach reduces lithotomy and general anesthesia time. (7).

1. Anesthesia:

For oral mucosal graft urethroplasty, nasal or oral endotracheal intubation anesthesia is used for harvesting the graft from the oral cavity. (22).

A surgical team approached to the urethral stricture region through perineal incision while the patient was in the lithotomy position, and another team prepared the oral cavity for harvesting of BMG. Following determination of the length of the stenotic urethral segment, graft harvesting region was marked from 1.5 cm medial to the commissure, and 1 cm below the Stensen duct, and fixated with two suspension sutures. To avoid trauma to the cheek muscles, and facilitate dissection, adrenaline diluted (1/100,000) with saline solution was injected in situ. Always a BMG 2 cm longer than required was harvested with sharp dissection. After accurate haemostasis with bibolar electrocautery the donor site either closed with continuous 4/0 vicryl sutures or left open to heal by secondary intention. Compression gauze soaked with diluted adrenaline was left in situ and removed in the recovery area. All patients used oral mouth- washes containing 0.15 g benzydamine hydrochloride solution 3 times daily for 3 weeks. The graft is pinned out and defatted/thinned on the back table. It is kept in saline until the time of implantation.

History of urethroplasty

Urethral strictures have always been common. Urethral dilators dating to 3000 BC have been found in the tombs of pharaohs to allow them to dilate their strictures in the afterlife. The ancients knew that having a stricture meant having it for life, even if treatment was only occasional, but only recently has this idea been given an evidence base (23).

Since 1909, a large variety of free extragenital graft tissues have been used for urethroplasty, such as the ureter, saphenous vein, appendix, full-thickness skin, bladder mucosa and buccal mucosa (24).

In (1941) Humby (25) really began Substitution urethroplasty. He used full-thickness skin grafts for urethral reconstruction, hypospadias, and urethral strictures and also described the first recorded case of buccal mucosal graft urethroplasty. After him, sporadic cases were reported in the British, European, and American literature. By the mid-1960s grafts were in regular use for urethral reconstruction for both hypospadias and strictures. The foremost proponents were Devine and Horton, (26) from Norfolk, Virginia, USA. They and others continued with graft repairs into the 1970s, but by then Yaxley, (27) and others began developing flap repairs. Most notable were Turner-Warwick, (28) and Blandy, (29) for the repair of urethral strictures in adults and Duckett, 1980 for the repair of hypospadias in children (30). The penile and scrotal skin was used almost exclusively in the past for urethroplasty, but the high failure rate (20%-30%) necessitated the search for a better tissue (2).

The prevailing view seemed to be that a flap was more reliable because it carried its own blood supply. Quartey (31) studied the vascular basis of flap repair and through the 1980s and early 1990s flap repairs dominated genital reconstructive surgery.

In (1980) Monseur (32) described a new urethroplasty that involved opening the dorsal urethral surface and fixing the urethra over the corpora cavernosa, and leaving a catheter in place for a long period of time so as to obtain regeneration of the urethral mucosa. In (1976) Devine et al. (33) described the use of a full thickness skin graft in urethroplasty.

Bladder mucosal free grafts have been used as tubes or patches for reconstruction of difficult hypospadias and urethral stricture disease (34). However, harvesting requires an additional suprapubic incision, bladder dissection, and cystotomy which increase the morbidity significantly in addition to high failure rate of 12% at 28 months (35). In (1992) Bürger et al. (36) rediscovered BMG as a substitution tissue. In the same year Dessanti, et al (24) and El- Kasaby, et al (6) reported the first good results of the application of a free BMG for hypospadias and urethral strictures. Since 1998, buccal tissue has become the preferred choice for urethral augmentation (37).

This led to a resurgence of interests in graft repairs – whatever the material used – so at the beginning of the 21st century, free grafts have regained their place in the reconstructive urologists' armamentarium.

Barbagli et al (38) introduced the concept of dorsal BM graft placement during urethral reconstruction, and some authors hypothesized that this approach might result in superior results compared with ventral grafting. It has become clear over time, however, that both techniques provide similar excellent outcomes and the two procedures are complementary and should be selected based upon stricture location and the condition of the corpus spongiosum at the time of surgery (39).

Complications of Urethroplasty

1. Recurrence
2. Urine Leak
3. Fistula
4. Urethral sacculation
5. Post-void Dribbling
6. Urinary Tract Infection (UTI)
7. Erectile Dysfunction (ED)
8. Complications of Patient Positioning
9. Oral Complications (40).

