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# Retrospective outcome analysis of urethroplasties performed for various etiologies in a single South African center

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## Abstract

**Objectives:** To compare the results of anastomotic versus augmentation urethroplasty (buccal mucosa graft (BMG) onlay), as well as dorsal versus ventral BMG techniques.

**Methods:** A retrospective audit of 69 patients who underwent urethroplasty at Eersteriver Hospital in Cape Town, South Africa between October 2004 and July 2011 was undertaken. Analysis included stricture etiology, location and length, type of surgery performed as well as complication rates over the follow-up period.

**Results:** The predominant stricture etiologies were traumatic and infective causes (55%), with a mean stricture length of 3 cm (0.5–15 cm). Forty two patients had bulbar urethra strictures (61%), with 8 (11%) located in the posterior, and penile & bulbar regions, respectively. The remaining strictures were located in the penile urethra (16%). Surgery performed included bulbar (12) and membranous anastomotic (8) urethroplasty, ventral (13) and dorsal (22) buccal mucosa onlay grafts (BMG), and 2-stage urethroplasty (14). Overall stricture recurrence was seen in 9 patients (13%), including 1 patient (8%) of the anterior end-to-end anastomotic group compared to 2 patients (6%) of the onlay BMG group ( $p = 0.77$ ). The re-structure rates were 5% and 8% in the dorsal (1/22) and ventral BMG onlay groups (1/13), respectively ( $p = 0.72$ ).

**Keywords:** Urethral stricture; Urethroplasty; Buccal mucosa graft

**Conclusions:** Both anastomotic and BMG onlay techniques are safe and effective surgical options. Similar outcomes were demonstrated between ventral and dorsal BMG onlay groups.

## Introduction

Open urethroplasty has become the gold standard for definitive treatment of urethral strictures [1]. It demonstrates a high success rate (up to 95%) compared to alternative treatments such as direct visual internal urethrotomy (DVIU) and dilatation, both of which show long-term recurrence rates of over 50% [2]. Many urological surgeons still believe reconstructive urethral surgery should only be offered as a last resort. However, urethroplasty has become safer, more successful and cost-effective [3,4].

Although much has been written on the various techniques used to reconstruct the urethra, there is little evidence comparing the outcomes of the different approaches. There are also no clear data to establish which type of urethroplasty to perform under which particular condition, with the exception of open perineal end-to-end anastomosis for the treatment of simple bulbar strictures [5,6]. Factors such as etiology, stricture length, stricture location and intraoperative findings determine which procedure is used [7]. There is also scant published evidence regarding which type of urethroplasty has the greatest efficacy.

The aim of this study was to compare the effectiveness of the various urethroplasty procedures, with specific focus on anastomotic versus augmentation (buccal mucosa graft (BMG) onlay) urethroplasty for bulbar strictures, and the outcomes of dorsal versus ventral placement of the BMG.

## Subjects and methods

A total of 69 patients (age range 19–82 years) had a urethroplasty at Eersteriver Hospital, attached to the University of Cape Town, South Africa, between October 2004 and July 2011 (82 months). Stricture location and length were evaluated with a pre-operative micrurating cystourethrogram (MCUG) as well as intra-operative findings. Five different surgical techniques were used: bulbar and membranous end-to-end anastomosis, ventral and dorsal buccal mucosa graft (BMG) onlay urethroplasty, and 2-stage Johansson urethroplasty. The choice of procedure was made according to the stricture length and location, patient factors, previous surgical attempts, and surgeon preference (in the BMG group only). Surgeries were performed by registrars and newly qualified urological surgeons under the guidance of an experienced consultant. The post-operative follow-up protocol was to see the patients at 3 weeks for removal of the catheter, then at 1 month and biannually thereafter.

Patients' records were retrospectively reviewed. Data were collected on stricture etiology, location and length, type of surgery performed, early and late complications and restriicture rates over the follow-up period, as well as the need for repeat surgery. Data were analysed using the Chi-square test.

**Table 1** Stricture etiology.

Etiology	Number	Percentage
Trauma	23	33%
Iatrogenic	18	26%
Infection	15	22%
Unknown	13	19%

**Table 2** Location of strictures.

Location	Number	Percentage
Posterior	8	11.5%
Penile	11	16%
Bulbar	42	61%
Penile and bulbar	8	11.5%

## Results

Stricture etiology is shown in Table 1. Mean stricture length was 3 cm (range 0.5–15 cm). Stricture location is shown in Table 2. The type of urethroplasty performed is shown in Table 3. One membranous end-to-end anastomotic urethroplasty was abandoned intra-operatively due to bone occluding the posterior urethra (after a motor vehicle accident). Twenty (29%) patients had unsuccessful dilatations and/or DVIU as initial treatment.

Mean follow-up was 28 months in the anterior and posterior end-to-end anastomotic groups, 18 months in the dorsal BMG onlay and 2-stage groups, and 13 months in the ventral BMG onlay group. Early complications occurred in 26 patients (38%) and late complications occurred in 18 (26%). The most common early complication was wound sepsis, with 15 patients (22%) affected. The majority settled with oral antibiotics and local wound care, and hospital stay was generally not affected adversely (Clavien Grade 2). The most common late complication was stricture recurrence, with 9 patients (13%) affected, the majority being in the membranous end-to-end anastomotic group. One patient of the anterior end-to-end anastomotic group (8%) had stricture recurrence, with 2 (6%) stricture recurrences seen in the BMG onlay group collectively. Specifically, 1 stricture recurrence was seen in each of the dorsal and ventral BMG onlay groups (5% vs 8%), with a single urethral diverticulum in the ventral BMG onlay group.

