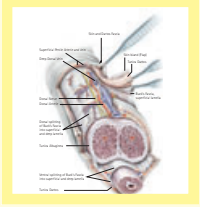
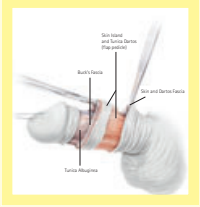
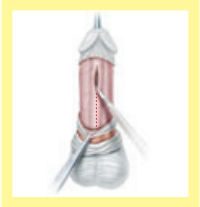
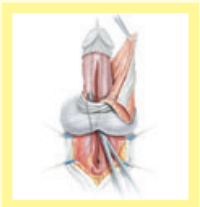
Surgery Illustrated









Distal penile circular fasciocutaneous flap for complex anterior urethral strictures

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KEYWORDS

fasciocutaneous flap, stricture, urethra, surgery

INTRODUCTION

Complex anterior urethral strictures represent challenging cases even for the experienced reconstructive urologist. Urethral trauma is the most common reported cause (≈ 50%) with the remainder being idiopathic. Risk factors are long-term urethral catheterization, previous urethral instrumentation, unrecognised urethral trauma, chronic urethritis, and compromised urethral blood flow. Scar excision and anastomotic urethroplasty is reserved for short bulbar urethral strictures (<2.0–2.2 cm) due to the risk of penile shortening and tissue ischaemia with more extensive resections [1].

Many different reconstructive techniques have been described and are chosen based on the length, location and extent of spongiofibrous tissue contributing to the stricture. Complex anterior urethral reconstruction relies on a tissue transfer technique in the form of either a free graft and/or pedicle flap. Both are successful individually [2–4], and in combination for pan-urethral strictures [5]. A distal circumferential penile fasciocutaneous flap can be used for any length anterior urethral stricture but is optimal for longer (>5.0 cm) or multiple anterior urethral strictures with an achievable flap length of 12–15 cm [6]. Its adaptability comes from its mobile, well-vascularized pedicle and elastic skin island that can be used from the membranous urethra to the fossa navicularis. Additionally, by dividing the flap it can provide two shorter flaps to reconstruct noncontiguous strictures. A fossa navicularis or shorter stricture does not require the length obtained from a circumferential flap thus, flap development is tailored to the length of the diseased urethra [7]. Although a fasciocutaneous flap can been tubularized, replacing the entire urethra, we prefer to use it as a ventral onlay flap and retain a portion of the urethral plate. Onlay repairs are more successful than those involving flap tubularization with recurrent stenosis reported at 13% vs 58%, respectively [8].

PATIENT SELECTION

Patient selection focuses on the length and location of the stricture, and the availability of foreskin in the uncircumcised male and penile shaft skin in the circumcised male. Foreskin or distal penile skin is chosen because of their hairless characteristic and reliable blood supply [9]. The patient should be carefully examined for lichen sclerosus (also known as

balanitis xerotica obliterans) as this would not be suitable skin for a complex urethral reconstruction. The stricture should be delineated before surgery with a retrograde urethrogram and voiding cystourethrogram. If these radiographic studies are inadequate to determine the extent of stricture disease, an intraoperative sonourethrogram can be performed.

