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Graft procedure on urethroplasty, in comparison with flap procedure: A literature review



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Gede Wirya Kusuma Duarsa,^{1*} Putu Kurnia Darma Pratama,²
I Made Nugraha Gunamanta Sabudi,² Donny Oktavius³

ABSTRACT

Urethroplasty is a surgical procedure to reconstruct urethral patency on urethral stricture. There are several options for repairing urethral stricture in general, one of the examples is using graft or flap for augmentation urethroplasty. The indications of augmentation urethroplasty with graft are bulbar or penile urethral stricture, risk of tension on urethral anastomosis, and stricture more than 1 cm. Graft is less reliable because it has to be revascularized, easier to harvest, on the other hand flap has generous blood supply, but it was time-consuming to collect and to dissect. In case of bulbar urethral stricture with intact corpus spongiosum, graft had more advantages rather than flap because the anatomy of the urethra moves proximally

giving thicker and more robust ventrally, and makes the graft suitable on vascular bed. Plenty of sites can be used to harvest graft for urethroplasty, there are buccal mucosa, genital skin, extragenital skin, lingual mucosa, bladder mucosa, and colonic mucosal graft. Although the treatment of urethroplasty depends on the length and location of stricture until today the comparison between the use of graft and flap in urethroplasty is still controversy and under debate. Some studies reported higher success rates in grafts than flaps procedure, but only few studies showed statistically significant difference. However, grafts procedure is easier, less operative time, and less morbidity, therefore leading to satisfaction in most of the patients.

Keyword: urethroplasty, buccal mucosal graft, penile skin flap, urethral stricture

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¹Department of Urology, Faculty of Medicine, Universitas Udayana-Sanglah General Hospital, Denpasar, Bali, Indonesia

²Faculty of Medicine, Universitas Udayana, Denpasar, Bali, Indonesia

³Faculty of Medicine, Universitas Kristen Krida Wacana, Jakarta-Indonesia

INTRODUCTION

A surgical procedure that used to reconstruct urethral patency on urethral stricture is called urethroplasty. Urethral stricture could cause by some of the etiologies that varies to which part of the anatomy involved. Repairing urethral stricture gave some treatment options depend on some indication such as stricture location, length of stricture, surgeon preferences and experiences. One of surgical procedure used to repair urethral stricture was graft urethroplasty reconstruction.¹

Urethral Stricture

Urethral stricture is an abnormal narrowing of the urethra caused by fibrosis of corpus spongiosum.² Etiology of urethral stricture, in general, are idiopathic, traumatic, inflammatory or iatrogenic.³ Male urethra has 20 cm in length that composed into posterior and anterior part that could located anywhere depend by the aetiology (Table 1).

Urethral stricture evaluation assessed by clinical manifestation present mostly voiding LUTS such as feeling incomplete emptying with or without hematuria, urinary tract infection and sometimes experience with post micturition dribbling. Objective parameter evaluation then planned such as (1) uroflowmetry to validate objective maximum urinary flow (Q_{max}), (2) retrograde urethrography

to provide information of stricture location, length and pathological possible happened (diverticulum, fistule, false passage), (3) cystourethroscopy to clearly confirm location and degree of urethral stricture and evaluate follow up patient undergoing urethroplasty, (4) further imaging kind of CT Scan and MRI if conventional imaging modalities couldn't help.³

Urethral stricture treatment approach grouped to posterior urethral stricture and anterior urethral stricture. There are many options of urethroplasty depend on cases. Posterior urethral stricture urethroplasty approach to Pelvic Fracture Urethral Injury (PFUI) case could do early by expert hand on acute phase by endoscopic guided catheter realignment, in other hands if PFUI treatment were delayed to chronic stable phase, urethroplasty done by creating bulbo-membranous anastomotic with perineal approach. Other common posterior urethral stricture case was iatrogenic to bladder neck stenosis due to Transurethral Resection of Prostate (TURP) that need to do urethroplasty with Vesico Urethral Anastomotic Stenosis (VUAS) approach.³

