Risk factors for recurrence of urethral stricture after urethroplasty

Factores de riesgo de recurrencia de estenosis uretral después de uretroplastia

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Abstract

Urethroplasty (UP) is currently considered the gold standard of surgical management for urethral stricture (URS). Although UP has a high success rate and is more cost-effective than other alternatives, recurrence of URS remains a significant problem after UP in this context. According to available evidence, the recurrence of URS after UP is determined by several factors, which may be categorized into technique-inherent, stricture-inherent, and patient-inherent factors. The different UP techniques have proven to be very efficient overall, but some are more suitable for specific types of stricture; thus, the physician must make informed choices to improve clinical outcomes. Likewise, longer and bulbopenile strictures require unique management because of the significantly greater risk of recurrence. Furthermore, assessing patients' comorbidities like DM and obesity, prior history of endourological procedures, etiology of the strictures, and many other factors is vital to establish preventive measures accordingly. Overall, risk management, proper diagnosis, and optimal surgical choice significantly improve clinical outcomes and reduces URS recurrence rates after UP. Gathering positive predictive factors for URS recurrence allows for realistic yet optimal assessment for the patient and the physician. Likewise, some variables are easily modifiable, which allows for preoperative preventive measures that can significantly increase the success rate of this surgical procedure. This review aims to analyze the risk factors and positive predictive factors for URS recurrence after UP, including the different techniques and surgical approaches.

Keywords: Urethroplasty, urethral stricture, surgical failure, risk factors, urology.

Resumen

La uretroplastia (UP) se considera actualmente el estándar de oro del tratamiento quirúrgico de la estenosis uretral (EU). Aunque la UP tiene una alta tasa de éxito y es más rentable que otras alternativas, la recurrencia de la EU sigue siendo un problema importante después de la UP en este contexto. Según la evidencia disponible, la recurrencia de EU después de la UP está determinada por varios factores, que pueden clasificarse en factores inherentes a la técnica, inherentes a la estenosis y factores inherentes al paciente. Las diferentes técnicas de UP han demostrado ser muy eficaces en general, pero algunas son más adecuadas para tipos específicos de estenosis; por tanto, el médico debe tomar decisiones informadas para mejorar los resultados clínicos. Asimismo, las estenosis más largas y bulbopeniles requieren un tratamiento único debido al riesgo significativamente mayor de recurrencia. Además, evaluar las comorbilidades de los pacientes como DM y obesidad, antecedentes de procedimientos endourológicos, etiología de las estenosis y muchos otros factores es vital para establecer medidas preventivas en consecuencia. En general, la gestión de riesgos, el diagnóstico adecuado y la elección quirúrgica óptima mejoran significativamente los resultados clínicos y reducen las tasas de recurrencia de EU después de la UP. La recopilación de factores predictivos positivos para la recurrencia del EU permite una evaluación realista pero óptima para el paciente y el médico. Asimismo, algunas variables son fácilmente modificables, lo que permite tomar medidas preventivas preoperatorias que pueden aumentar significativamente la tasa de éxito de este procedimiento quirúrgico. Esta revisión tiene como objetivo analizar los factores de riesgo y factores predictivos positivos de recurrencia de EU después de UP, incluyendo las diferentes técnicas y abordajes quirúrgicos.

Palabras clave: Uretroplastia, estenosis uretral, fracaso quirúrgico, factores de riesgo, urología.

Introduction

Urethral stricture (URS) is defined as the progressive narrowing of the urethral lumen due to inflammatory processes, resulting in low obstructive urinary symptoms resembling bladder obstruction[1]. This condition affects nearly 600 of every 100,000 men in the at-risk population, usually those over 50 years of age[2]. Historically, infectious urethritis has been the leading cause of URS, in particular in developing countries[3,4]. However, current epidemiological data suggests that there has been an epidemiological shift towards iatrogenic and post-traumatic URS[5,6]. Indistinctive of the cause, URS remains a significant financial burden; for instance, in the United States (US), nearly 200 million dollars were spent on the management of URS in 2000, which amounts to a significant proportion compared to other conditions[7].