RECOMMENDED EQUIPMENT

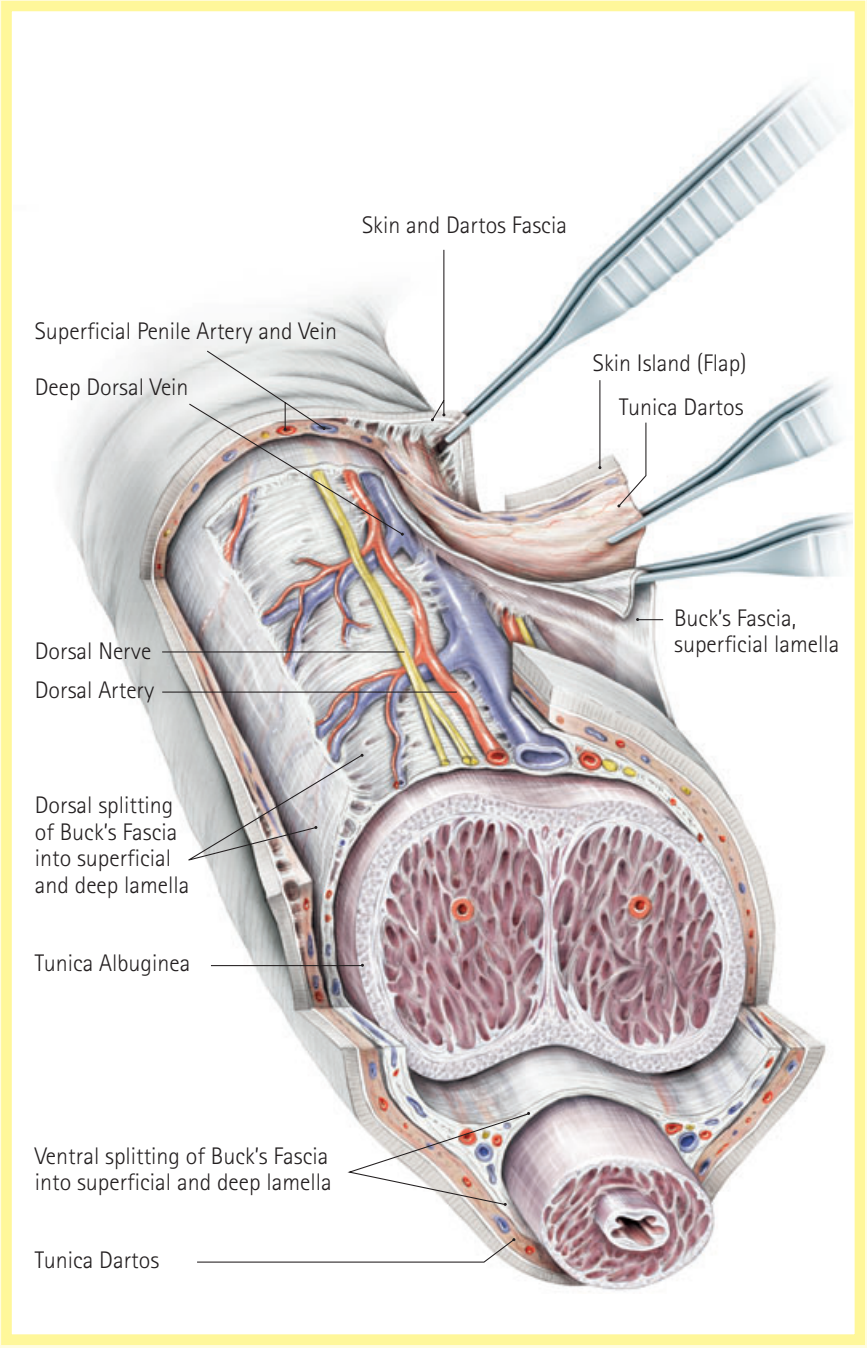
- Fine serrated scissors.
- Non-crushing fine forceps.
- Bipolar electrocautery.
- Lone Star retractor and tissue hooks (for patients with proximal anterior urethral strictures requiring the lithotomy position).

SURGICAL TECHNIQUE

After general anaesthesia and i.v. antibiotics, the patient is positioned supine for pendulous urethral strictures and in either low or high lithotomy for more proximal bulbar urethral strictures. For a stricture involving the entire anterior urethra, the procedure is begun in the supine position to develop the fasciocutaneous penile flap and incise the pendulous urethra. A sterile dressing is placed over the perineum and the patient is repositioned in high lithotomy to allow optimal access to the remaining proximal bulbar urethral stricture. This minimizes the operative time and risk of peripheral neuropathy from an exaggerated lithotomy position [8]. Alternatively, a low lithotomy position can be used as access to both the pendulous and bulbar urethra.

