The New Journal of Urology
eISSN 3023-6940
doi: https://doi.org/10.33719/nju1763401

RESEARCH ARTICLE

Predictors of Success in Buccal Mucosal Graft Urethroplasty: The Impact of Stricture Length and Smoking on Surgical Outcomes – A Retrospective Observational Study

Cem Tuğrul Gezmiş [1] *, Nusret Can Çilesiz [1], Buğra Çetin [2], Basri Çakıroğlu [3], Ali Eroğlu [4], Mustafa Bahadır Can Balcı [1]

[1] Department of Urology, University of Health Sciences Taksim Training and Research Hospital, İstanbul, Türkiye

[2] Department of Urology, Altınbaş University Medicalpark Bahçelievler Hospital, İstanbul, Türkiye

[3] Department of Urology, Hisar Intercontinental Hospital, Faculty of Medicine, Üsküdar University, İstanbul, Türkiye

[4] Department of Urology, Torbalı State Hospital, İzmir, Türkiye

Submitted: *2025-08-12*
Accepted: *2025-12-21*

Corresponding Author;
Cem Tuğrul Gezmiş, MD
Address: Department of Urology, University of Health Sciences Taksim Training and Research Hospital, İstanbul, Türkiye
Email: ctgezmis@gmail.com

ORCID
C.T.G. 0000-0002-1634-4516
N.C.Ç. 0000-0003-2115-698X
B.Ç. 0000-0001-6424-2787
B.Ç. 0000-0001-5337-5226
A.E. 0000-0002-5545-5892
M.B.C.B. 0000-0003-0395-1154

Abstract

Objective: Buccal mucosa graft (BMG) urethroplasty is a well-established treatment option for complex anterior urethral strictures. However, factors affecting surgical outcomes remain under investigation. This study aimed to evaluate the impact of stricture length and smoking on surgical success following dorsolateral onlay BMG urethroplasty.

Materials and Methods: This retrospective observational study included 51 patients who underwent single-stage dorsolateral onlay BMG urethroplasty between 2021 and 2025. Patients with short strictures (<1.5 cm), urethral fistula or abscess, prior failed urethroplasty, or oral mucosal pathology were excluded. The primary outcome was surgical success, defined as the absence of obstructive symptoms and the need for further intervention. Statistical analysis included the Mann–Whitney U test, Fisher's exact test, and logistic regression.

Results: The overall success rate was 74.5%. Patients in the success group had significantly shorter strictures compared to the failure group (median: 2.1 [2.0–2.8] cm vs. 5.0 [2.25–5.25] cm; p=0.002), and smoking prevalence was lower (21.1% vs. 69.2%; p=0.005). No significant differences were observed in age, comorbidities, stricture location, etiology, or preoperative Qmax. In the multivariate analysis, stricture length (OR: 0.461; 95% CI: 0.252–0.844; p=0.012) and smoking (OR: 5.572; 95% CI: 1.130–27.845; p=0.035) remained independent predictors of surgical failure.

Conclusions: Stricture length and smoking are independent risk factors for failure following dorsolateral BMG urethroplasty. These factors should be addressed during preoperative counseling.

Keywords: buccal mucosal graft, smoking, stricture length, urethral stricture, urethroplasty

Cite; Gezmis CT, Cilesiz NC, Cetin B, Cakiroglu B, Eroglu A, Balci MBC. Predictors of Success in Buccal Mucosal Graft Urethroplasty: The Impact of Stricture Length and Smoking on Surgical Outcomes – A Retrospective Observational Study. New J Urol. 2026;21():22-29. **doi:** https://doi.org/10.33719/nju1763401

INTRODUCTION

Urethral stricture disease (USD) is a complex medical condition defined by the narrowing of the urethra, potentially leading to significant urinary complications. The etiology of urethral strictures is multifactorial and includes traumatic, inflammatory, iatrogenic, and idiopathic causes(1). USD typically develops through progressive epithelial injury and spongiofibrosis of the corpus spongiosum, which gradually reduces luminal caliber and contributes to persistent obstruction.

