

# Surgery Illustrated



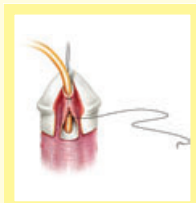
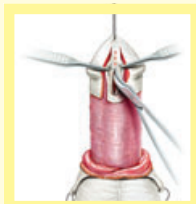
## Surgical Atlas

### Snodgrass technique for hypospadias repair

**WARREN T. SNODGRASS**

*Department of Paediatric Urology, Children's Medical Center of Dallas and University of Texas South-western Medical Center at Dallas, TX, USA*

ILLUSTRATIONS by STEPHAN SPITZER, [www.spitzer-illustration.com](http://www.spitzer-illustration.com)



#### INTRODUCTION

Options for urethroplasty in children with hypospadias can be classified as tubularizations of the urethral plate, skin flaps and grafts. Throughout the history of surgery for this condition flaps have been most commonly used, but in the past 10 years incision and tubularization of the urethral plate (tubularized incised-plate, TIP) has rapidly gained popularity for correcting distal, proximal and re-operative hypospadias. TIP potentially simplifies both decision-making and surgical technique, and has a low complication rate with better cosmetic results. However, careful attention to surgical details and awareness of contraindications to the procedure are needed to achieve optimal results.

#### PATIENT SELECTION

Essentially all patients with midshaft and more distal hypospadias can undergo TIP of the urethral plate. Those whose plates are deeply grooved to near the underlying corpora cavernosa do not need midline plate incision, except to remove any transverse webs that might deflect the urinary stream, whereas most with a flat or only moderately grooved plate benefit from the relaxing incision to create an adequately sized neourethra. Many cases of proximal hypospadias can also be corrected by TIP, assuming any associated ventral curvature is

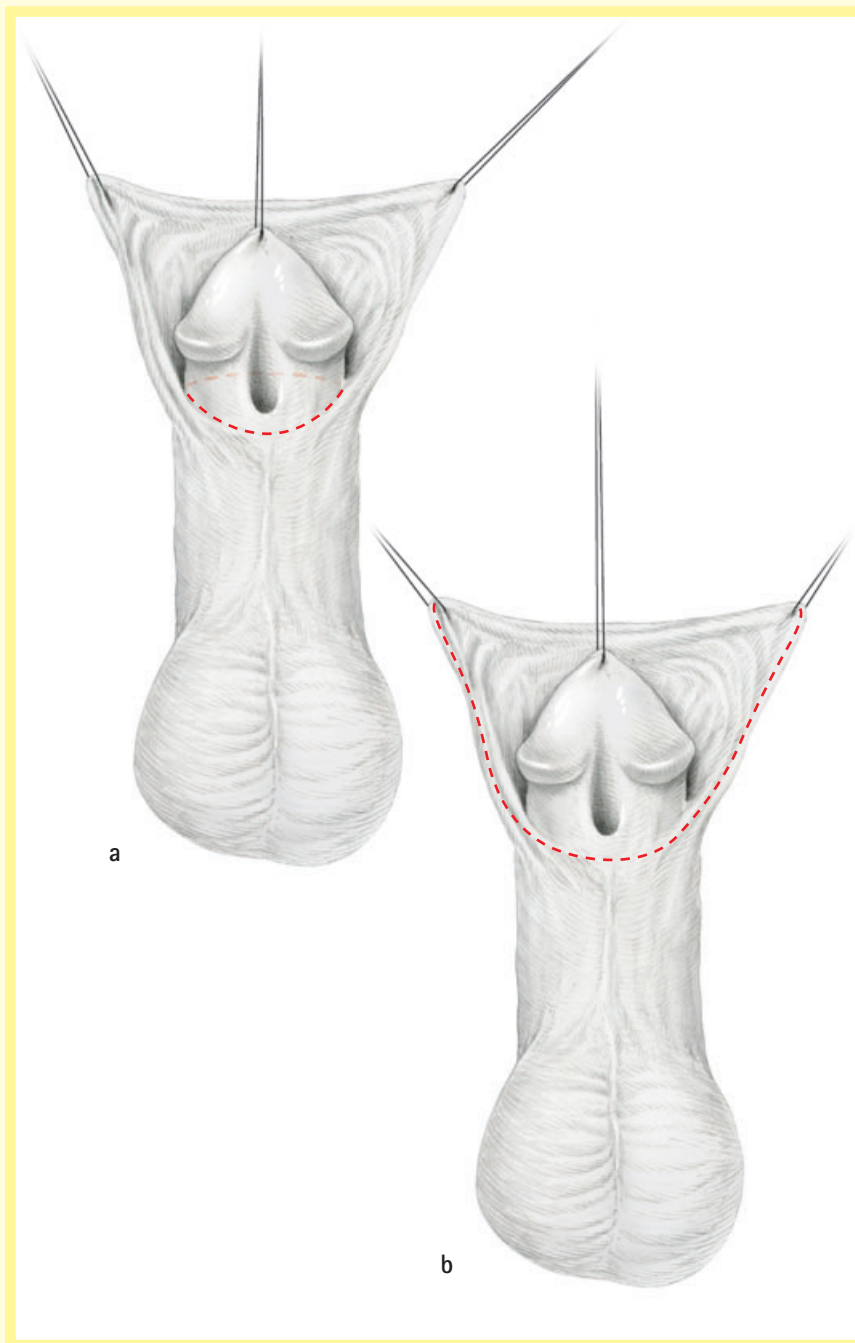
straightened without transecting the urethral plate, and that the incised plate appears supple. Similarly, TIP is an option for re-operations if the urethral plate has not been excised previously and still appears healthy without gross scars.