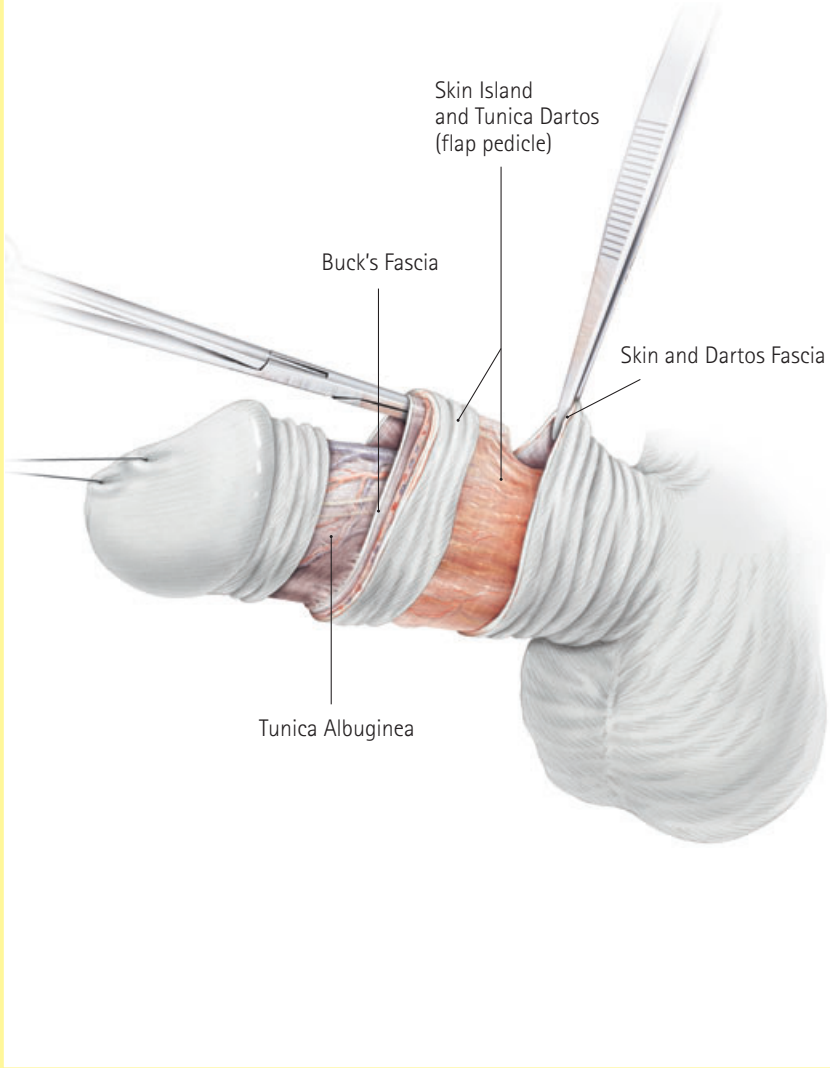
Figure 1

Fundamental to performing a fasciocutaneous penile flap reconstructive urethroplasty is a thorough understanding of penile anatomy, vascular supply and fascial planes. The blood supply to the penile skin and the fasciocutaneous penile flap arises from the superficial and deep external pudendal artery, a branch of the femoral artery. As these arteries descend inferiorly they branch and create an arterial network that nourishes the penile skin via a subdermal plexus and the fasciocutaneous flap via the tunica dartos [10,11]. Proper surgical development of the fasciocutaneous flap requires two planes of dissection. Superficially, between the dartos fascia and tunica dartos and deeper, below Buck's fascia as it is the fascial support for the tunica dartos. Buck's fascia splits dorsally around the neurovascular bundle and ventrally around the urethra into a superficial and deep lamella. The vascular supply to the penile shaft skin exists in the subdermal plexus superficial to the dartos fascia thus it is critical it remain with the penile skin to prevent skin necrosis. The tunica dartos carries the blood supply to the island of penile skin and is supported by Buck's fascia reflected in the 'fasciocutaneous penile flap' name [12].