The treatment options for urethral stricture disease vary based on the stricture's characteristics, including its location and length. Initial management often includes urethral dilation, direct vision internal urethrotomy (DVIU), which are minimally invasive procedures aimed at widening the urethra and are commonly used for strictures. Dilation or DVIU may be used for short urethral strictures, but are not recommended when the stricture exceeds 2 cm (2). Moreover, these methods have high recurrence rates, reported between 30% and 90%, and this variation is influenced by factors such as the stricture's location, its length, and whether previous procedures had been performed (3–5). In addition, while these endoscopic approaches may offer short-term improvement, repeated interventions can lead to progressive fibrosis and diminish long-term success.

Urethroplasty is widely regarded as the preferred treatment for long, complicated, or recurrent strictures, providing a reconstructive approach that offers the most durable and effective outcomes in this patient group (6,7). Reported long-term outcomes for various urethroplasty techniques frequently reach the 90% range(8,9).

Reconstructive urethroplasty commonly involves grafts or flaps derived from buccal mucosa or penile skin to restore urethral continuity(10). The success rates of buccal mucosa graft (BMG) urethroplasty vary across studies; however, most series describe generally favorable long-term outcomes. In selected cohorts, BMG urethroplasty performed using different techniques has even been shown to achieve success rates approaching 100% (6,11).

Outcomes of BMG urethroplasty depend on multiple factors, including stricture length and location, surgical technique, surgeon experience, and patient-related clinical factors (12). This study aimed to explore potential factors influencing the outcomes of BMG urethroplasty in cases of complex urethral strictures.

MATERIAL AND METHODS

Following ethical approval from the Hisar Hospital Intercontinental Local Ethics Committee (Approval No: 25-27, Date: 2025-02-28), a retrospective observational study was conducted using data from 60 patients who underwent single-stage dorsolateral onlay BMG urethroplasty for urethral stricture between January 2021 and January 2025. Short strictures (<1.5 cm) were excluded because such strictures are generally suitable for endoscopic management (13). Moreover, patients with complex strictures associated with fistula or abscess, prior oral surgery, oral mucosal abnormalities, limited mouth opening, or a history of failed urethroplasty were also excluded. Preoperative evaluations included demographic data, uroflowmetry (UFM), urethrography, cystourethroscopy, and assessment of stricture and oral mucosal characteristics. All procedures were performed only after confirmation of sterile urine cultures. All surgeries in this cohort were conducted by the same operating surgeon.

Surgical Technique

All procedures were carried out under general anesthesia via a midline perineal approach. To preserve vascular integrity, the bulbospongiosus muscle was meticulously dissected, and the urethra was mobilized unilaterally from the corpus cavernosum, extending slightly beyond the midline. Stricture length was measured intraoperatively after performing the longitudinal urethrotomy on the lateral aspect of the urethra. Following submucosal injection of lidocaine with adrenaline, the buccal graft was obtained from the inner cheek. Care was taken to protect Stensen's duct by preserving the surrounding mucosa. Donor sites were left open for healing. The graft was harvested approximately 2 cm longer than the measured stricture to compensate for an anticipated 10% contraction over time. The graft width ranged between 15 and 25 mm, aiming to achieve a final urethral lumen of at least 24 Fr. After excision, the graft was defatted until a creamy-white appearance. To prevent postoperative diverticula formation and postvoid dribbling, the graft was fixed to the urethral plate using a dorsolateral onlay approach with interrupted

4-0 absorbable polyglactin (Vicryl) sutures (Ethicon, Johnson & Johnson, USA). In the final step, the urethra was closed over a 16 Fr catheter using 4-0 Vicryl sutures.

Postoperative Follow-up

Patients were discharged on postoperative day 3 with antibiotics and oral antiseptics, and the urethral catheter was removed between postoperative days 21 and 28. Follow-up visits were scheduled at 6 weeks, 3 months, 6 months, and 12 months, and subsequently continued at six-month intervals. Primary screening for stricture recurrence was based on uroflowmetry and the Turkish-validated IPSS, while urethrography or cystourethroscopy was performed only in patients with obstructive symptoms or in those with a screening Qmax <15 mL/s(14). The primary outcome of the study was urethroplasty success, defined as the absence of obstructive symptoms and the absence of any need for additional interventions such as dilatation, cystourethroscopy, or internal urethrotomy.

