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Dorsal onlay urethroplasty for urethral stricture repair

Abstract Full-thickness penile skin grafts have long proved to be valuable in substitution urethroplasty. However, occasional cases of poor graft take, sacculation, or shrinkage of the repairs have mitigated their success. A determining factor in the outcome of grafts is their mechanical support. Historically, ventral placement of the graft has been used, primarily because of the simplicity of access and the excellent graft bed offered by the spongy tissue. However, mechanical support in this location is suboptimal in comparison with that offered by the corpora cavernosa. Recently, dorsal placement of the graft has been proposed, allowing the skin patch to be spread fixed on the tunica albuginea of the corporal bodies overlying the stricture. Fixation of the graft may minimize its retraction and increase its neovascularization. To date, this innovation has proved to be very promising.

Nonsurgical options in the management of urethral stricture include urethral dilation, optical urethrotomy, and, more recently, urethral stents. Whereas some strictures are cured by these minimally invasive methods, others recur early and need an open surgical repair. There are two basic varieties of urethroplasty. Excision and reanastomosis are best suited for short strictures, particularly in the bulbar urethra. On the other hand, longer strictures of the anterior urethra require substi-

tution repairs using onlay flaps or grafts, usually of penile skin. Often these two principles may be combined to achieve optimal reconstruction of the urethra.

Enthusiasm for urethral reconstruction using full-thickness skin grafts arose out of dissatisfaction with the results of the techniques used in the early 1950s. In that era, urethral regeneration over a splinting catheter was often used; however, the new epithelialized urethra would usually contract and restricture [1]. On the other hand, two-stage urethroplasty had the disadvantages of a minimal waiting period of 3 months between the two operations, in addition to the inconveniences of the anatomical changes after the first intervention, and the fact that the neourethra was generally constructed from hair-bearing scrotal skin [12]. Nearly half a century ago, Presman and Greenfield [17] described a successful one-stage urethroplasty with preputial skin graft. Although this technique was progressively adopted and improved, placement of the graft remained ventral primarily for reasons of simplicity of access and custom [7–11].

Although the long-term results of ventral free full-thickness skin-graft urethroplasty are satisfactory, sacculation of the graft and pseudodiverticulum have been reported, causing postvoid dribbling and ejaculatory failure [4, 5, 10]. The main problem, however, has been shrinkage of the graft [4, 10, 11, 17]. These failures were attributed to the folding of the graft upon itself because of the lack of mechanical support or to insufficient graft neovascularization. The use of large urethral stents (> 20 Fr) was advocated by some investigators in the hope of increasing intraluminal graft support, whereas others favored prolonged bed rest, hoping that it would improve graft neovascularization.

An improved graft bed was recently proposed by Barbagli and co-workers [3]. Rather than placing the graft in a ventral position, they interposed it dorsally, thereby allowing it to be firmly anchored to the corpora cavernosa. A dorsal approach to stricture disease had previously been described by Monseur [13], who demonstrated the efficiency of widening the urethral lumen