Urethroplasty (UP) is the gold standard of surgical management for URS. UP has a success rate between 85-90% for simple procedures, and nearly 80% for complex repairs, significantly greater than any other surgical alternatives[8]. Available data have demonstrated that UR outperforms urethral dilation and direct vision internal urethrotomy (DVIU)[9,10]. Likewise, UP is more cost-effective as initial therapy, even if it follows initial failed DVIU or repeated dilation[11]. Many variables must be pondered when considering UP, like performing anastomotic surgery or graft substitution; moreover, the surgical approach, either ventral, dorsal, or combined onlay, varies depending on the URS location and surgeon preference. The latter variables, inherent to the procedure and surgical choices, tend to influence the outcomes, both in the short and long term. Typically, UP failure is defined as the recurrence of the URS or the need for reintervention[12].

On the other hand, variables unrelated to the procedure provide valuable information regarding the prediction of future URS recurrence. Several authors have stated that age, body mass index (BMI), multiple location stricture, prior endourological procedures, and many other variables seem to influence the effectiveness of UP. Gathering positive predictive factors for URS recurrence allows for realistic yet optimal assessment for the patient and the physician[13]. Likewise, some variables are easily modifiable, which allows for preoperative preventive measures that can significantly increase the success rate of this surgical procedure[14]. This review aims to analyze the risk factors and positive predictive factors for URS recurrence after UP, including the different techniques and surgical approaches.

URETHROPLASTY AND RECURRENCE OF URETHRAL STRICTURE: CAN WE PREDICT IT?

Before UP, the management of URS consisted of serial dilations and urethrotomy procedures. Current migration towards UP lies on the foundation that urethrotomy had a significant recurrence of URS. Specifically, the recurrence rates for urethrotomy were 58%, 82%, and nearly 100% after the first, second, and third internal iterations, respectively[15]. As a result, a history of prior urethral dilation or urethrotomy is a well-established risk factor for URS recurrence, including patients undergoing UP[16]. However, few controversial results support no association between prior urethrotomies or dilation procedures and URS recurrence in UP[17]. Current recommendations suggest performing a single attempt of dilation or urethrotomy in short strictures; if unsuccessful, then open UP may be the next best step[8].

Regarding the nature of the UP itself, two different approaches are mainly discussed: end-to-end urethroplasty (EEUP) and buccal mucosal graft urethroplasty (BMGUP). Notably, EEUP is preferred for shorter length URS[18]. Different meta-analyses and systematic reviews have compared the effectiveness of these procedures head-to-head. Evidence has shown that EEUP is superior to BMGUP when comparing USR recurrence (8.4% vs. 30%, relative risk (RR) 0.38, p= 0.016)[19]. On the other hand, a more recent prospective study analyzed URS recurrence after BMGUP and EEUP. Results showed that EEUP, similar to those mentioned above, had a lower URS recurrence rate than the BMGUP; however, these differences were non-significant after adjusting for stricture length[20]. Several studies have successfully demonstrated that URS recurrence after EEUP and BMGUP is nearly equal when stricture length is similar[21].

Likewise, stricture length is considered an independent risk factor for URS recurrence, thus, explaining the possible bias regarding the difference in recurrence rates between EEUP and BMGUP. Kinnaird et al.[22] conducted a retrospective study to assess the relevance of stricture length and etiology concerning URS recurrence. After performing multivariate analysis through logistic regression, it was shown that strictures longer than 5 cm had a significantly increased risk of URS recurrence (13.8% vs. 5.9%) with a hazard ratio (HR) of 2.3 (1.2-4.5; p≤ 0.01). Similarly, Breyer et al.[23] had previously demonstrated that strictures over 4 cm significantly increased the incidence of URS recurrence.

Along these lines, stricture location seems to influence the recurrence rates of URS, with some disparities across different studies. For example, Verla et al.[24] performed a prospective study in patients undergoing UP for URS correction to identify independent risk factors for surgical failure, defined as URS recurrence. Although analyses could not identify an increased risk of recurrence associated with stricture location, they found bulbar stricture location conferred protection against UP failure (HR 0.44; p=0.043). Similarly, Shalkamy et al.[25] assessed positive predictive factors for URS recurrence after dorsal onlay BMGUP. Analyses regarding stricture characteristics showed that stricture length greater than 4.5 cm (HR: 6.83) and penile stricture location (HR: 3.09) conferred significantly greater risk for URS recurrence than shorter strictures and other locations.