Statistical Analysis

Descriptive statistics for continuous variables were expressed as mean ± standard deviation or median (IQR), while categorical variables were summarized using frequencies and percentages. The distribution of data was assessed using the Shapiro-Wilk test. Comparisons between groups were performed with the Mann-Whitney U test for continuous variables and either the Chi-square or Fisher's exact test for categorical variables, when appropriate. Logistic regression was used to identify factors independently associated with surgical failure. Variables with a p-value < 0.2 in the univariate analysis were included in the multivariate logistic regression model. Results were presented as odds ratios (OR) along with 95% confidence intervals (CI), and a p-value < 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Out of 60 patients initially selected, five were excluded based on predefined criteria, and data from four patients were not analyzed due to loss to follow-up (Fig. 1). Thus, 51 patients constituted the final study group.

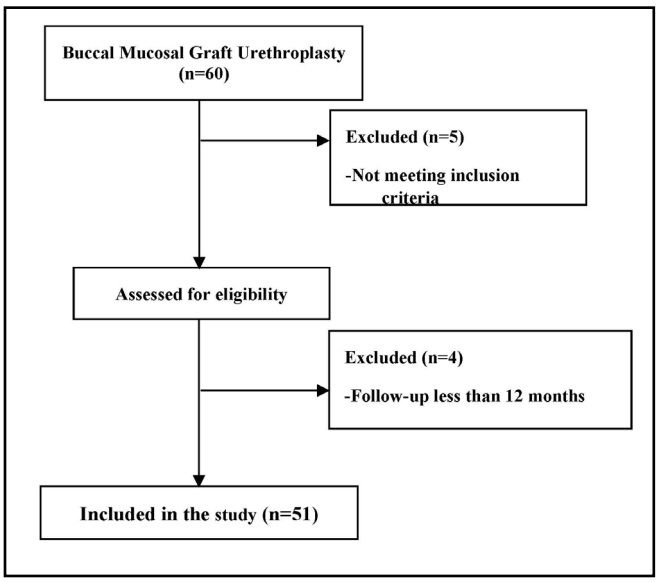

Figure 1. Patient selection and inclusion flowchart

Follow-up averaged 15.8 months (12–18 months). The median age was 50 years (IQR: 45–62 years). Comorbidities were present in 41.1% of patients, including hypertension (25.5%), diabetes mellitus (23.5%), and coronary artery disease (5.9%). Smoking was reported in 33.3% of patients. The median preoperative Qmax was 5.9 mL/s (IQR: 5.0–6.5 mL/s). Stricture location was most commonly in the bulbar urethra (70.6%), followed by bulbar+penile (21.6%) and penile (7.8%) segments. The leading etiological factors were trauma (39.2%), prior endourological interventions (29.4%), hypospadias surgery (9.8%), Fournier's gangrene (7.8%), gunshot injury (3.9%), lichen sclerosus (3.9%), urethral catheterization (3.9%), and previous urethritis (2.0%). The overall success rate of BMG urethroplasty was 74.5%, while failure was observed in 25.5% of patients. No surgical or buccal mucosa site complications were reported.

Patients were divided into two groups according to urethroplasty outcomes: successful (Group 1, n=38) and unsuccessful (Group 2, n=13). Stricture length was significantly shorter in the successful group compared to the unsuccessful group (2.1 [2.0–2.8] cm vs. 5.0 [2.25–5.25] cm, p=0.002). Smoking prevalence was also lower in Group 1 (21.1% vs. 69.2%, p=0.005). No statistically significant differences were found between the groups regarding age, comorbidities, stricture location, or preoperative Qmax (Table 1).

For additional analysis, stricture etiology was reclassified into three categories: iatrogenic, consisting of endourological interventions and urethral catheterization (n=17); traumatic, consisting of external trauma and gunshot injury (n=22); and other etiologies (n=12). Their distributions in the successful and unsuccessful groups were iatrogenic (14 vs. 3), traumatic (17 vs. 5), and other (7 vs. 5). Fisher's exact test demonstrated no significant association between these etiological categories and surgical outcome (p = 0.28).

