

# Analysis of the Determinants, Characteristics and Management of Recurrent Urethral Strictures

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ABSTRACT

**Background:** The presentation and management of the recurrent urethral stricture varies and depends largely on the initial treatment and the characteristics of the recurrent stricture. What are the likely determinants of recurrence? **Patients and Methods:** This is a retrospective review of all patients who had urethroplasties from January 2013 to December 2017 for anterior urethral strictures in our institution. Patients with a recurrence of the strictures were identified and reviewed, while patients with hypospadias and posterior urethral stenosis or contractures were excluded from the study. The etiology, length, site, and type of urethroplasties were evaluated as variables that may contribute to the recurrence of strictures using inferential statistics and logistic regression analysis. Time to recurrence was analyzed using the Kaplan–Meier method. **Results:** A total of 206 urethroplasties for anterior urethral strictures were evaluated with recurrence of strictures noted in 29 patients and a recurrence rate of 14.1%. Recurrence was higher in long-segment strictures, penobulbar strictures, and postinflammatory strictures. Pedicle flaps were used in 45% of the strictures that reoccurred. Using Chi-square, the length, site, of urethroplasties were statistically significant determinants of recurrence; however, only the site of stricture was found to be statistically significant following logistic regression analysis. The site of recurrence was in the bulbar urethra in 79% and the penile urethra in 21%. The choice of treatment of the recurrent strictures was anastomotic urethroplasty in 76.5%. The mean time to failure in this study was 13 months with a range of 6-120 months. **Conclusion:** In this study, the site of stricture was found to be the most determinant of stricture recurrence, with penobulbar strictures mostly implicated. Long-segment strictures were also noted to contribute to some extent in recurrence. These recurrent strictures were mostly short-segment strictures in the bulbar urethra which were amenable to excision and anastomosis to achieve cure.

**KEYWORDS:** *Determinants, management, recurrent urethral strictures*

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## INTRODUCTION

Urethral strictures are common among middle-aged and elderly men with bladder outlet obstruction.<sup>[1]</sup> The treatment varies from minimally invasive procedures such as direct visual internal urethrotomy (DVIU) or urethral dilation to urethroplasties with the latter having a higher success rate. Stricture excision and end–end anastomotic urethroplasties offer the best outcomes

when properly performed with success rates as high as 90%–95% reported, while substitution urethroplasties using either buccal mucosa grafts (BMG) or pedicled penile flaps have similar efficacies of about 80%.<sup>[2-5]</sup>

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Recurrence of stricture after urethroplasty is a known complication that may occur following the repair. It is characterized by the recurrence of lower urinary tract symptoms from a stricture after the return of satisfactory voiding following urethroplasty for the same stricture.<sup>[6]</sup> A stricture recurrence rate of between 8.3% and 20% has been reported following urethroplasty by Meeks *et al.* in a systematic review of recurrent strictures.<sup>[7]</sup> The management of these recurrent strictures which may be complex requires reevaluation and good reconstructive armamentarium to achieve success as there are less healthy tissues for reconstruction, more adhesions, and scarring and these strictures are also more prone to recur.<sup>[8]</sup> Although the recurrence of strictures is dreaded by the surgeon when it does occur, it is a significant cause of morbidity to the patient due to poor quality of life, low self-esteem, depression, increased time off work, and higher cost of health care.<sup>[9,10]</sup>

Hence, it is important to review the possible variables that may contribute to stricture recurrence and identify them as red flags when performing the urethroplasty using available best practices.

The etiology of the stricture, the extent of the spongiofibrosis, length, and site of the stricture and associated comorbidities as well as the type of the urethroplasty may be the determinants of the rate of stricture recurrence.<sup>[11]</sup> We hereby performed a retrospective review of the urethroplasties performed in a single center to identify the rate of recurrence of strictures, the determinants of recurrence, and the management of these recurrences.

## PATIENTS AND METHODS

### Study population

This is a review of the presentation and management of all patients who had urethroplasties for anterior urethral strictures by the Division of Urology Ahmadu Bello University Teaching Hospital, Zaria, between January 1, 2013, and December 31, 2017. Patients with incomplete data, hypospadias, and posterior urethral stenosis or contractures were excluded from the study. Furthermore, patients with failed urethroplasties (patients who could not void satisfactorily within a month following removal of the catheter) and those with <12 months of follow-up were excluded from the study. Patients with recurrent urethral strictures following anterior urethroplasties were identified. Ethical approval was obtained from the institution's ethical research committee before the commencement of the study.