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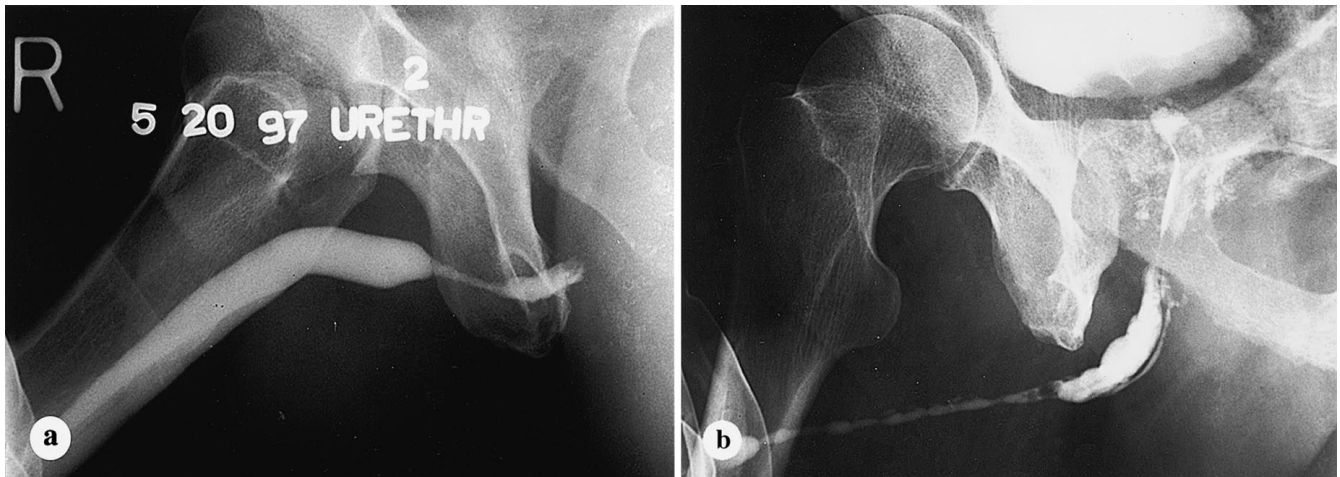


Fig. 1 **a** Retrograde urethrography showing a 2-cm stricture of the bulbar urethra. **b** Retrograde urethrography showing a 11-cm stricture of the bulbar and pendulous urethra

by incising the dorsal urethral layer and suturing it to the corpora cavernosa, albeit without the use of an onlay skin graft. The dorsal placement of the graft allows it to benefit from the tensile strength of the tunica albuginea of the corporal bodies. Although follow-up of the single series of dorsal onlay urethroplasties remains short, the technique seems to be conceptually sound and potentially offers significant advantages [3]. The dorsal onlay urethroplasty seems best suited for anterior urethral strictures proximal to the suspensory ligament, as in the pendulous urethra the lack of elasticity of these grafts may result in erectile chordee.

Patient evaluation

The most important aspects of urethral stricture anatomy are provided by retrograde urethrography (Fig. 1). The urethra proximal to the stricture may also need evaluation by voiding cystourethrography, particularly when the stricture is tight and impedes retrograde passage of contrast medium. Sonographic urethrography is a complementary diagnostic modality that has proved its efficiency in identifying the extent and thickness of spongiofibrosis [2, 14]. Endoscopy sometimes also further outlines the limits of the disease, especially when it shows “gray” urethra, which means that spongiofibrosis extends beyond the limits of the stricture. Preoperative urine culture should be sterile.

Penile inspection is of paramount importance with regard to the location and amount of skin available for repair. Previous circumcision will often dictate whether preputial or penile shaft skin will be used. Generally, in graft harvest from the penile shaft a width of up to 3 cm can be safely excised without compromising penile skin closure. In the event of insufficient penile skin, other donor sources, such as buccal mucosa, may also be used [6, 15].

Technique

Urethral exposure

Surgery is conducted with the patient in the standard lithotomy position (Fig. 2a). A 20-Fr catheter is inserted per urethram until it impacts at the stricture site, which is marked on the skin. A midline perineal incision is then made over the stricture and is bifurcated posteriorly. After the perineal tissues have been incised the stricture site is again located with the catheter, and the bulbospongiosus muscle is dissected from the underlying urethra. On each side of the urethra, Buck’s fascia is incised at the level of the crus, creating a window that exposes the corporeal bodies. Further incision of this fascia facilitates mobilization around the dorsal surface of the urethra, allowing for circumferential dissection at the stricture site and for a further 2 cm proximally and distally.