In otherwise healthy infants born full-term hypospadias can be repaired, as an outpatient procedure, as early as 3 months of age, and is probably best completed before the child develops genital awareness at  $\approx$  18 months old. Preoperative hormonal stimulation is given when the glans appears small, which is most common in boys with proximal defects.

Specific instruments and materials used for hypospadias repair include:

- Optical magnification (loupes);
- Marking pen;
- 0.5 Castro-Viejo forceps;
- Castro-Viejo needle driver;
- 69 Beaver scalpel;
- Tenotomy scissors;
- 6 F silicone stent;
- 5-0 polypropylene suture;
- 6-0 polydioxanone;
- 6-0 and 7-0 polyglactin sutures;
- 1 : 1000 and 1 : 100 000 noradrenaline.

Patients are positioned supine for surgery. In distal repairs either a dorsal penile or caudal nerve block is given before beginning the operation, while a caudal block is preferred for proximal cases.



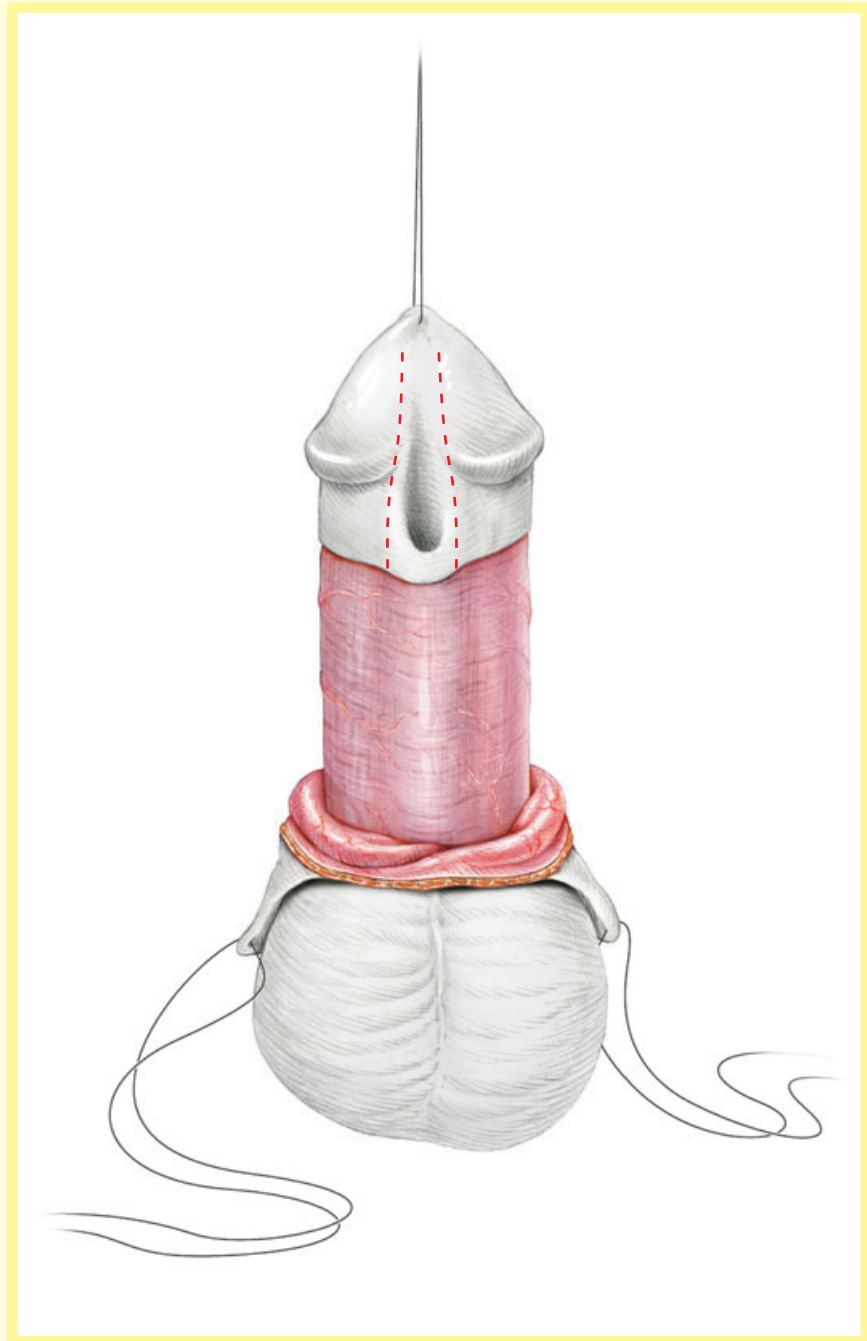
**Figure 1**

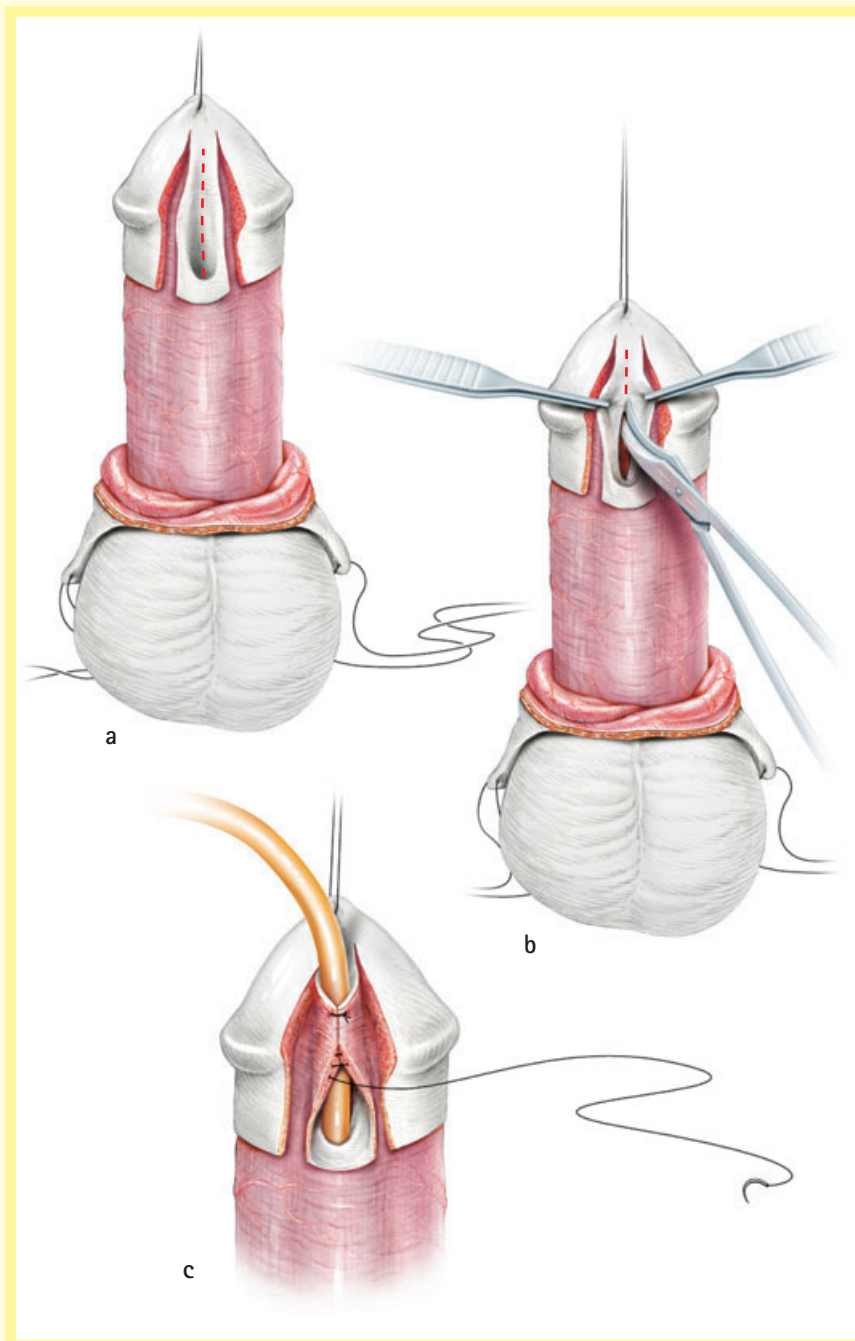
A 5-0 polypropylene suture is placed into the glans for traction and to later secure the urethral stent. The initial skin incision depends upon whether the family prefers circumcision or foreskin reconstruction, as either can be performed. When circumcision is the desired result care is taken to preserve sufficient inner prepuce so that a so-called 'mucosal collar' can be approximated in the ventral midline after glansplasty. Then the penis is degloved to near the penoscrotal junction. If the foreskin is to be reconstructed the skin incision extends from the corners of the dorsal preputial hood to 2 mm proximal to the meatus. Ventral shaft skin is released until normal dartos tissues are encountered.

An artificial erection confirms the absence of ventral curvature, but if there is significant bending a midline dorsal plication is done using a single 6-0 polydioxanone suture placed in the tunica albuginea of the corpora cavernosa directly opposite the point of maximum curvature.

**Figure 2**

Next, longitudinal incisions are made along the visible junction of the glans wings to the urethral plate. Proposed lines for incision are first infiltrated with 1 : 100 000 noradrenaline or a tourniquet is used around the base of the penis for haemostasis. After making the skin incision with the 69 Beaver scalpel, I prefer to complete the dissection and glans wings mobilization using tenotomy scissors, taking care both to preserve vascularity to the urethral plate and sufficient thickness for the wings to be securely approximated.