Univariate and multivariate logistic regression analyses were performed to identify factors associated with urethroplasty success. In the univariate analysis, longer stricture length (OR: 0.403; 95% CI: 0.234–0.692; p=0.001) and smoking (8.437; 95% CI: 2.055–34.649; p=0.003) were significantly associated with lower odds of surgical success. Diabetes mellitus also showed a borderline association (OR: 2.768; 95% CI: 0.692–11.069; p=0.150), while other variables, including age, hypertension, coronary artery disease, and preoperative Qmax, were not significantly associated with outcome.

In the multivariate model, both stricture length (OR: 0.461; 95% CI: 0.252–0.844; p=0.012) and smoking status (OR: 5.572; 95% CI: 1.130–27.845; p=0.035) remained independent predictors of urethroplasty success. Diabetes mellitus was not independently associated with the outcome (OR: 1.383; 95% CI: 0.204–9.361; p=0.74)(Table 2).

Table 1. Comparison of groups in terms of urethroplasty success

Parameters	Group 1 (n:38)	Group 2 (n:13)	p-value
Age, years, median (IQR)	50 (46 – 60.5)	50 (35.5 – 62.5)	0.393[a]
Preoperative Qmax, mL/sec, median (IQR)	5.85 (4.975 – 6.525)	5.9 (5.05 – 6.35)	0.787[a]
Stricture length, cm, median (IQR)	2.1 (2.0 – 2.8)	5.0 (2.25 – 5.25)	*0.002*[a]
DM, (%)	8 (18.4)	5 (38.5)	0.141[b]
HT, (%)	9 (23.6)	4 (30.8)	0.716[c]
CAD, (%)	2 (5.3)	1 (7.7)	>0.99[c]
Smoking, (%)	8 (21.1)	9 (69.2)	*0.005*[c]
Stricture site, (%)			
Bulbar+Penile Urethra	8 (21)	3 (23.1)	
Penile urethra	1 (2.6)	3 (23.1)	0.087[c]
Bulbar urethra	29 (76.3)	7 (53.8)	
Stricture etiology, (%)			
Endourological intervention	13 (34.2)	2 (15.4)	
Trauma	16 (42.1)	4 (30.8)	
Fournier's gangrene	2 (5.3)	2(15.4)	
Infection	1 (2.6)	0 (0)	
Hypospadias repair	2 (5.3)	3 (23.1)	
Gunshot injury	1 (2.6)	1 (7.7)	0.203[c]
Lichen sclerosus	2 (5.2)	0 (0)	
Urethral catheterization	1 (2.6)	1 (7.7)	

IQR: Interquartile range, Group 1: Successful urethroplasty group, Group 2: Unsuccessful urethroplasty group, DM: Diabetes mellitus, HT: Hypertension, CAD: Coronary artery disease

[a] *Mann-Whitney U test,* [b] *Chi-square test,* [c] *Fisher's exact test*

Table 2. Univariate and multivariate logistic regression analysis for predictors of urethroplasty success

	Univariate			Multivariate		
	OR	**95% CI**	**p-value**	**OR**	**95% CI**	**p-value**
Age (years)	1.017	0.971 – 1.066	0.468			
DM	2.768	0.692 – 11.069	0.15	1.383	0.204 – 9.361	0.74
HT	1.432	0.355 – 5.779	0.614			
CAD	1.500	0.125-18.052	0.749			
Stricture length	0.403	0.234 – 0.692	*0.001*	0.461	0.252 – 0.844	*0.012*
Smoking	8.437	2.055 – 34.649	*0.003*	5.572	1.130 – 27.845	*0.035*
Preoperative Qmax	1.215	0.582 – 2.538	0.605			

DM: Diabetes mellitus, HT: Hypertension, CAD: Coronary artery disease. P-values were calculated using logistic regression analysis.

DISCUSSION

Urethral strictures are a common problem in urology and can lead to significant morbidity. Various techniques, including urethral dilation, DVIU, and surgical reconstruction, are used in the treatment of urethral strictures, with surgical reconstruction generally providing superior long-term outcomes. Although skin flaps, bladder mucosa, and penile and preputial flaps have been used in urethroplasties, oral mucosal grafts remain the most commonly utilized material (10). Oral mucosal grafts can be harvested more easily than penile flaps and have a lower risk of morbidity. Additionally, they possess a thick epithelium with a thin lamina propria and a dense panlaminar vascular plexus, which facilitates early inosculation. Chapple et al., in their systematic review, reported that the success rates of augmentation urethroplasty varied between 43% and 100%, depending on the surgical technique used(15). The observed success rate of 74.5% in this study is consistent with previously published data and further supports the effectiveness of buccal mucosal graft urethroplasty.