Urethrotomy

The urethra is rotated and stay sutures are placed at the 12 o’clock position, facilitating rotation of the urethra to gain access to its dorsal surface. The 20-Fr catheter is inserted down to the stricture and the urethral wall is incised onto the tip of the catheter at the 12 o’clock position. Further stay sutures are inserted to splay open the urethral lumen (Fig. 2b). The urethrotomy continues into healthy urethra proximal and distal to the stricture to reduce the risk of recurrence. Once the whole stricture has been exposed, part of the urethral scar may need to be excised according to the degree of spongiofibrosis (Fig. 2c). In this case the ventral/floor side of the urethra would be reanastomosed after spatulation.

Graft harvest

The graft is marked out on the ventral surface of the shaft of the penis or adjacent to the coronal sulcus. The

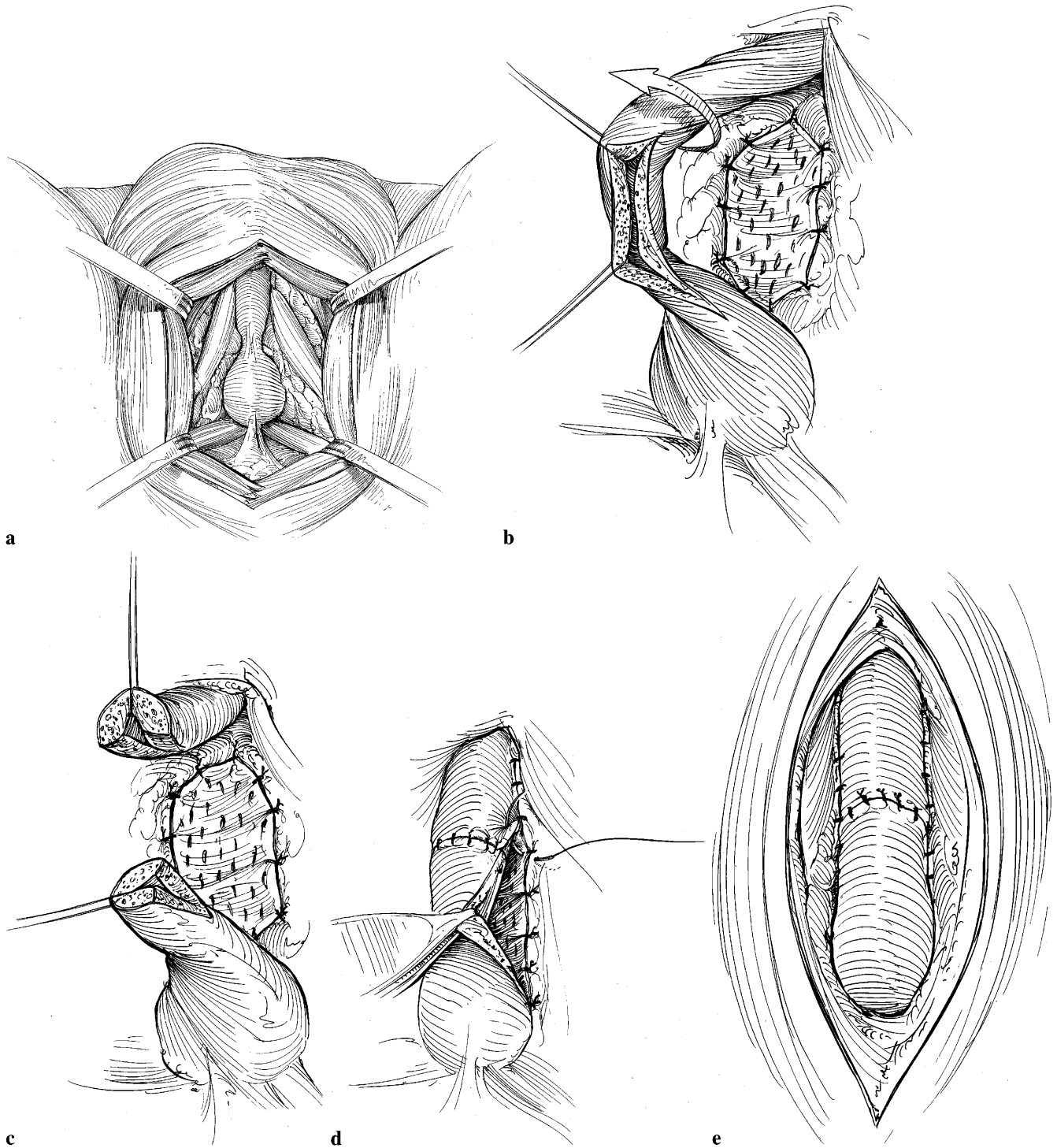


Fig. 2 a–e The dorsal onlay-graft bulbar urethroplasty. **a** Exposure of the urethra. **b,c** Fenestrated graft sutured to the overlying undersurface of corporal bodies. Strictured portion of the urethra, either cut open and rotated (**b**) or excised (**c**). **d** Suture of the urethral margin to the graft margin. **e** Completed repair