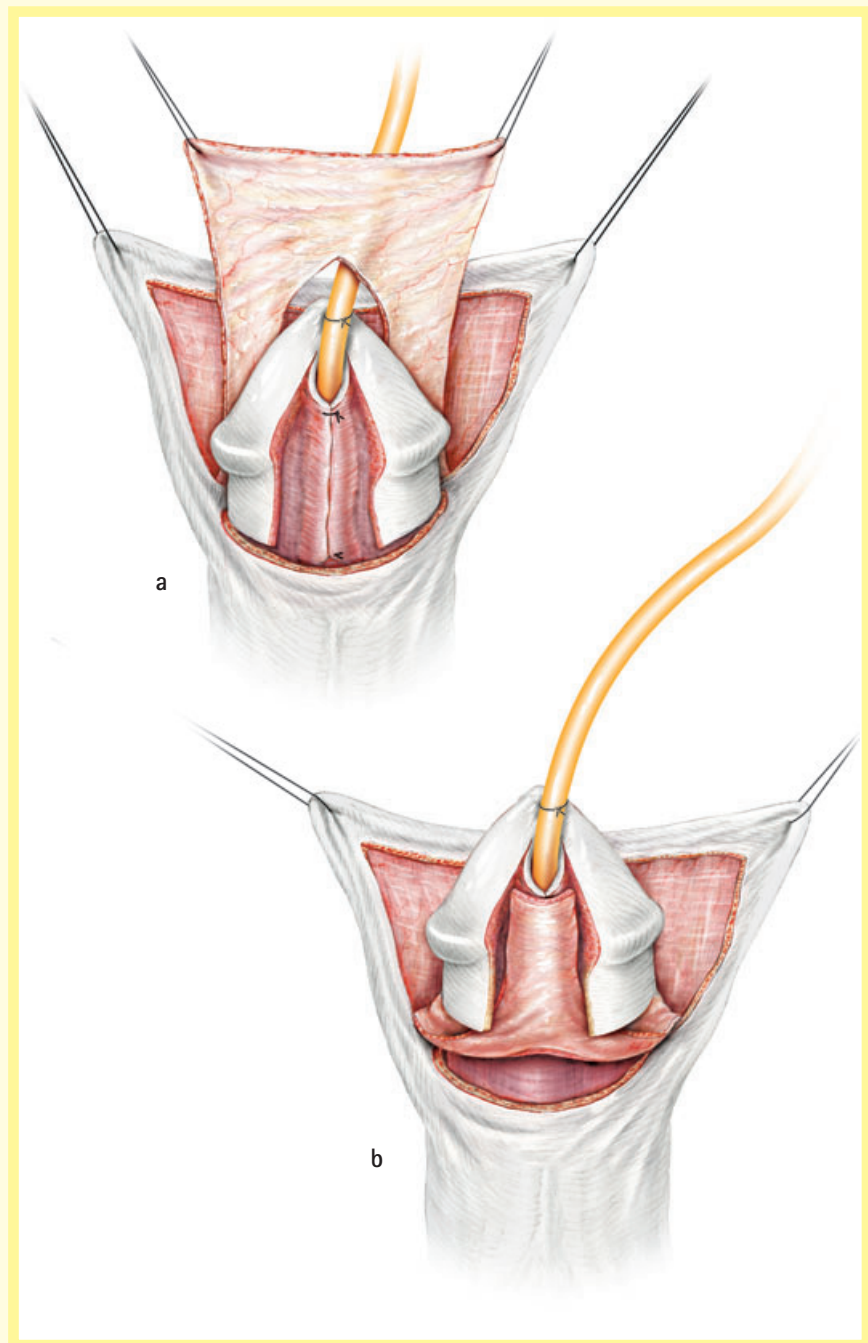
**Figure 3**

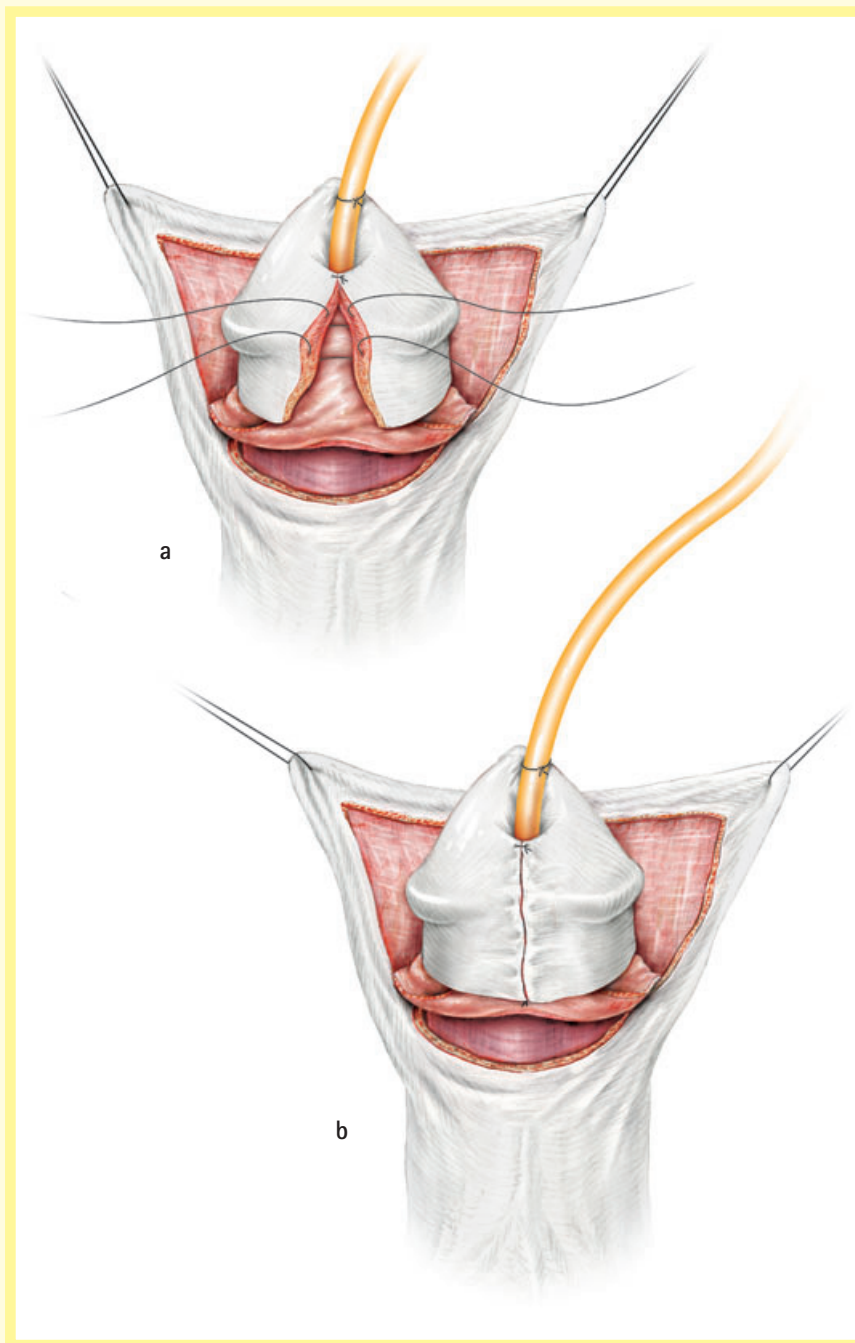
The key step in the procedure is midline incision of the urethral plate. This manoeuvre is facilitated by counter-traction maintained by the surgeon and assistant along opposite margins of the plate. Using tenotomy scissors, the relaxing incision is made from within the meatus to the tip of the urethral plate. It should not be carried further distally into the glans. The depth of incision depends upon whether the plate is grooved or relatively flat, but in all cases extends down to near the corpora cavernosa.

Figure 3c: A 6 F Silastic stent is passed into the bladder and secured to the glans traction suture. Then the urethral plate is tubularized beginning at the neomeatus, using 7-0 polyglactin suture. The first suture is placed through the epithelium at a point just distal to the midglans so that the meatus has an oval, not rounded, configuration. Tubularization is completed with a running two-layer subepithelial closure, turning all epithelium into the neourethral lumen.

**Figure 4**

A dartos pedicle flap is dissected from the preputial hood and dorsal shaft skin in patients undergoing circumcision, then button-holed and transposed ventrally to cover the entire neourethra. When the foreskin is reconstructed this layer is not accessible, yet there has been no increased incidence of fistula in my experience.