Figures 2 and 3

After placing a 2/0 silk suture vertically in the glans for traction, the flap width is carefully measured and outlined using fine callipers to 20–25 mm. Inner preputial skin is used in the uncircumcised male and distal penile skin is used in the circumcised patient. Critical to avoiding redundancy and succulations is to measure the distal penile skin on full stretch and to not exceed a width 25 mm. A15 blade knife is used to incise the stretched penile skin.



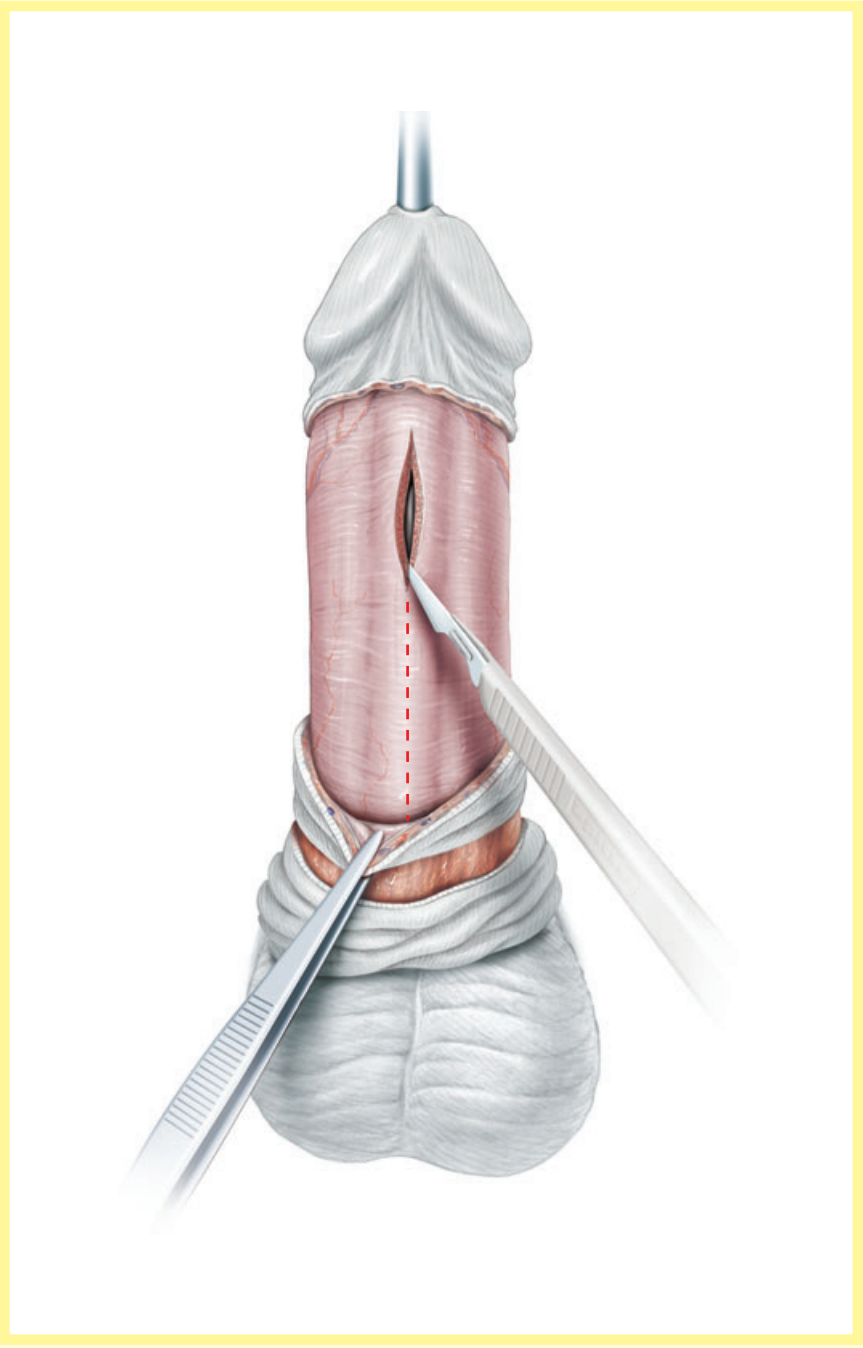