scissors, and is fenestrated with a scalpel. The graft's fenestrations will allow blood and serous exsudates to escape from the graft bed.

graft width is generally 2.5 cm, and its shape may be adjusted according to the needs of the repair. Once the graft has been raised and the penile skin closed, the graft is spread fixed on a paraffin block, is defatted with

Suture of the graft

First the proximal and distal ends of the graft are fixed to the apex of the urethral incision and to the adjacent corporal bodies with a 4.0 or 5.0 polyglycolic acid

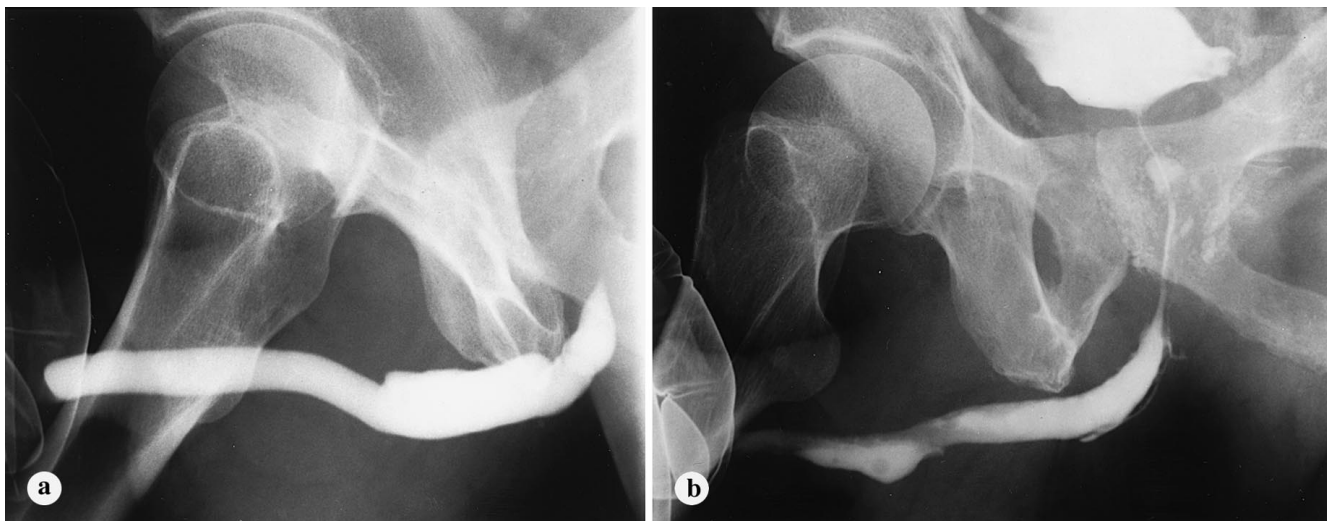


Fig. 3 a Retrograde urethrography (patient in Fig. 1a) 3 months after dorsal onlay-graft urethroplasty, showing the absence of extravasation and a urethra of normal caliber throughout. **b** Retrograde urethrography (patient in Fig. 1b) 6 weeks after dorsal onlay-graft urethroplasty and Orandi flap urethroplasty, showing the absence of extravasation and a urethra of normal caliber throughout