As a unit policy, clinical assessment entailed a detailed medical history and physical examination, a urine microscopy culture and sensitivity, retrograde

urethrogram, and in patients with complete strictures, a combined study including a micturating cystourethrogram was done to define the strictures.

The type of urethroplasty is based on the characteristics of the stricture (site, length, number, and extent of spongiofibrosis) as well as intraoperative findings. Patients with short-segment strictures (<2 cm) can benefit from excision of the stricture and end-to-end anastomosis of the urethra. Patients with long-segment strictures ( $\geq 2$  cm) are considered for substitution urethroplasty with a pedicled penile flap for a long-segment penile and penobulbar stricture or a BMG for long-segment bulbar strictures. Severe spongiofibrosis found intraoperatively may require a staged repair. Patients are usually discharged with a urethral catheter on day 5 postoperatively following an uneventful recovery and a pericatheter retrograde urethrogram done on the 3 weeks to assess the urethra as well as the presence of extravasation of contrast at the site of repair. Urethral catheters are subsequently removed immediately if a satisfactory pericatheter retrograde urethrogram is obtained; otherwise, a delay in the removal of the catheter may be entertained. The patient's follow-up in the clinic was done afterward at 1 month, 3 months, and 6 months. Patients with recurrent complaints of lower urinary tract symptoms are further reviewed including the details of the previous urethroplasty and a repeat urethrogram obtained. A redo-urethroplasty was performed subsequently with another attempt at cure.

Successful urethroplasty was determined clinically by the absence of lower urinary tract symptoms at a month following removal of urethral catheter (7 weeks postsurgery) or absence of need for further surgical instrumentation.

### Assessment of data

The patient's medical data were retrospectively reviewed over the study period. The etiology, length, site of stricture, and the type of urethroplasty including the time to failure (TTF) were appraised. The TTF was defined as the time from catheter removal to the recurrence of symptoms. The data were collected on a study pro forma and analyzed using SPSS Version 22 (IBM Armonk, NY 10504 U.S.A). Frequencies and proportions were used to describe categorical variables. Chi-Square was done to compare the variables that contributed to stricture recurrence and univariate logistic regression analysis was done to determine the relationship of these variables to the recurrence of stricture and a  $P < 0.05$  was defined as statistically significant. Stricture-free survival was analyzed using Kaplan–Meier methods.

## RESULTS

A total of 206 urethroplasties were performed within the study period, while 29 (14.1%) of the strictures recurred and were therefore assessed. The mean age at presentation of patients with recurrent strictures was 54 years with a range of 25–80 years. The distribution of the length, site, etiology, and initial treatment of the strictures are shown in Table 1.

The length of the stricture, site, and type of urethroplasty done were statistically significant in the determination of stricture recurrence as shown in Table 1; however, on univariate logistic regression, only the site of stricture was found to be a statistically significant factor with regard to recurrence with  $P = 0.016$  as shown in Table 2.

The recurrent strictures were managed using the following approaches of urethroplasties as depicted in Figure 1.

The mean TTF in this study was 13 months with a range of 6–120 months. The Kaplan–Meier curve depicts the survival function for TTF in Figure 2.

**Table 1: Characteristics of successful and recurrent urethroplasties**

Characteristics of strictures	Success, n (%)	Recurrence, n (%)	P
Length			
Short (<2 cm)	91 (93.8)	6 (6.2)	0.02
Long (>2 cm)	86 (78.9)	23 (21.1)	
Site			
Penile	43 (91.5)	4 (8.5)	0.001
Penobulbar	17 (26.2)	14 (73.8)	
Bulbar	116 (93.5)	8 (6.5)	
Pan urethral strictures	1 (25.0)	3 (75.0)	
Etiology			
Postinflammatory	83 (84.7)	15 (15.3)	0.289
Posttraumatic	72 (91.1)	7 (8.7)	
Iatrogenic	16 (80.0)	4 (20.0)	
Previous treatment			
Excision and anastomosis	91 (93.8)	6 (6.2)	0.018
BMG	39 (81.2)	9 (18.8)	
Pedicled flap	42 (76.4)	13 (23.6)	
Staged	5 (83.3)	1 (16.7)	

BMG: Buccal mucosa graft

**Table 2: Univariate logistic regression analysis of the determinants of recurrent strictures**

Determinants	95% CI	P
Site of stricture	0.017-0.151	0.016
Length of stricture	0.051-0.349	0.144
Previous urethroplasty	0.061-0.160	0.375