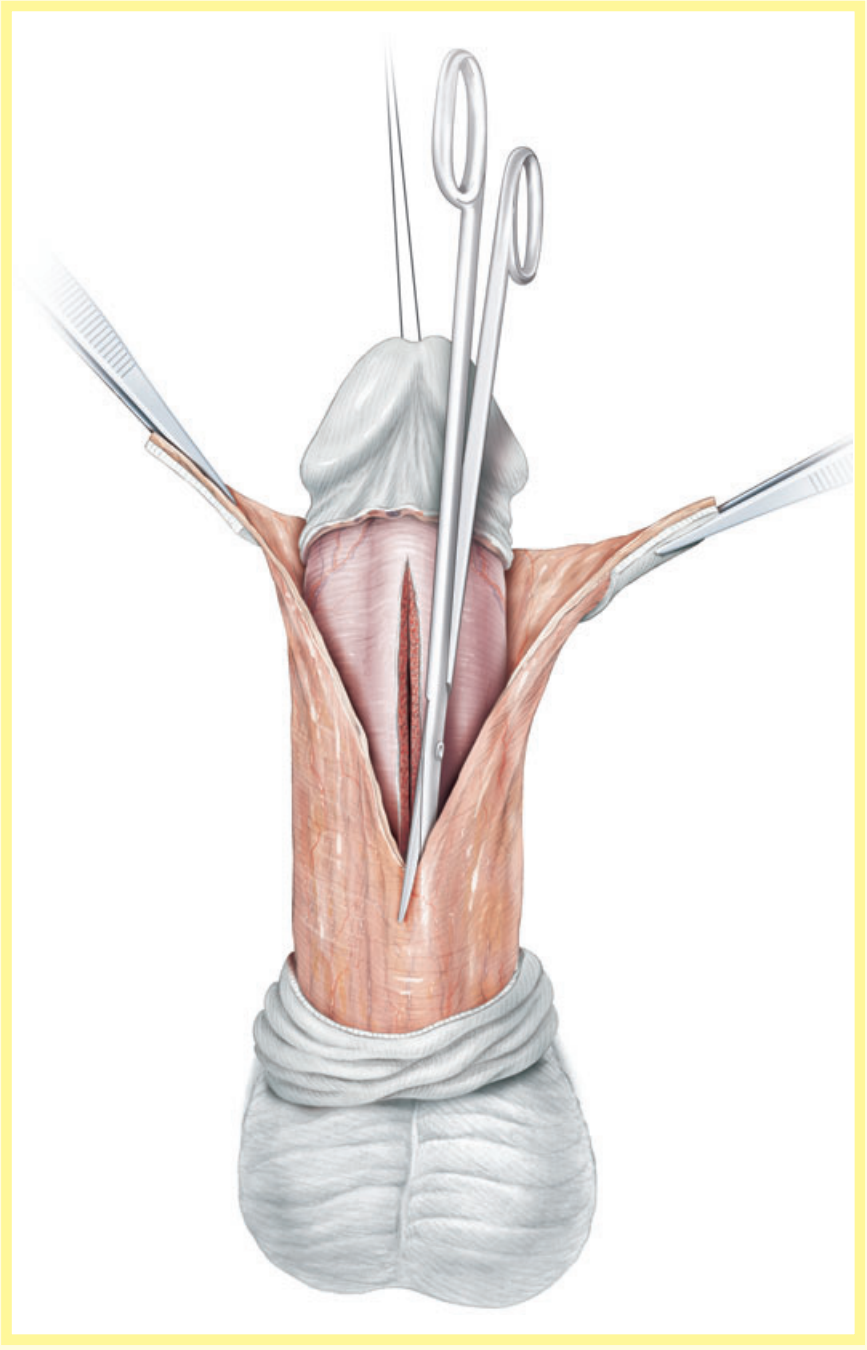
Figure 4

Using a knife, the urethra is opened ventrally over a 20 F red rubber urethral catheter and 4/0 urethral tacking sutures are placed. The remainder of the urethra is incised with fine scissors. In near occlusive urethral strictures, maintaining urethral continuity can be difficult and when possible should be bridged with a small feeding tube. Deviating off the midline while opening the urethra ventrally can make the onlay flap reconstruction difficult and can be avoided by keeping the penis on stretch.

