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Original article

The Treatment of Complex Urethral Strictures Using Ventral Onlay Buccal Mucosa Graft or Ventral Onlay Penile Skin Island Flap Urethroplasty: A Prospective Case Series

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ABSTRACT

Objectives: To compare the outcome of free onlay Buccal Mucosa Graft (BMG) with onlay penile Skin Island Flap (SIF) urethroplasty in the treatment of complex urethral strictures.

Patients and Methods: A prospective comparative study was conducted at the Universitas Academic Hospital in Bloemfontein, South Africa. Patients presenting with complex urethral strictures were allocated to receive either ventral onlay penile SIF urethroplasty or ventral onlay BMG urethroplasty. A complex urethral stricture was defined as a stricture length of more than 2.5 cm or previous failed procedures, including urethral dilatation, internal Optical Urethrotomy (OU) and urethroplasty. Successful treatment outcome or cure was defined as no further treatment of the urethral stricture required after urethroplasty. Statistical analysis was performed with the t-test or chi-square test as appropriate.

Results: BMG and SIF urethroplasty were performed on 18 and 17 patients, respectively. The mean age of the patients was 49.1 years (range 21–77) for the SIF group and 44.3 years (range 27–73) for the BMG group (p= 0.28). The mean urethral stricture length in the BMG group was 2.9 cm (range 2.4–4.0) and 4.5 cm (range 2.4–7.0) in the SIF group (p= 0.002). The urethral stricture site was bulbar in 67% in the BMG group and 59% in the SIF group. The cure rate was 11/17 (64.7%) for the SIF group and 13/18 (72.2%) for the BMG group (p= 0.63).

Conclusions: No statistically significant difference in outcome between BMG and SIF urethroplasty was observed. However, given the longer operation time and more extensive surgical dissection of SIF reported in other studies, we recommend onlay BMG urethroplasty for the treatment of complex strictures.

Key Words: Urethral stricture, Urethroplasty, Buccal mucosa graft, Skin island flap

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INTRODUCTION

In the Department of Urology at the Universitas Academic Hospital in Bloemfontein, South Africa, a complex urethral stricture is defined as more than 2.5 cm in length or failed previous procedures, including urethral dilatation, internal Optical urethrotomy (OU) and previous urethroplasty. Complex strictures usually require some form of substitution urethroplasty[1]. Urethral stricture disease affects mainly the anterior urethra and is a scarring process that involves the urethral epithelium and corpus spongiosum. The most common etiology of stricture disease in South Africa is previous gonococcal urethritis[2].

Urethral reconstruction remains an evolving art and numerous reconstructive procedures to treat complex urethral strictures have been described. The most popular methods are penile Skin Island Flap (SIF) and free Buccal Mucosa Graft (BMG) urethroplasty. Prospective randomized trials comparing these two techniques are lacking, although the outcome of SIF urethroplasty was found to be comparable to BMG urethroplasty[3]. However, according to Raber et al. the re-stricture rate after free penile skin urethroplasty was higher than after BMG urethroplasty[4].

In our department, penile SIF urethroplasty was the most common procedure used to treat urethral strictures. However, since 2003 the use of buccal mucosa to repair these strictures gained recognition. A success rate of up to 94% with BMG urethroplasty as ventral onlay in patients with stricture recurrence after previous endoscopic procedures or dilatation has been reported by McLaughlin et al[5]. However, most of the 57 patients in this study had trauma-related urethral strictures. Penile SIF urethroplasty yielded a success rate of 85.6%, compared with 89.9% with buccal mucosa, as reported by Dubey et al. in a randomised controlled trial[3].

The use of buccal mucosa as free graft is becoming more popular, as it is easy to harvest and readily available[6]. Buccal mucosa has beneficial properties such as a thick, elastin-rich epithelium, which contributes to its toughness and renders it easy to handle. The thin and highly vascular lamina propria facilitates imbibition and inosculation, resulting in easy transplantation of the graft[7]. Free skin grafts contract by as much as 50%, compared to approximately 10% for buccal mucosa free grafts[8].

The aim of this study was to prospectively compare the outcome of onlay BMG with onlay penile SIF urethroplasty in the treatment of complex urethral strictures.