Likewise, Spilotros et al.[26] conducted a retrospective review of 128 patients undergoing BMGUP to determine risk factors associated with surgical failure. The total recurrence rate was 19%, and the complications rate was similar at 12.5%. After univariate analysis, age, stricture length, stricture site, and inflammatory etiology were reported as significant risk factors for URS recurrence. However, the multivariate analysis reported penile stricture location as the only significant independent risk factor for recurrence. Nonetheless, other authors have reported that the penile location of the stricture confers a lower recurrence rate, but these results have failed to achieve statistically significant results[27]. However, surgical approximation of penile and bulbar stricture differs in most cases. The latter is a possible confounding factor when comparing different stricture locations, and further research is needed to assess an accurate conclusion[12].

On the other hand, patient-associated factors have also been studied as risk factors for URS recurrence after UP. For instance, obesity is a risk factor that is constantly reported across different studies and populations. Chapman et al.[17] reported that although bulbar UP has a good stricture-free rate, patients with increased comorbidities and obesity had an increased risk of recurrence. On the other hand, Rapp et al.[28] specifically assessed the impact of BMI on stricture recurrence. The found no significant difference in BMI between patients with and without recurrence (28.9 vs. 30.5 kg/m^2). However, a higher stricture recurrence was seen when comparing the obese cohort against the group with a BMI <25 kg/m^2. Nonetheless, univariate and multivariate analyses failed to demonstrate statistical significance for BMI as a predictive factor for URS recurrence.

Furthermore, Breyer et al.[29] also vealuated the impact of obesity on URS recurrence after UP. Nearly 400 patients underwent UP and had a complete anthropometrical assessment. Moreover, the median follow-up after surgery was 6 years. After analyses, obese and overweight patients were more likely to have URS recurrence, but this remained significant only for obese patients after univariate and multivariate analyses. However, among obese patients, those with severe or morbid obesity (BMI 35-40 kg/m^2 and >40 kg/m2, respectively) did not have an increased risk of URS recurrence, thus showing a non-linear relationship between BMI and UP failure. Beyond these results, more recent studies have determined that obesity in general, indistinctive of BMI, significantly increases the risk of URS recurrence[25].

Other variables like age, comorbidities like diabetes mellitus (DM), smoking, infectious etiology of the URS, and previous UP have been linked to UP failure. While several authors report age as a risk factor for URS recurrence, this is probably biased, because the mean age for the need of endourological procedures is 50 years; therefore, most patients in these studies belong to older age groups. Furthermore, it has been established that UP can be safely performed in elderly patients after assessing stricture length[30]. DM and smoking have been related to URS recurrence in several studies, probably because of their impact on microvascular circulation and impaired wound healing. However, other studies have failed to find a significant association between URS recurrence and smoking or DM[22,30]. In contrast, several reports have established infectious etiology of the stricture as an independent risk factor for URS recurrence[22, 31].

Conclusions

UP is currently the gold standard for managing URS because of its significantly greater success rate than older alternatives like urethrotomy and serial dilations. Despite the significant improvement in success rates provided by UP, a considerable proportion of patients still experience URS recurrence. According to available evidence, the recurrence of URS after UP is determined by several factors, which may be categorized into technique-inherent, stricture-inherent, and patient-inherent factors. The different UP techniques have proven to be very efficient overall, but some are more suitable for specific strictures; thus, the physician must make a proper choice to improve clinical outcomes. Likewise, longer and bulbopenile strictures require unique management because of the significantly greater risk of recurrence. Furthermore, assessing patients' comorbidities like DM and obesity, prior history of endourological procedures, etiology of the strictures, and many other factors is vital to establish preventive measures accordingly. Overall, risk management, proper diagnosis, and optimal surgical choice significantly improve clinical outcomes and reduces URS recurrence rates after UP.

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