There are various techniques used for BMG urethroplasty. In our cohort, all patients underwent the dorsolateral onlay graft technique due to its low complication rates and high success rate. The dorsolateral onlay technique involves unilateral urethral dissection, preserving the contralateral vascular supply, bulbospongiosus muscle, and its innervation, while a perineal incision minimizes chordee risk and offers a cosmetic advantage(16). Kartal et al., in their study comparing the dorsal onlay graft and dorsolateral onlay graft techniques, reported success rates of 70.3% and 87.1%, respectively. Furthermore, they noted lower complication rates with the dorsolateral onlay graft technique(11).

Although BMG urethroplasty generally yields high success rates, several factors may contribute to recurrence, including stricture location and length, etiology, whether the procedure is primary or a revision, and the patient's overall health status(17). Among these, stricture length is the most frequently emphasized factor in the literature. Shalkamy et al. identified stricture length greater than 4.5 cm as a predictor of urethroplasty failure(18). Consistently, Kay et al. reported that strictures longer than 5 cm were associated with a significantly increased risk of recurrence (19). Our findings indicated that patients in the failure group had longer strictures than those in the successful group, in line with previous studies. Moreover, both univariate and multivariate analyses confirmed stricture length as an independent risk factor for recurrence following urethroplasty.

In this study, the recurrence rate was significantly higher among smokers compared to non-smokers. Both univariate and multivariate analyses identified smoking as an independent risk factor for BMG urethroplasty failure. This may be attributed to the adverse vascular effects of smoking, as well as the harmful impact of tobacco smoke on oral mucosal integrity and graft viability. Chronic tobacco exposure contributes to vascular and immune dysfunction in the oral mucosa by increasing prostaglandin synthesis and the number of Langerhans cells(20). A review on smoking in urologic reconstructive surgery suggested that smoking and poor oral hygiene may negatively affect surgical

outcomes. It emphasized the importance of encouraging patients to quit tobacco use preoperatively(21). Furthermore, the urethroplasty failure prediction model developed by Barbagli et al. highlighted smoking, graft usage, and instrumentation-related strictures as significant predictors of long-term treatment failure(22).

In line with our findings, a recent systematic review and meta-analysis by Ma et al. also reported that smoking may increase the risk of stricture recurrence following urethroplasty(23). However, that study included a wide range of surgical techniques, graft types, and etiologies, with substantial methodological heterogeneity. Moreover, subgroup analysis specific to buccal mucosa graft urethroplasty was not performed, despite the potential impact of smoking on oral mucosal graft viability. In contrast, our study focused exclusively on patients undergoing single-stage dorsolateral onlay BMG urethroplasty performed by a single surgeon, providing a more homogeneous surgical cohort and controlled setting for evaluating risk factors.

On the other hand, Baradaran et al., in a multi-institutional study evaluating recurrence following anterior urethroplasty, reported that smoking was not a significant factor associated with urethroplasty failure(24). However, in this study, buccal mucosa graft urethroplasties accounted for less than 10% of the cohort, which may explain the discrepancy between their results and those observed in our study.

This study has several limitations that should be acknowledged. First, the sample size was relatively small, which may limit the statistical power to detect associations, particularly for variables with subtle effects. In addition, the etiological distribution observed in our cohort likely reflects the referral pattern of our tertiary center and may differ from large population-based series. However, all surgeries were performed by a single experienced surgeon using a standardized dorsolateral onlay technique, providing a homogeneous cohort that reduces inter-operator variability and enhances internal validity.

Second, although the follow-up duration was extended to an average of 15.8 months, longer-term data would be necessary to evaluate late recurrences and assess the durability of surgical success. Nevertheless, the majority of recurrences in urethroplasty tend to occur within the first postoperative year, and the follow-up duration in our study exceeds the minimum threshold used in many previously published series(2).