PATIENTS AND METHODS

A prospective study was performed in the Urology Department of Universitas Academic Hospital in Bloemfontein, South Africa, between June 2006 and June 2008. The diagnosis of urethral stricture was suspected in patients presenting with obstructive lower urinary tract symptoms (LUTS) or urinary retention where a transurethral catheter could not be passed. The diagnosis of urethral stricture was confirmed with retrograde urethrography. Patients meeting the inclusion criteria were consecutively allocated to undergo either SIF or BMG urethroplasty. The inclusion criteria were stricture length 2.5 cm or longer, or recurrence after previous urethroplasty, internal OU or urethrotomy. Patients who refused consent, had previous hypospadias repair or penile skin grafts were excluded.

The surgical techniques were similar in both groups. The urethra was approached through a perineal incision. The stricture was split ventrally. Subsequently, either BMG or the penile SIF was used for the reconstruction of the neo-urethra as a ventral onlay graft.

The BMG was harvested from the mouth, the cheek or lower lip of the patient, while the SIF was created from a circular penile skin flap with dartos pedicle mobilized from the shaft or foreskin. The graft was spread over the stricture site and sutured with 4/0 Vicryl to normal urethral epithelium proximal and distal to the stricture. The lateral sides were sutured to the spatulated urethra. Care was taken to cover the graft with well vascularized tissue as proposed by Fichtner et al[9]. The BMG and penile SIF width was approximately 2.5 cm. A 16F urethral catheter was left in situ for approximately 14 days.

The patients were followed up two weeks after surgery for removal of the catheter and again at 6 weeks, 3, 6 and 12 months. Due to

Table 1: Previous procedures and stricture site in study groups

	Procedure			
	SIF (n=17)		BMG (n=18)	
	n	%	n	%
Previous procedures	14	82.4	17	94.4
Dilatation	10	58.8	10	55.6
Optical urethrotomy	12	70.6	17	94.4
Urethroplasty	4	23.5	4	22.2
Stricture site				
Bulbar	10	58.8	12	66.7
Penobulbar	6	35.3	4	22.2
Penile	1	5.9	2	11.1

financial constraints routine urethrography was not performed, which would have enabled identification of asymptomatic stricture recurrence. Urethrography was performed only when the patient had stricture-related complaints. Failure of treatment was defined as recurrence of the urethral stricture requiring repeat urethroplasty, OU or urethral dilatation.

Results were expressed as mean and standard deviation for numerical variables, or frequencies and percentages for categorical variables. Statistical evaluation was performed with Excel® and GraphPad InStat® software, using Student's t-test with Welch correction for parametric data and the Chi-squared test for contingency table analysis.

RESULTS

Urethroplasty was performed with BMG in 18 and SIF in 17 patients. The mean patient age was 49.1 years (range 21–77) in the SIF and 44.3 years (range 27–73) in the BMG group (p= 0.28, not significant). The mean stricture length was 2.9 cm (range 2.5–4.0) in the BMG and 4.5 cm (range 2.4–7.0) in the SIF group (p= 0.002). There was a history of urethritis in 71% of the SIF and 83% of the BMG group. There were no significant differences between the groups with regard to previous procedures and stricture sites (Table).

Post-operatively, superficial wound infection occurred in two patients (11.8%) in the SIF group and 1 (6.2%) in the BMG group. All cases healed spontaneously with saline dressings, without adverse effect on the urethroplasty.

At one year followup the cure rate was 64.7% (11/17) in the SIF and 72.2% (13/18) in the BMG urethroplasty group (p= 0.63). No patients were lost to follow up. In the SIF group treatment failure in six patients (35.3%) consisted of recurrent urethral stricture at the anastomotic site, diverticulum formation in four and complete necrosis of the island skin flap in two patients who developed urinary retention within three days after removal of the catheter. On cystoscopy complete necrosis of the skin flap was observed, although the overlying skin on the penile shaft was normal. OU could not be performed due to obliteration of the urethra.

In the BMG group treatment failure in five patients (27.8%) consisted of recurrent urethral stricture at the anastomotic site in three and complete graft necrosis in two patients with peno-bulbar and penile strictures, respectively. Three of the patients with treatment failure in the SIF group had previously undergone stricture excision and primary re-anastomosis,

while two had undergone OU on two or more occasions. Of the failures in the BMG group two patients had previously undergone stricture excision and primary re-anastomosis, while the others had undergone OU on two or more occasions.

DISCUSSION

The treatment of complex urethral strictures is challenging. However, the evolving art of urethroplasty with pedicled penile SIF and free BMG has revolutionized this treatment. Patients with complex urethral strictures attend our outpatient clinic on a regular basis for urethral dilatation and are hospitalized for cystoscopy and internal OU, which has a re-stricture rate of 45% to 68%[10]. Due to long surgical waiting lists, patients are frequently managed with repeated urethral dilatation. It would be more cost-effective to find a permanent solution for recurrent urethral strictures and the best option in these patients is urethroplasty.