**Table 3** Types of urethroplasty performed.

Type	Number	Percentage
Bulbar anastomotic	12	17%
Membranous anastomotic	8	12%
Ventral buccal mucosa graft (BMG)	13	19%
Dorsal BMG	22	32%
2-Stage	14	20%

Two-stage Johansson-type urethroplasty was performed in 13 patients (18%). Major complications were recurrent stricture in 3 (23%) and urethrocutaneous fistula in 2 (15%).

Six patients with stricture recurrence were initially managed with urethral dilatation and/or DVIU, and successfully treated patients were advised to continue regular self-dilatation. Open surgical interventions included repeat onlay BMG urethroplasty (1 patient), staged procedures for failed posterior end-to-end anastomotic urethroplasty (2 patients), and repeated 1st stage urethroplasty (3 patients) (Clavien Grade 3b).

## Discussion

Urethral stricture disease has been known since antiquity, with the use of a reed for urethral dilatation described in Egypt as early as 1700 BC [8]. Despite these ancient descriptions, the modern management of strictures remains a dilemma. The longterm success of open urethroplasty ( $\pm 95\%$ ) compared to dilatation or DVIU ( $< 50\%$ ) is well established [1,2]. The superiority of open urethroplasty is confounded by the many open techniques described. Zimmerman and Santucci have proposed a simplified and unified approach whereby all strictures can be managed with only three surgical techniques: anastomotic urethroplasty, BMG onlay urethroplasty and two-staged Johansson urethroplasty [9].

Excision and spatulated end-to-end anastomosis is regarded as the gold standard for the treatment of single, short, uncomplicated bulbar strictures, as well as more complex posterior urethral strictures. Eltahawy et al. studied the long-term complications of 260 patients who all underwent end-to-end anastomosis for bulbar urethral strictures with an average length of 1.9 cm, in which they reported an astonishing success rate of 98.8% [10]. In a series of more than 160 patients who underwent end-to-end urethroplasty performed by McAninch and associates, the reported success rate was 95% [11]. In our series bulbar (anterior) and membranous (posterior) anastomotic urethroplasty accounted for 12 (17%) and 8 (12%) patients, respectively. Recurrent strictures were seen in 1 of 12 anterior and 3 of 8 posterior urethroplasties, with success rates of 92% and 63%, respectively.

Although the anastomotic technique is highly effective, its use is limited by the length of the stricture, and it is not recommended for bulbar strictures  $> 2$  cm and penile strictures  $> 1$  cm in length. In this setting Andrich and Mundy recommend substitution urethroplasty [12]. Barbagli's description of substitution urethroplasty requires excision of the strictured urethral segment, either partly or wholly, and replacing it with another appropriate tissue such as local preputial skin flaps or free grafts, typically a BMG. Buccal mucosa epithelium is thick, pliable, tough and easy to manage [13]. Harvesting the graft is straightforward. Additionally, the donor bed heals quickly with minimal morbidity and no need for suturing [14,15].

BMG was the most common urethroplasty technique in our series, with 35 patients (51%) undergoing the procedure. BMG onlay urethroplasty has become our favoured technique for all but the simplest bulbar stricture (where end-to-end anastomosis was performed). The outcomes from this large BMG onlay group were good, with only 2 of 35 (6%) patients presenting with stricture recurrence. No donor site complications were reported.

In our series 22 (63%) BMG were placed dorsally, while 13 (19%) were placed ventrally. The re-stricture rates were similar (5% vs 8%,  $p = 0.72$ ), with a single stricture recurrence in each group. However, it must be noted that the follow-up period for the dorsal BMG group was longer (18 vs 13 months).

Barbagli et al. first proposed dorsal onlay BMG for augmentation urethroplasty in 1996 [16]. While dorsal only BMG has become more popular, its superiority over the potentially simpler ventral procedure is debated. In a systematic review Mangera et al. found no difference between the success rates of dorsal and ventral onlay procedures (88% for both techniques) [7].

Membranous urethral strictures are typically due to urethral rupture following pelvic fracture. Our practice for such patients is to divert the urine via a suprapubic catheter followed by delayed urethroplasty. A recognised alternative is endoscopic primary realignment. The use of endoscopic skin-graft urethroplasty has previously been described with good outcomes [17].

The etiological factors in this patient series from a developing country make for interesting comparisons. Lumen et al. reported that in developed countries strictures are of an iatrogenic origin in about half of the patients [18]. In South Africa, by contrast, the incidence of sexually transmitted infections is high, as is the burden of trauma. In this study traumatic and infective causes accounted for over 50% of the documented stricture etiology.

This study has some limitations. The study group is heterogeneous in terms of stricture etiology and characteristics, and the follow-up was short and varied between the dorsal and ventral onlay BMG groups.

## Conclusion

Due to the heavy burden of urethral stricture disease in a resource limited country like South Africa, safe and efficient corrective surgical techniques are of the utmost importance. Our results compare satisfactorily with international publications, with an 8% stricture recurrence rate in the anterior end-to-end urethroplasty group, and 6% in the BMG onlay group. This difference in outcome was not statistically significant ( $p = 0.77$ ).

We did not find a significant difference between the complication rates in our ventral and dorsal BMG groups, taking into account the limitations mentioned above, and therefore we conclude that both onlay techniques are safe and effective surgical options.

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