Third, the retrospective nature of the study may introduce potential selection bias and limit the granularity of some clinical variables such as smoking intensity, duration, and cessation timing. Future prospective studies incorporating detailed tobacco exposure history and objective oral mucosa assessments could provide further insights into the mechanism by which smoking influences graft-related outcomes.

Lastly, although our findings align with previous reports, the exclusive inclusion of patients undergoing BMG urethroplasty may limit the generalizability of the results. Nonetheless, this focused approach enhances the internal consistency of the study.

CONCLUSION

This study points out that buccal mucosa graft urethroplasty using the dorsolateral onlay technique is an effective and reliable surgical approach for the treatment of complex anterior urethral strictures. Stricture length and smoking status were identified as independent predictors of surgical failure. These findings highlight the importance of thorough preoperative assessment, particularly in patients with long-segment strictures and a history of tobacco use. These factors should be considered when counseling patients prior to surgery. Further prospective studies with larger cohorts and longer follow-up are warranted to validate these results and refine patient selection criteria.

Conflict of Interest: The authors declare no conflicts of interest.

Consent for Publication : As this study does not involve identifiable images or personal/clinical details that could compromise participant anonymity, the "Consent for Publication" is not applicable.

Funding: No financial support was received for this study.

Ethics Approval: This study was conducted in accordance

with the Declaration of Helsinki. It received approval from the Ethics Committee of Hisar Hospital Intercontinental (Decision Number: 25-27, Decision date: February 28, 2025). Informed consent to participate was obtained from all participants.

Author Contributions: • Concept and Design: CTG, NCÇ • Supervision: NCÇ, BÇ, MBCB • Data Collection and/or Analysis: CTG,BÇ, AE • Analysis and/or Interpretation: CTG, BÇ, • Literature Search: NCÇ, AE • Writing: CTG, NCÇ • Critical Review: BÇ, MBCB

REFERENCE

1. Lumen N, Hoebeke P, Willemsen P, et al. Etiology of urethral stricture disease in the 21st century. J Urol. 2009;182(3):983-987. https://doi.org/10.1016/j.juro.2009.05.023
2. European Association of Urology (EAU). EAU Guidelines. Presented at the EAU Annual Congress, Paris 2024. Arnhem, The Netherlands: EAU Guidelines Office; 2024. ISBN: 978-94-92671-23-23
3. Yürük E, Yentur S, Çakır ÖO, et al. Catheter dwell time and diameter affect the recurrence rates after internal urethrotomy. Turk J Urol. 2016;42(3):184-189. https://doi.org/10.5152/tud.2016.90490
4. Al Taweel W, Seyam R. Visual internal urethrotomy for adult male urethral stricture has poor long-term results. Adv Urol. 2015;2015:656459. https://doi.org/10.1155/2015/656459
5. Heyns CF, van der Merwe J, Basson J, van der Merwe A. Treatment of male urethral strictures: possible reasons for the use of repeated dilatation or internal urethrotomy rather than urethroplasty. S Afr J Surg. 2012;50(3):82-87. https://doi.org/10.7196/sajs.1081
6. Bhargava S, Chapple CR. Buccal mucosal urethroplasty: is it the new gold standard? BJU Int. 2004;93(9):1191-1193. https://doi.org/10.1111/j.1464-410X.2003.04860.x
7. Hassan AA, Soliman AM, Shouman HA, et al. Dorsal vs ventral onlay buccal mucosal graft urethroplasty for urethral strictures: a meta-analysis. BJU Int. 2025;136(3):385-394. https://doi.org/10.1111/bju.16811
8. Vasudeva P, Nanda B, Kumar A, et al. Dorsal versus ventral onlay buccal mucosal graft urethroplasty for long-segment bulbar urethral stricture: a prospective randomized study. Int J Urol. 2015;22(10):967-971. https://doi.org/10.1111/iju.12859
9. Morey AF, Watkin N, Shenfeld O, Eltahawy E, Giudice C. SIU/ICUD consultation on urethral strictures: anterior urethra—primary anastomosis. Urology. 2014;83(3 Suppl):S23-S26. https://doi.org/10.1016/j.urology.2013.11.007
10. Levy ME, Elliott SP. Graft use in bulbar urethroplasty. Urol Clin North Am. 2017;44(1):39-47. https://doi.org/10.1016/j.ucl.2016.08.009
11. Kartal I, Çimen S, Kokurcan A, et al. Comparison between dorsal onlay and one-sided dorsolateral onlay buccal mucosal graft urethroplasty in long anterior urethral strictures. Int J Urol. 2020;27(9):719-724. https://doi.org/10.1111/iju.14286
12. Spilotros M, Sihra N, Malde S, et al. Buccal mucosal graft urethroplasty in men—risk factors for recurrence and complications: a third referral centre experience in anterior urethroplasty using buccal mucosal graft. Transl Androl Urol. 2017;6(3):510-516. https://doi.org/10.21037/tau.2017.03.69
13. Tinaut-Ranera J, Arrabal-Polo MÁ, Merino-Salas S, et al. Outcome of urethral strictures treated by endoscopic urethrotomy and urethroplasty. Can Urol Assoc J. 2014;8(1-2):E16-E19. https://doi.org/10.5489/cuaj.1407
14. Cam K, Senel F, Akman Y, Erol A. The efficacy of an abbreviated model of the International Prostate Symptom Score in evaluating benign prostatic hyperplasia. BJU Int. 2003;91(3):186-189. https://doi.org/10.1046/j.1464-410x.2003.04055.x
15. Chapple C, Andrich D, Atala A, et al. SIU/ICUD Consultation on Urethral Strictures: The management of anterior urethral stricture disease using substitution urethroplasty. Urology. 2014;83(3 Suppl):31-47. https://doi.org/10.1016/j.urology.2013.09.012
16. Barbagli G, Kulkarni SB, Fossati N, et al. Long-term follow-up and deterioration rate of anterior substitution urethroplasty. J Urol. 2014;192(3):808-813. https://doi.org/10.1016/j.juro.2014.02.038