suture. This anchors the graft in its correct longitudinal orientation. The graft is then sutured to the overlying corporal bodies around the graft perimeter (Fig. 2b, c). This spread fixes the graft to the corporal body overlying the strictured portion of the urethra. A few additional sutures may also be placed to secure the central portion of the graft to the overlying corporal body so as to improve its coaptation (“quilting” sutures). The opened urethra is next sutured to the margins of the graft (Fig. 2d), commencing with the posterior sutures and using a 4.0 or 5.0 polyglycolic acid suture. The suture picks up the superficial surface of the corporeal body, the perimeter of the graft, and the adjacent wall of the urethra. Sutures are placed progressively around the perimeter of the graft on each side of the urethra, splaying open the strictured urethra to the new roof, which is the spread fixed full-thickness skin graft (Fig. 2e).

Stenting and closure

The repair is stented with a 14-Fr silastic Foley catheter, which is fenestrated at the stricture site to allow for drainage of secretions. A suction drain is placed alongside the repair prior to the closure of the bulbo-spongiosus muscles and the perineal tissues.

Postoperative care

Oral anti-erectile agents are given, and the patient generally stays in hospital for 24 h, during which parenteral antibiotics are given. The suction drain is removed on

the day of discharge, and the Foley catheter stent remains in place for 3 weeks. Its removal is preceded by a retrograde urethrogram around the catheter to ensure that there is no extravasation. Thereafter, the patient is allowed to void naturally and to return to normal activities.

Complications

Complications are similar to those following open surgery for urethral stricture, namely, urethrocutaneous fistulae and stricture recurrence [18]. None of these occurred in the single series available at this time, which had a mean follow-up of 36 months [3]. Our own experience with this technique mirrors these results. In the initial series [3], extravasation of contrast medium at the time of catheter removal (2 weeks) was observed in 5 of 25 patients and subsided after a further week of catheterization [3]. In repairs of the pendulous urethra, erectile chordee may occur.

Discussion

The dorsal onlay-graft urethroplasty seems to offer significant advantages over standard ventral flap or graft techniques. Spread fixation of the graft provides a secure bed, likely reduces graft shrinkage, and certainly prevents sacculation at the repair site. Interposition of the graft between the urethra and the corporal bodies may decrease the risk of fistula formation. Furthermore, the dorsal onlay-graft urethroplasty seems particularly useful in the repair of recurrent strictures, as it allows the surgeon to work on the contralateral, unscarred side of the urethra.

This technique finds its main use in the bulbar urethra. However, it has also been applied to the repair of pendulous strictures [3]. When it is used in the pendulous urethra, one must be cautioned of the risk for penile chordee, should the graft prove to be inelastic.

A total of 29 patients underwent dorsal onlay-graft urethroplasty at our institution over a period of 27 months (June 1995 to September 1997). This accounted for 43% of the 68 anterior urethroplasties performed during this period. In 25 patients, a dorsal onlay graft was used alone, and in 12 of these cases, excision of a portion or all of the stricture and ventral/floor strip anastomosis was performed. In a further 4 patients an Orandi flap urethroplasty (Fig. 3b) was associated because of penile extension of the stricture (Fig. 1b). In the majority of patients (27), penile shaft skin or foreskin grafts were used, whereas 2 patients had buccal grafts. Early results obtained using dorsal onlay-graft urethroplasty are very promising. However, at 10 years a 40% re-stricture rate of substitution repairs using ventral free full-thickness skin grafts has been reported [16]. Therefore, this technique has yet to stand the test of time.

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