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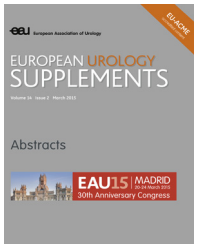

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Reconstructive Management with Urethroplasty

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Abstract

To answer the question of which surgical technique represents the most efficient procedure for urethral reconstruction, the most common techniques are described. Depending on stricture length, stricture location, and patient history, suitable techniques are presented. Preoperative examination and intraoperative findings, such as the condition of the urethral plate, guide the choice of technique. Excision and primary anastomosis is the technique of choice in post-traumatic and short strictures. Flaps and free transplants are necessary in longer strictures. In cases of destruction of the urethral plate, two-stage urethroplasties using buccal mucosa or skin grafts are necessary. For decision making about the adequate urethroplasty technique, underlying pathophysiology, previous treatments, stricture length and location, and shape of the urethral plate have to be considered.

Patient summary: After unsuccessful primary treatment of urethral strictures and in long urethral strictures, open urethroplasties represent the gold standard treatment. Several techniques are available. Selecting the optimal technique depends on preoperative diagnostic evaluation and intraoperative findings.

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1. Introduction

Various surgical techniques have been established for the treatment of urethral strictures including endoscopic procedures for primary and short strictures as well as open urethroplasties for recurrent or long strictures [1]. Although numerous studies have demonstrated promising outcomes, most studies comprised inhomogeneous patient cohorts with different stricture aetiologies and varying stricture locations and lengths [1]. Selection of the appropriate surgical technique in an individual patient should include a preoperative clinical examination as well as intraoperative findings. Consequently, detailed clinical examination is mandatory, and urethral surgeons should be familiar with the clinical work-up and various urethroplasty techniques: excision with primary anastomosis (EPA) and substitution urethroplasty with flaps and free transplants.

2. Essential preoperative examinations

Basic examinations include an anamnesis and ultrasonography of the urinary bladder and kidneys, and an assessment of postvoid residual urine. Clinical data such as trauma, stricture, aetiology, and previous treatment of the urethra have to be determined. An uroflowmetry is required to analyse obstructive lower urinary tract symptoms including a weak urinary stream and a prolonged micturition. Other causes of infravesical obstruction (eg, prostatic

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hyperplasia or neurogenic bladder dysfunction) should be ruled out prior to urethral reconstruction and treated separately. A retrograde urethrogram is the most important preoperative examination to detect and characterise the length and location of urethral strictures, thus facilitating decision making on the most adequate reconstructive urethroplasty technique. The evaluation of spongiofibrosis in the retrograde urethrogram remains challenging; however, a urethroscopy may add valuable information in certain cases. Importantly, the intraoperatively detected spongiofibrosis of the urethra may be more extended compared with the preoperative findings on the retrograde urethrogram or ultrasonography. Consequently, the definitive extent of urethral strictures may become evident intraoperatively, and the appropriate surgical technique mainly depends on the length and location of the stricture.

3. Management of traumatic strictures

EPA is the gold standard treatment for post-traumatic urethral strictures [2]. Immediately after the initial trauma, a suprapubic cystostomy is inserted, and urethral reconstructive surgery is performed following primary wound healing [2]. In selected cases, primary endoscopic realignment represents a valid option to restore the junction between the proximal and the distal ends of the urethra. After pelvic fracture–associated urethral injuries, primary endoscopic realignment reduces the risk of stricture development compared with the placement of a suprapubic cystostomy [3]. Conversely, other authors found high rates of urethral strictures following early endoscopic realignment [4,5], with a subsequent need for further interventions [6]. Complex urethral distraction defects and prostatic displacement are associated with unfavourable outcomes [7]. A complete resection of the scar and a tension-free anastomosis is necessary for long-term success. In some cases a tension-free direct end-to-end anastomosis is not possible. Some techniques enable a reconnection of longer distances. At first separation of the corporal bodies or an additional resection of the pubic bone reduces the distance from the proximal to the distal ending of the urethra and allows a tension-free anastomosis. In some selected cases, a rerouting technique is necessary. Consequently, the corpus spongiosum is turned around the corpus cavernosum and placed laterally to fix it to the proximal urethral ending [8]. After post-traumatic complete obliteration of the urethra, stricture excision and primary end-to-end anastomosis resulted in urethral stricture recurrence in 18% of patients in one study. Complications occurred in a total of 28% of patients including erectile dysfunction and urethrocutaneous fistulas in 5% and 3%, respectively [9].

4. Management of nontraumatic strictures

4.1. Excision with primary anastomosis

EPA offers excellent functional outcomes for the treatment of nontraumatic urethral strictures. Success rates of 98.8% after a mean follow-up of 50.2 mo have been published, and this technique is generally recommended as the treatment of choice for short urethral strictures [10,11]. However, insufficient excision of the stricture and incomplete mobilisation of the urethra may result in treatment failure [10]. Complications of EPA include erectile dysfunction, penile deviation, and penile shortening, although these complications have not been reported frequently in strictures with a length <2 cm [12]. Because of the risk of deviation, we would not recommend this technique in the penile urethra. In proximal bulbar strictures with a length ranging from 2.6 to 5.0 cm, primary bulbomembranous anastomosis represents a promising technique without the need for flaps or grafts [12,13]. The trend towards non-transsecting techniques helps keep the blood supply in the reconstructed area. These vessel-sparing techniques preserve the proximal urethral blood supply and show satisfying functional outcomes after midterm follow-up [14,15].

4.2. Flaps

Orandi was one of the first to use pedicled skin flaps for the reconstruction of urethral strictures [16]. The skin flap keeps its blood supply by preserving the blood vessels. The pedicled skin graft technique was modified by McAninch in the early 1990s [17]. He used a fasciocutaneous flap with Buck fascia in 10 patients with complex strictures. Patients showed a stricture-free follow-up after a mean of 14.4 mo. It is of pivotal importance to preserve the blood supply of the flap and to perform an adequate mobilisation for a tension-free anastomosis. The use of hair-bearing skin flaps has to be avoided to prevent intraurethral growth of hairs. Thus preputial and penile shaft skin flaps are most commonly used. Using pediculated flaps, a complete closure of the corpus spongiosum is not possible, with postvoid dribbling the main consequence (Fig. 1).

4.3. Onlay and inlay grafts

Grafts currently represent the most established technique for urethral reconstruction. Free skin grafts have been implemented in reconstructive urethral surgery since the early 1950s and 1960s [18,19]. Several modifications have been developed and have helped improve the success rates of these reconstructive techniques [20,21]. Buccal mucosa has been used as a free transplant for urethral reconstruction since the early 1990s [22]. In 2001 Asopa published a free buccal mucosa graft technique for the reconstruction of the distal urethra [23]. It remains controversial whether functional outcomes of skin and buccal mucosa grafts are comparable [24] or if buccal mucosa graft substitution urethroplasty offers an advantage [25]. At present, various techniques for buccal mucosa substitution urethroplasty have been introduced in daily clinical practice [26]. The length of the urethral stricture limits the utilisation of buccal mucosa grafts because tension and scar formation of the oral cavity may cause significant pain and discomfort.

Following the dissection of the urethra, the graft can be inserted in a ventral onlay or dorsal inlay fashion, depending mainly on the location of the stricture. In the