17. Jasionowska S, Bochinski A, Shiatis V, et al. Anterior urethroplasty for the management of urethral strictures in males: a systematic review. Urology. 2022;159:222-234. https://doi.org/10.1016/j.urology.2021.09.003

18. Shalkamy O, Abdelazim H, Elshazly A, et al. Factors predicting urethral stricture recurrence after dorsal onlay augmented buccal mucosal graft urethroplasty. Urol Int. 2021;105(3-4):269-277. https://doi.org/10.1159/000512065

19. Kay HE, Srikanth P, Srivastava AV, et al. Preoperative and intraoperative factors predictive of complications and stricture recurrence following multiple urethroplasty techniques. BJUI Compass. 2021;2(4):286-291. https://doi.org/10.1002/bco2.83

20. Boyle JO, Gümüs ZH, Kacker A, et al. Effects of cigarette smoke on the human oral mucosal transcriptome. Cancer Prev Res (Phila). 2010;3(3):266-278. https://doi.org/10.1158/1940-6207.CAPR-09-0192

21. Sterling J, Policastro C, Elyaguov J, Simhan J, Nikolavsky D. How and why tobacco use affects reconstructive surgical practice: a contemporary narrative review. Transl Androl Urol. 2023;12(1):112-127. https://doi.org/10.21037/tau-22-427

22. Barbagli G, Bandini M, Balò S, et al. Risk calculator for prediction of treatment-related urethroplasty failure in patients with penile urethral strictures. Int Urol Nephrol. 2020;52(6):1079-1085. https://doi.org/10.1007/s11255-020-02397-y

23. Ma YC, Lin L, Luo Z, Jin T. Smoking is an independent risk factor for stricture recurrence after urethroplasty: a systematic review and meta-analysis. Int Braz J Urol. 2023;49(1):8-23. https://doi.org/10.1590/S1677-5538.IBJU.2022.0244

24. Baradaran N, Fergus KB, Moses RA, et al. Clinical significance of cystoscopic urethral stricture recurrence after anterior urethroplasty: a multi-institution analysis from Trauma and Urologic Reconstructive Network of Surgeons (TURNS). World J Urol. 2019;37(12):2763-2768. https://doi.org/10.1007/s00345-019-02653-6