1. Recurrence

When using grafts, oral mucosa grafts may result in lower restricture rates then skin grafts. (41). Though the location of the graft placement, dorsal or ventral or lateral, seems not to affect success. (42). Strictures after graft or onlay flap urethroplasties tend to occur as short rings at the proximal or distal extent of the repair, a condition named “fibrous ring” (43).

Short recurrent strictures may be treated successfully by visual internal urethrotomy; longer strictures resulting from graft or flap failure may require repeated urethroplasty or perineal urethrostomy. (44)

Authors believe that a common reason for urethroplasty failure is underestimation of the true extent of the urethral stricture disease leaving parts of the diseased urethra untreated. Therefore several measures should be used to minimize the chance of urethroplasty failure. These include careful preoperative assessment of the urethra with urethrography and cystoscopy to better plan the surgery in advance. Intraoperatively, the urethra proximal and distal to the stricture is assessed by flexible urethroscopy and calibrated to 30 Fr with bougie a boules Suspicious areas (white and blanched mucosa) are incorporated into the repair. When performing urethroplasty, the urethra should be opened generously proximally and distally into apparently healthy urethra to minimize the chance of missing a region of occult urethral disease. (40)

2. Urinary leakage

Urinary extravasation at the time of the postoperative urethrography after removing the urethral catheter has been reported after anastomotic urethroplasty in 1–4 % of patients (45) and in 0–25 % of buccal graft urethroplasties. These "leaks" typically resolve after an additional time of catheter urinary drainage. (46)

3. Urethral fistula

Fistulae occur very rarely after bulbar urethroplasty, as the bulbospongiosus muscle and thick perineal subcutaneous layers intervene between the bulbar urethra and the perineal skin. Fistulae are much more common after reconstructions involving the penile urethra. This is obviously due to the thin or even lack of tissue layers between the penile urethra and penile skin. (40)

Two techniques frequently used for penile urethral reconstruction are the fascio-cutaneous flaps (skin island flaps) and the staged graft urethroplasty (buccal mucosa or split thickness skin grafts). Fistula can occur in up to 20 % of cases of fascio-cutaneous onlay urethroplasty (45) and in up to 10 % after one or two stage buccal urethroplasty (47). Care must be used when developing the vascular pedicle. Delicate handling of the flap is important to avoid devitalization and fistula formation. Avoidance of overlapping skin and urethral suture lines as much as possible is important to avoid fistula formation. (40)

Postoperative erections may also play a role in fistula formation. Some reported that fistulas are less common when monofilament sutures (PDS) were used (48), however other studies failed to confirm this advantage.(49). Fistula formation is less common if additional tissue layers are used to cover the suture line, such as Dartos flaps or tunica vaginalis flaps.(50). It is thought that fistula formation is due to necrosis of the skin, the intervening tissue and the graft and due to wound infection or dehiscence. (51)

Fistulae are more common in ventral graft urethroplasty in comparison to dorsal graft urethroplasty. Small fistulae may heal spontaneously with prolonged catheter drainage and strict skin wound care. Established fistulae usually require multilayer fistula closure, 6-12 months later. Strictures distal to the fistula must be treated carefully. (52)

4. Urethral sacculation

Sometimes, urethral sacculation occurs after buccal graft urethroplasty, but rarely it results in bothersome post micturition dribbling while when become large enough, it is labeled a urethrocele or diverticula (42). Sacculations, however, are less common after dorsally placed BMG. In (2003) Elliot et al. (53) reported the importance of proper tailoring of ventrally placed buccal grafts. Additionally, adequate closure of the adventitia of the corpora spongiosum (spongioplasty) over the graft will provide backing and further decrease this complication.

5. Post voiding dribbling

Incidence of post micturition dribbling is underestimated in the literature, as many authors didn't consider it as a complication or even ask their patients about it. Some patients, however, perceive post micturition dribbling and associated semen sequestration as bothersome. Many patients complaining of urinary incontinence after surgery actually have instead significant post micturition dribbling, as actual stress urinary incontinence is very uncommon after urethral surgery. (40)

There are various explanations for post micturition dribbling and semen sequestration after urethroplasty such as loss of urethral elasticity, loss of continuity of the corpus spongiosum, urethral diverticula or sacculation, and loss of the efficiency of the bulbospongiosus muscle contraction. It is important to note that the appearance of dribbling may also indicate recurrence of a urethral stricture. (40).

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