Proximal, the urethra is calibrated to 26 F. Urethrocystoscopy is used to evaluate the proximal urethra, the prostate and the bladder for additional pathology.

Figure 5

The skin island and pedicle are divided ventrally in the midline. The flap length is reliably 12–15 cm. The flap is rotated to one side to begin the onlay reconstruction.



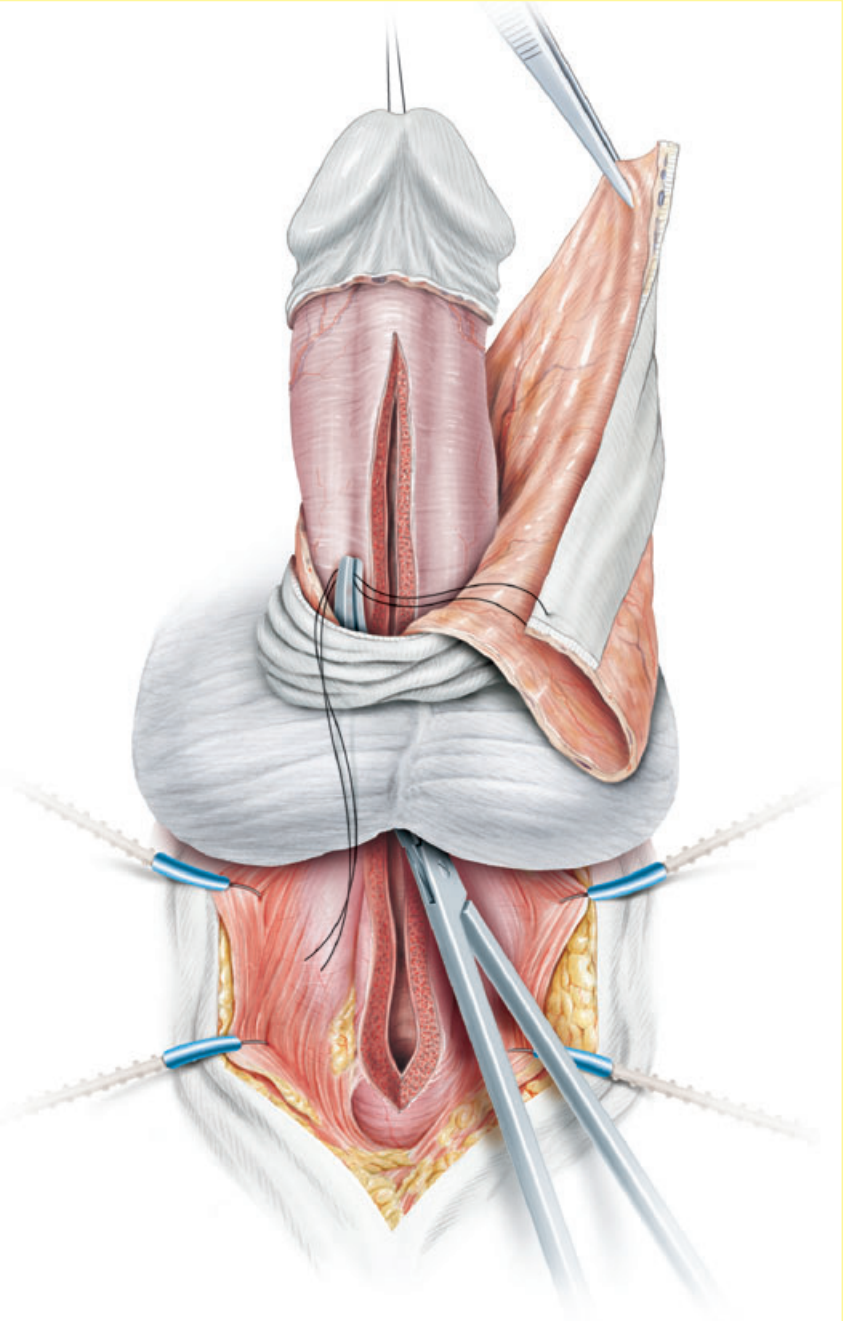


Figure 6

For proximal bulbar strictures the flap is passed through the scrotum. The flap is placed on gentle tension and tailored to the length of the urethral opening. Fine-tooth forceps are used to manoeuvre the flap avoiding direct handling of the pedicle.

Figure 7

Fine absorbable 6/0 suture is used to tack the flap to each apex, careful to obtain an epithelial to epithelial anastomosis. The length of the flap is then aligned to the urethra with several interrupted sutures. This ensures proper approximation and tension during the continuous simple suturing avoiding flap redundancy and preventing development of sacculations. The ipsilateral back-wall is anastomosed first from the inside to avoid the flap pedicle. Periodic locking of the suture prevents gathering of the tissue. A 16 F urethral catheter is placed and the onlay flap reconstruction is completed by a continuous watertight suture line to the distal apex. The pedicle is loosely tacked down and the penile skin is advanced distally to begin skin closure.

With more proximal anterior strictures, the scrotum might need to be opened to access the urethra. Positioning the patient in low or high lithotomy, depending on the location of the stricture, will facilitate the dissection. A Lone Star retractor is placed and tissue hooks are used to assist with exposure. The scrotum is reconstructed after the onlay flap is complete in a standard two-layer closure re-approximating the median raphe. A 0.6 cm (0.25 in) Penrose drain is placed on the contralateral side of the pedicle to alleviate any reactive fluid collection and removed on postoperative day 2.