Trials comparing BMG and SIF are few, prompting our decision to evaluate the two procedures against each other. Dubey et al[3]. prospectively compared BMG with penile SIF urethroplasty (success rates 89.9% and 85.6%, respectively). In our study the success rate was 64.7% in the SIF group and 72.2% in the BMG group (difference not statistically significant). The lower success rates in our study compared with those reported by Dubey et al. may possibly be attributed to the dorsal graft placement in their study, as opposed to the ventral onlay we used[3]. A further difference which might have had a negative influence on treatment outcome was that Dubey et al. excluded patients who had more than one urethral dilatation. In our study the majority of patients had undergone previous dilatation, internal OU or urethroplasty (Table). Raber et al. also reported that free BMG was superior to penile SIF urethroplasty (success rate 87.5% versus 76.5%)[4]. BMG has gained popularity as urethral substitute and studies reported in the literature show better results compared to our findings, for example success rates of 81% reported by Levine et al[11] and 94.3% reported by Kane et al[12].

BMG urethroplasty is easier to perform than penile SIF and in our study it yielded slightly better results (sucess rate 72.2% versus 64.7%, p= 0.63). The statistically significant difference in mean stricture length (2.9 cm in the BMG and 4.5 cm in the SIF group) may explain the worse result in the SIF group. It well known that a greater stricture length has a negative impact on treatment outcome[13].

Diverticulum formation associated with post-void dribbling in four patients who underwent SIF urethroplasty could be attributed to the weakness of the flap which was placed as a ventral onlay. We encouraged such patients to squeeze the penis after voiding to expel any residual urine. A possible solution to this problem has been proposed by Raber and colleagues, who suggested placement of the SIF dorsally to prevent diverticulum formation[4].

Two patients with penile urethral strictures and severe fibrosis in the BMG group might have benefited from a staged urethroplasty. According to Patterson et al. two-stage procedures are preferable in the penile urethra when circumstances do not allow a one-stage dorsal BMG graft[14]. A penile neomeatus (for strictures distal to the penoscrotal junction) or perineal urethrostomy (for strictures proximal to the penoscrotal junction) was performed as part of a staged urethroplasty by Eliot et al. in men with complex strictures secondary to lichen sclerosis and recurrent adult hypospadias[15]. In this group, approximately 30% of patients elected not to undergo the second stage procedure due to satisfaction with the first stage procedure. In our patients the idea of a perineal urethrostomy is usually not acceptable.

There is controversy whether the BMG should be placed as a dorsal instead of ventral onlay.

According to Andrich et al. dorsal BMG onlay compared with ventral onlay yielded better results in patients with iatrogenic strictures (restricture rates of 5% versus 14%, respectively)[16]. Heinke et al, reported that BMG can be used as a ventral patch with favorable results[7]. Barbagli et al. recommended the use of BMG urethroplasty modulated according to the stricture site and its characteristics, where dorsal placement of the BMG will be more successful in the penile urethra[18].

Previous procedures such as urethral dilatation, cystoscopy and internal OU may have a negative effect on the success of urethroplasty. This may have been the case in our BMG urethroplasty group, where the success rate was 72.2% as compared to the 87% success rate reported by Kellner et al[18]. SIF urethroplasty is a more difficult operation than BMG, since the surgical dissection is more extensive and requires longer theater time[3]. These factors may contribute to an increased risk for post-operative complications[19]. In our study, the cumulative success rate in both groups could have been improved with internal OU for the management of recurrent anastomotic strictures, as reported by Elliot et al., who reported an increase in eventual success rate from 90% to 97%[20].

Substitution urethroplasty resulted in lower re-stricture rates, although a tendency remains for deterioration with time. Longer follow-up periods of 5 to 10 years may reveal which technique is superior[16,18].

Barbagli et al. reported a higher success rate for grafts (80%) used in one-stage urethroplasty compared with flaps (67%)[21]. In our study, we could not demonstrate a statistically significant difference between the success rates of penile SIF and BMG urethroplasty.

CONCLUSIONS

Although this study could not demonstrate a statistically significant difference between the outcomes of penile SIF and BMG urethroplasty, we recommend onlay BMG for the treatment of complex strictures, given the longer operation time and greater extent of surgical dissection associated with penile SIF urethroplasty that has been reported in other studies.

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