Anterior urethral stricture group treatment approach more varies. It could done by Direct Visual Internal Urethrotomy (DVIU) or Sachse. DVIU usually used if the stricture just single and short on bulbar with <1 cm length. Other

*Correspondence to:

Gede Wirya Kusuma Duarsa,
Department of Urology, Faculty of
Medicine, Universitas Udayana-
Sanglah General Hospital, Denpasar,
Bali, Indonesia
gwkduarsa@gmail.com

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consideration of cost-effective still use DVIU as treatment option of <2 cm length of stricture until it had one failed, then urethroplasty option needs to do. As a gold standard of urethroplasty was Excision and Primary Anastomosis (EPA) in maximal taking 2 cm of urethra. If it takes more than 2cm in length augmentation urethroplasty will be needed to free tension of anastomosis and avoid chordee. When do the augmentation urethroplasty sometimes it needed repair with mucosal graft.³

Type and Site of Harvesting Graft

Trauma, iatrogenic injury, lichen sclerosis, or prior urethral surgery which all causes of a stricture, have the potential to form long, complex strictures that need extensive reconstruction. Cause of the stricture, location, length, and the surgeon preference and experience level are leading to treatment selections, which can be done by doing grafts or flaps tissue transfer.^{1,4}

Tissue that is transferred with its native blood supply intact, while a graft refers to tissue removed from its donor site without its native blood supply and relies on establishing new circulation through a process termed “take” is referred as a flap. This process consists of two separate 48-hour phases: imbibition is the initial phase in which the graft is directly absorbing nutrients from the graft recipient bed; this is followed by inosculation, during which new blood supply is established.^{1,4}

Places a premium on buccal mucosa grafts, but additional grafts are available to use as an alternative or adjunct in complex cases are current practice of urethral reconstruction, particularly pan-urethral strictures, recurrent strictures when buccal mucosa has been previously harvested, or in patients in whom retrieval of oral mucosa is contraindicated.^{1,4,5} Alternate graft options include lingual mucosal grafts, bladder epithelium, colonic mucosa, and tissue-engineered grafts, which can all be used for urethroplasty in complex cases.^{1,4,5,7}

Buccal Mucosal Graft

The oral mucosal graft (BMG) is the current gold standard for augmentation urethroplasty. BMG has strong microvascular tissue that produces better circulation. Also buccal mucosa is readily available, strong, and resists from infection. BMG is harvested from the inner cheeks or the inner lip and has been successfully used to repair urethral abnormalities up to 17 cm long.^{1,5} Care must be taken to avoid Stensen’s duct and not to get too close to the lip, to prevent mouth contractures. Morbidity in BMG harvest is minimal, with a complication rate reported at 3%–4%. The most common complications include donor site scarring, perioral sensory defect and jaw opening impairment.^{1,4,5}

Genital Skin

Either a flap or graft deployed from penile skin, which achieves similar efficacy for urethral reconstruction. Regarding on this, there is less morbidity with the use of grafts, that is, reduced penile skin necrosis and penile torsion. In the era of buccal mucosa urethroplasty, genital skin grafts are less commonly used, but they still play a key role in urethral reconstruction. Penile skin has the benefits of being elastic, well-vascularized tissue without hair.¹

Extragenital Skin

Postauricular skin can serve as an alternative full-thickness graft when oral mucosa and genital skin are inadequate or unavailable for urethroplasty. The best tissue for harvest is located along the lower half of the mastoid and posterior to the tragus, which can yield a graft measuring up to 8 cm from each side.