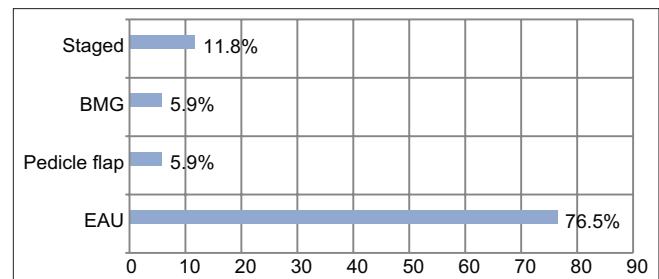
CI: Confidence interval

## DISCUSSION

The aim of urethroplasty for a urethral stricture is cure. It is quite rewarding when this is achieved. Minimal tissue handling, adequate mobilization, and spatulation of the urethra to ensure mucosa–mucosa apposition on a tension-free anastomosis, use of appropriate size sutures, as well as adequate excision of spongiositis have all been demonstrated to improve success rates in urethroplasties.<sup>[12,13]</sup> Furthermore, in substitution urethroplasties, the use of a well-vascularized bed for grafts and wide vascular pedicle for flaps are all vital to avoid recurrence of the stricture.<sup>[14]</sup> During the period of this study, 206 urethroplasties were performed for anterior urethral strictures by the center. This is because we routinely afford fit patients with anterior urethral strictures who consented to the procedure urethroplasties with the aim of a cure, while DVIU or urethral dilations are generally reserved for the elderly unfit patients.

The length of the stricture may contribute to the rate of recurrence as noted in this study on univariate analysis. 21.6% of long-segment strictures recurred as compared to 6.1% of the short-segment strictures. Blaschko *et al.* in a review of 130 patients who had repeat urethroplasties also found longer and complex strictures more prone to recurrence.<sup>[15]</sup> Also, Lumen *et al.* in Belgium performed a systematic review and meta-analysis comparing penile skin grafts and BMG.<sup>[16]</sup> They noted that the length of stricture was a negative prognostic factor in the recurrence of stricture. This may be related to the fact that the need for substitution urethroplasty increases with strictures  $\geq 2$  cm long. Besides, in substitution urethroplasties, especially when onlay BMGs are utilized and multiple anastomoses made, a ring of stricture may occur at either the proximal or distal anastomotic sites leading to recurrence.<sup>[14,17]</sup>

There are controversies over the best choice for substitution of the urethra when the anastomosis is not feasible either a free graft or a vascularized pedicle flap. The success rate reported in the literature is relatively the same for both approaches, usually within the range



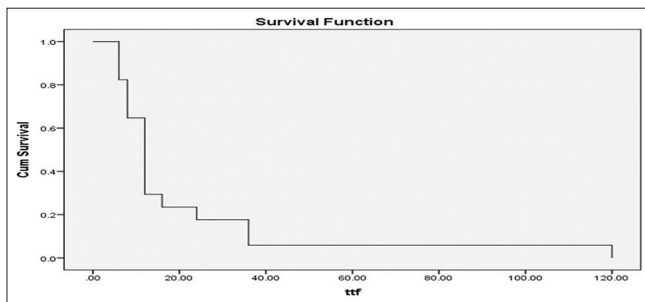
**Figure 1:** The distribution of redo-urethroplasties performed of recurrent anterior strictures. BMG: Buccal mucosa grafts, EAU: Excision, and anastomotic urethroplasty

of 80%–88%.<sup>[18,19]</sup> However, in this institution, when the urethral plate is preserved (healthy for augmentation), we usually use a penile skin flap for long-segment penile and penobulbar strictures especially considering the watershed in vascularization of the latter region and we prefer a BMG for our long-segment bulbar strictures. To avoid diverticulum formation and postvoid dribbling, a dorsal or a lateral onlay of the buccal mucosa is usually done.

The recurrence rate of 18.8% found in this study following BMG urethroplasty is similar to the findings of Rosenbaum *et al.* who found the rate of recurrence of strictures in 33 patients after buccal mucosa urethroplasties for bulbar strictures as 18%.<sup>[20]</sup>

Rarely, a longitudinal perineal skin flap (Jordan's flap) may be used for a failed BMG bulbar urethroplasty. However, in the presence of severe spongiofibrosis and extensive scarring from previous failed repairs, a staged urethroplasty may be considered.