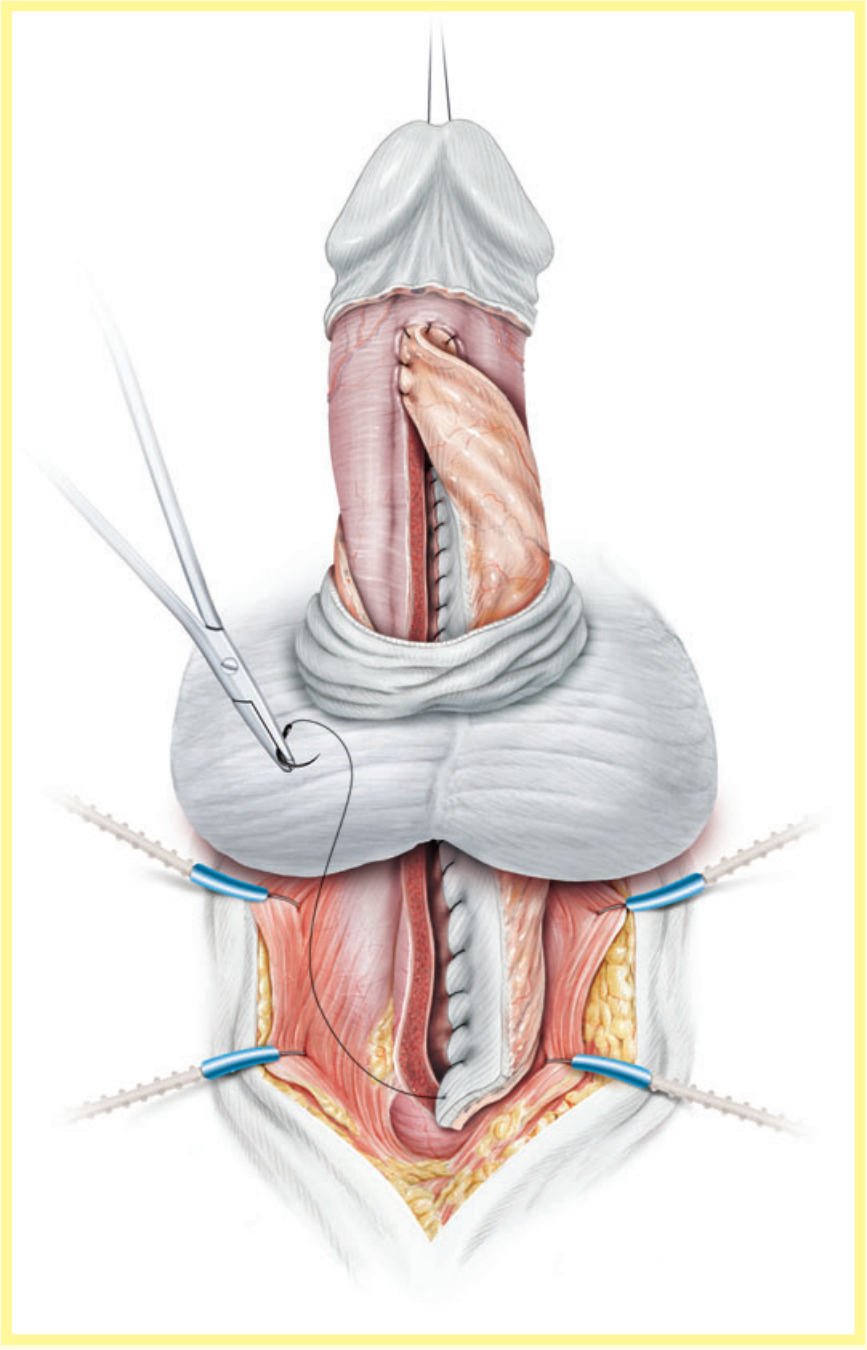


Figure 8

Interrupted absorbable 4/0 suture is used to re-approximate the penile shaft skin. The wound is dressed with two medium Tegaderm dressings (3M Health Care, St. Paul, MN, USA) in a 'sandwich' fashion around the penile shaft to create an occlusive dressing. Pressure is used to control glandular bleeding from the stay suture. Fluffs dressing and scrotal support are placed with the urethral catheter secured on the abdomen.

POSTOPERATIVE CARE

The occlusive Tegaderm dressing can be removed on postoperative day 2. Showers should occur daily and with the incision left uncovered. The patient is discharged on 1 week of an oral cephalosporin and scheduled for a voiding cystourethrogram at 3 weeks after surgery. Erections are encouraged and help prevent ventral bowing, which is a temporary complaint experienced by some patients. Slight penile torsion can also occur but should resolve within the first few months. The operation is well tolerated by the patient with minimal pain, satisfying cosmesis and high success rates (85–90%) in experienced reconstructive hands for an otherwise daunting problem [5,8,12].

CIRCULAR FASCIOCUTANEOUS FLAP CHARACTERISTICS

- Hairless
- Adequate mobility and length
- Predictable blood supply
- Acceptable donor site cosmesis
- Preservation of sexual function

SURGICAL TIPS – CRITICAL STEPS FOR SUCCESS

1. Stretch penile skin during initial width calibration for flap development, ideal width 20–25 mm.
2. Elevation of buck's fascia, support of the tunica dartos superficial to the neurovascular bundle.
3. Adequate mobilization of the skin and pedicle flaps.
4. Epithelium to epithelium anastomosis, water tight.
5. Fasciocutaneous flap tapering to stricture length.
6. Complete stricture incision with calibration.

SURGICAL PITFALLS

1. Fasciocutaneous flap redundancy – divericulum formation.
2. Skin necrosis – wrong dissection plane.
3. Incomplete flap mobilization – ventral bowing of the urethra.
4. Fistula formation – epithelial to epithelial breakdown.
5. Recurrent stricture – inadequate scar incision.

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