Abdominal skin can also provide full-thickness skin graft for urethral reconstruction. Optimal abdominal skin is located along the flank and lower abdomen, where there are fewer hair follicles. This graft also should be used for patients who have no signs of lichen sclerosis and who do not have adequate oral mucosa. But further studies are needed to elucidate the role of abdominal

Table 1 Epidemiology characteristic of aetiology and anatomic urethral stricture

	Penile (n,%)	Bulbar (n, %)	Panurethral (n, %)	Posterior (n, %)
Prostatectomy	0	3 (2.33)	1 (2.78)	5 (12.50)
Perineal trauma	0	6 (4.65)	0	0
Urethral catheterization	9 (14.29)	13 (10.08)	9 (25.00)	0
Idiopathic/unknown	13 (20.63)	62 (24.06)	5 (13.89)	0
Transurethral resection	7 (11.11)	32 (24.81)	9 (25.00)	4 (10.00)
Hypospadias	18 (28.57)	5 (3.88)	2 (5.56)	0
Pelvic fracture	0	0	1 (2.78)	29 (72.50)
Urethritis	1 (1.59)	6 (4.65)	3 (8.33)	0
Lichen sclerosis	10 (15.87)	0	3 (8.33)	0
Cystoscopy	0	1 (0.78)	2 (5.56)	0
Tumour	3 (4.76)	0	1 (2.78)	0
Penile fracture	2 (3.17)	1 (0.78)	0	0
Brachytherapy	0	0	0	2 (5.00)
Total	63	129	36	40

skin grafts as stand-alone or combination grafts in urethral reconstruction.¹

Lingual Grafts

The biological qualities of oral mucosa, including adaptation to a fluid environment and relative resistance to lichen sclerosus, make it ideal for augmentation urethroplasty. Clinical data regarding lingual mucosa grafts are not as extensive as for buccal mucosa, but the similar anatomic and physiologic characteristics make lingual grafts similarly appealing. Both grafts display a thick epithelial layer with thin lamina propria and a robust, pan-laminar vascular bed, which facilitates graft take and minimises contracture. Because of the similar architecture, lingual mucosa can serve as an ideal substitute when buccal mucosa has already been harvested or as an additional graft for repair of long defects (6-20 cm).^{1,5,7}

Urethral reconstruction with lingual grafts can be performed in the same manner as any urethral reconstruction; with both one-stage (dorsal onlay, dorsal inlay, ventral onlay) or 2-stage approaches a viable option. Lingual mucosa grafts can be especially useful in patients with lichen sclerosus, who are prone to long and recurrent strictures. Some pan-urethral strictures are longer than the available buccal mucosa is able to repair, whereas others will have recurrence of their stricture after bilateral buccal graft urethroplasty and need subsequent reconstruction.^{1,5}

Although lingual mucosa has notable positive characteristics, its use does may cause appreciable patient morbidity. Several studies have specifically investigated postoperative pain and disability at the harvest site. Pain in the mouth was mostly limited to the first 1 to 2 days, and all patients were pain-free by postoperative day 6. As would be expected, bilateral lingual graft harvest caused a slight increase in postoperative pain. Also of note, harvest of lingual grafts longer than 7 cm or bilateral grafts were more likely to cause long-term speech changes.^{1,5}

Bladder Mucosal

Bladder mucosa may be harvested to create a graft that has most commonly been used for hypospadias repair. The graft is rarely used because of the invasive harvest, which is accomplished by an open bladder dissection, in addition to frequent stricture recurrence. Meatal problems are reported in 68% of patients, and repeat procedures are required in two-thirds of patients to achieve successful results.¹

Colonic Mucosal

Colonic mucosa has recently gained attention as a tissue source for long segment urethral strictures. To save urethroplasty, they used the transanal



Figure 1 Colonic mucosal graft

endoscopic microsurgical technique (TEM) to harvest colonic mucosa without bowel resection (Figure 1).¹ The TEM technique is able to reach the tissue 20 cm above the anal verge and, thus, is ideally suited for harvest of long graft segments.^{1,5,7}

Comparison studies between grafts and flaps in urethroplasty

The use of graft versus flap in urethroplasty is still controversy and under debate. The current literature does not clearly support the use of one procedure over the others, because some of the studies compare a non-homogeneous series of patients and stricture disease.