The site of stricture was the independent predictor of recurrence in this study following a regression analysis (95% confidence interval: 0.017–0.151;  $P = 0.016$ ) with 73% and 75% of penobulbar and pan urethral strictures recurred, respectively. Penobulbar strictures extend over the genu of the urethra; an area with thinning of corpus spongiosum and decreased vascularity as compared to other parts of the urethra.<sup>[21]</sup> This may be the underlying reason for the high recurrence despite the use of pedicle flaps for these penobulbar strictures. Elevating the phallus from the dependent position following reconstruction involving the penobulbar urethra may improve outcomes as it reduces the anatomical curve as well as taking the weight of the catheter off the suture lines used in urethroplasty. Similarly, pan urethral strictures which are long >8 cm extend through the penile and bulbar urethra and share some of the observed limitations in vascularization as penobulbar strictures. Besides, pan urethral strictures require more complex reconstructions utilizing multiple grafts or a combination of flaps and grafts, which may further predispose them to some recurrence.<sup>[22]</sup>



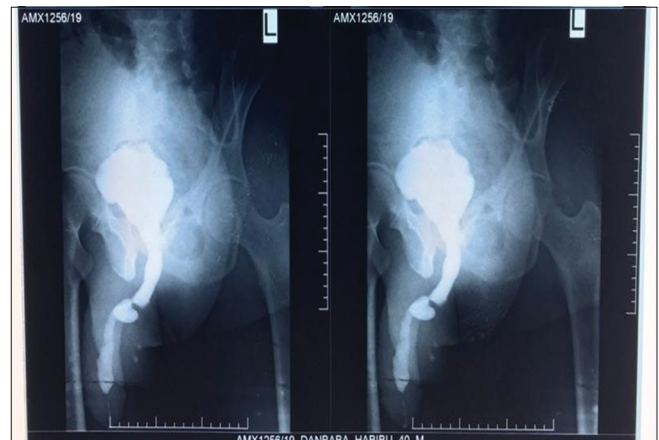
**Figure 2:** Kaplan–Meier analysis of time to failure of the recurrent strictures

The etiology of the stricture was not found to be a statistically significant determinant of recurrence in this study. This may be because both the incidence of postinflammatory and posttraumatic strictures occurred at almost similar high frequencies and the recurrence in both was also similar. Although Breyer *et al.*, in a multivariate analysis of the determinants of recurrence of stricture, also found etiology as not a statistically significant variable, other reconstructive surgeons such as Joseph *et al.* and Chapman *et al.* found etiology as an independent risk factor for recurrences, notably the postinflammatory strictures.<sup>[23–25]</sup>

Not surprisingly, the recurrent strictures were managed usually by an end-to-end anastomosis in 74% of the patients. This is because these were short-segment recurrent bulbar strictures amenable to the anastomosis and the aim of treatment of these recurrent strictures is still cure as shown in the micturating cystourethrogram in Figure 3.

Although pedicled flaps and BMG grafts were noted to be used in the management of recurrent strictures with similar frequencies in this study, this may be due to our preference of using a BMG for a failed long-segment stricture previously treated with pedicled flap and vice versa. This is because regrafting a failed BMG may affect graft-take from a bed with some scarring,<sup>[26]</sup> and for a failed pedicle flap, dissection of the flap with a good vascular pedicle may not be as satisfactory due to altered tissue planes from the previous urethroplasty,<sup>[8]</sup> making a BMG in this scenario a preferred option. Staged urethroplasties are reserved for the few multiple recurrent complex strictures where the chance of success of a single staged repair is deemed guarded.

There is no documented timeline for the possible TTF following urethroplasties.<sup>[27]</sup> However, the attrition rate



**Figure 3:** Images recurrent strictures. A micturating cystourethrogram of a short segment recurrent bulbar stricture following a penile fasciocutaneous urethroplasty for a penobulbar stricture

of the substituted tissue may play a role. The mean TTF in this study is 13 months with a range of 6–120 months is like the findings by Javali *et al.* in India.<sup>[28]</sup> A mean time of 24.4 months was found in their review of the management of recurrent strictures.

We acknowledge the limitations of this study being a retrospective study and some other possible determinant could not be assessed. The extent of spongiofibrosis may be an important determinant of recurrence. This could not be reviewed in this study as it was not assessed for all the patients preoperatively. This can be resolved by a prospective study with logistic regression analysis to identify all the likely factors causally related to recurrence.

## CONCLUSION

The risk of recurrence of urethral stricture from this study is higher for long-segment strictures, strictures in the penobulbar urethra, and following substitution urethroplasties usually at the proximal anastomosis in the bulbar urethra. Most of the recurrent strictures are short-segment amenable to excision and end-to-end anastomosis. This study may guide in patient counseling before surgery.

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## Conflicts of interest

There are no conflicts of interest.

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