Syed et al. in a prospective 5 years follow up study between dorsal onlay free graft buccal mucosal urethroplasty and penile circular fasciocutaneous skin flap urethroplasty, showed that buccal mucosal graft urethroplasty had slightly better 5 years overall success rate (84%) than circumferential penile skin flap (75%) irrespective of age, aetiology, and stricture length.⁸

Soliman et al. in a prospective randomized study, compared the use of buccal mucosal graft (BMG) and penile skin flap (PSF) in management of long anterior urethral strictures, with dorsal onlay urethroplasty technique, showed the success rate was higher in the BMG than in the PSF group (89.5% and 83.3%), but there is no statistically significant different. The mean operative time was significantly shorter in the BMG than in the PSF group. In 6 months of urethroplasty, patient satisfaction was statistically significantly higher in the BMG than in the PSF group, because of its less postoperative morbidity.⁹

Hussein et al. in a prospective randomised study, compared between the use of penile skin graft and penile skin flap in long bulbo-penile urethral Stricture, showed both penile circular graft and flap had similar and high success as a ventral onlay to repair of long bulbo-penile stricture with a low rate of complications at intermediate follow-up.

Operative time was significantly shorter in graft than in flap (203.3 minutes and 281.6 minutes, $P = 0.00$). Early postoperative complications were similar in both groups.¹⁰

Barbagli et al. in retrospective analysis compared between graft and flap in one-stage penile urethroplasty, concluded that grafts have a higher success rate (80%) than flaps (67%). The use of oral mucosal grafts (82%) and skin grafts (78%) was not clinically significant.¹¹

Dubey et al. in a randomised prospective study comparing dorsal onlay BMG urethroplasty and penile skin flap urethroplasty, reported that success rates at two-year follow-up were slightly in favour of BMG (89.9% vs 85.6%), but the difference was not statistically significant. Dubey and his group found that buccal mucosal graft had significantly less operative time than penile skin flap in repair of anterior urethral stricture in their comparative (162 minutes vs 224 minutes; $p=0.001$). In this study concluded that penile flap procedures are technically complex, associated with higher morbidity and less preferred by patients compared with buccal mucosa graft.¹²

Hosseini et al. in comparative study of long term results of buccal mucosal graft and penile skin flap techniques in the management of diffuse anterior urethral strictures (>3 cm), showed BMG were better than PSF (93.9% vs 83%), this difference was not statistically significant. However, BMG is better than PSF in cosmetic aspect and the scar of genital site.¹³

Wessell and McAninch, reviewed the average of success rates between free graft and pedicled skin flap for urethroplasty in some literatures, and concluded that the success of free grafts and flaps are 84.3% and 85.9%.¹⁴

Alsikafi et al. compared the outcome of oral graft and penile skin graft urethroplasty. The study concluded that penile skin and oral mucosa are both excellent materials for substitution urethroplasty, with a comparable success rate (84% vs 87%), though penile skin appears to have a longer follow-up.^{1,15}

CONCLUSION

Graft urethroplasty is a surgical procedure to repair urethral stricture at any cause of aetiology. Sites of harvesting graft are optional, most of surgeons preferred to use the buccal mucosal graft as the most favourite option, although the other harvesting site such as genital skin, extragenital skin, lingual, bladder and colonic mucosal still had good result as the option when buccal mucosal graft couldn't be harvested. The comparison between grafts and flaps in some studies concluded higher success rates in grafts than flap procedure, but only few studies showed statistically significant difference. However, grafts procedure is technically easier, takes less operative time, and less

morbidity, therefore leading to satisfaction in most of the patients. More prospective studies about graft and flap procedure are needed to conclude which is the best procedure in urethroplasty.

CONFLICT OF INTEREST

The author declares there is no conflict of interest regarding publication of current review.

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