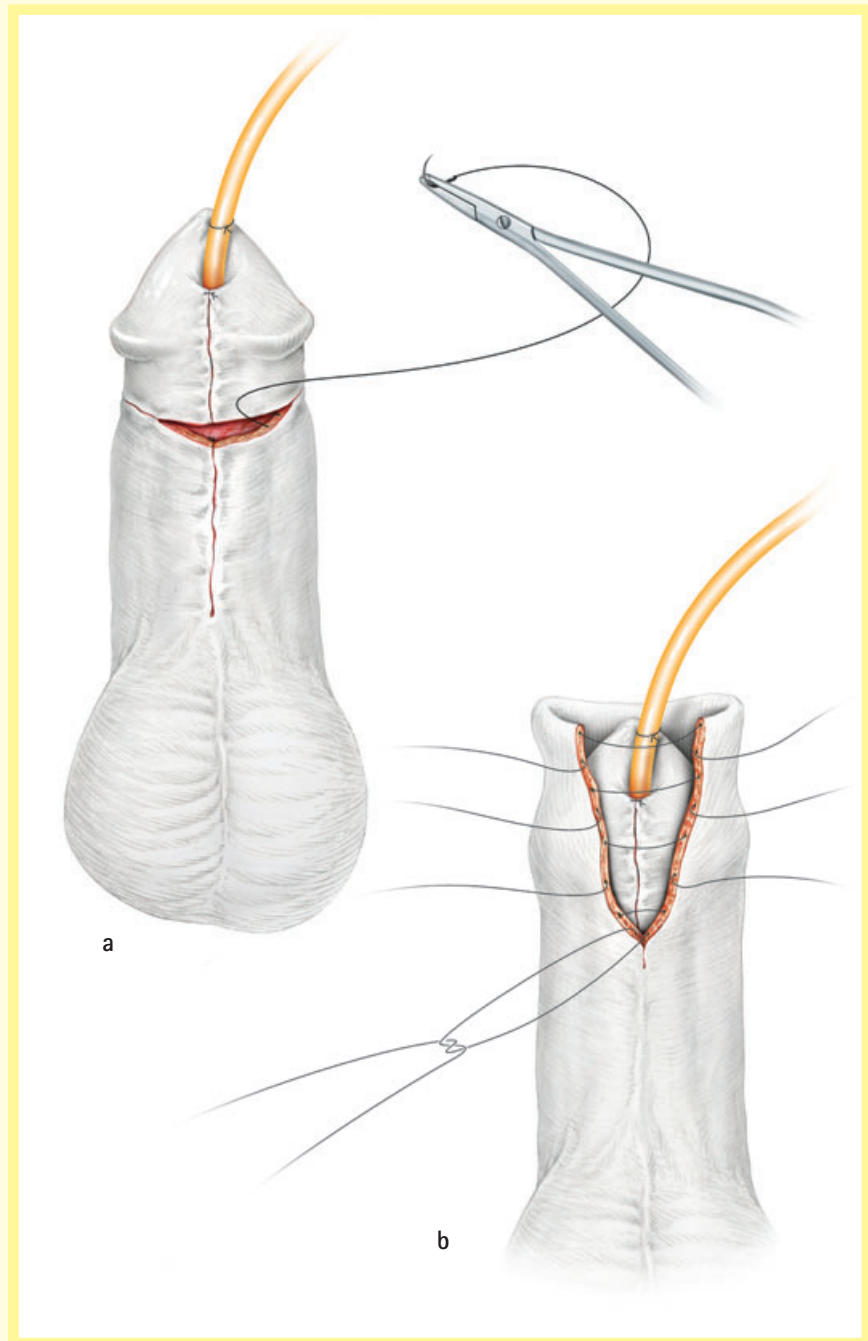


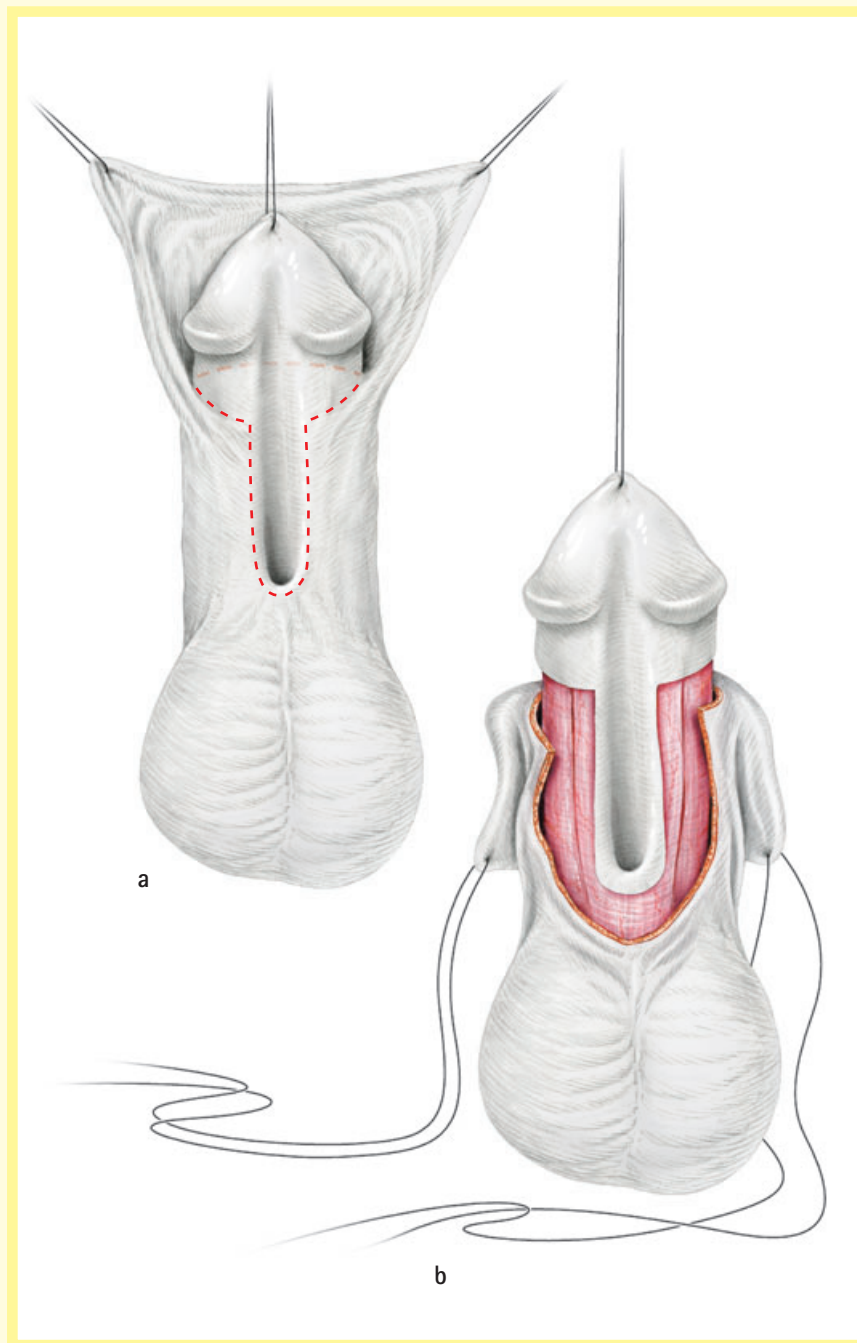
**Figure 5**

Glansplasty is a key determinant of the final cosmetic outcome. Over the years my technique has developed, and currently begins with a 7–0 polyglactin suture through the epithelium at the desired point for the ventral lip of the meatus. A second 7–0 suture is placed subepithelially in this same location to further buttress the neomeatus and hopefully prevent partial dehiscence that would result in a larger than normal meatus. No attempt is made to secure the glans to the underlying neourethra. The remainder of glans approximation is then done using interrupted 6–0 polyglactin subepithelial sutures proximally to the corona. It is not necessary to place sutures through the epithelium of the glans, and I have seen a few patients develop suture tracks when a second layer was created.

Figure 6

Skin closures also use subepithelial 7–0 polyglactin sutures to minimize the risk of suture tracks. During circumcision the dorsal hood is incised down the midline to the level of the subcoronal collar of the inner prepuce. This point is sutured, and then the ventral shaft skin is approximated up the midline, simulating the normal median raphe. Excess skin is next excised and remaining edges sutured. When the foreskin is reconstructed the inner prepuce is first closed with interrupted sutures, then dartos is approximated, and finally the outer shaft skin is sewn, giving a three-layer closure. A Tegoderm dressing is applied and the stent is left open dripping into a diaper.





**Figure 7**

I recommend initially maintaining the urethral plate in all proximal hypospadias repairs, as even apparently severe ventral curvature sometimes can be straightened without transecting the plate. The skin incision should be made immediately next to the plate to minimize the risk of incorporating hair follicles into the neourethra.

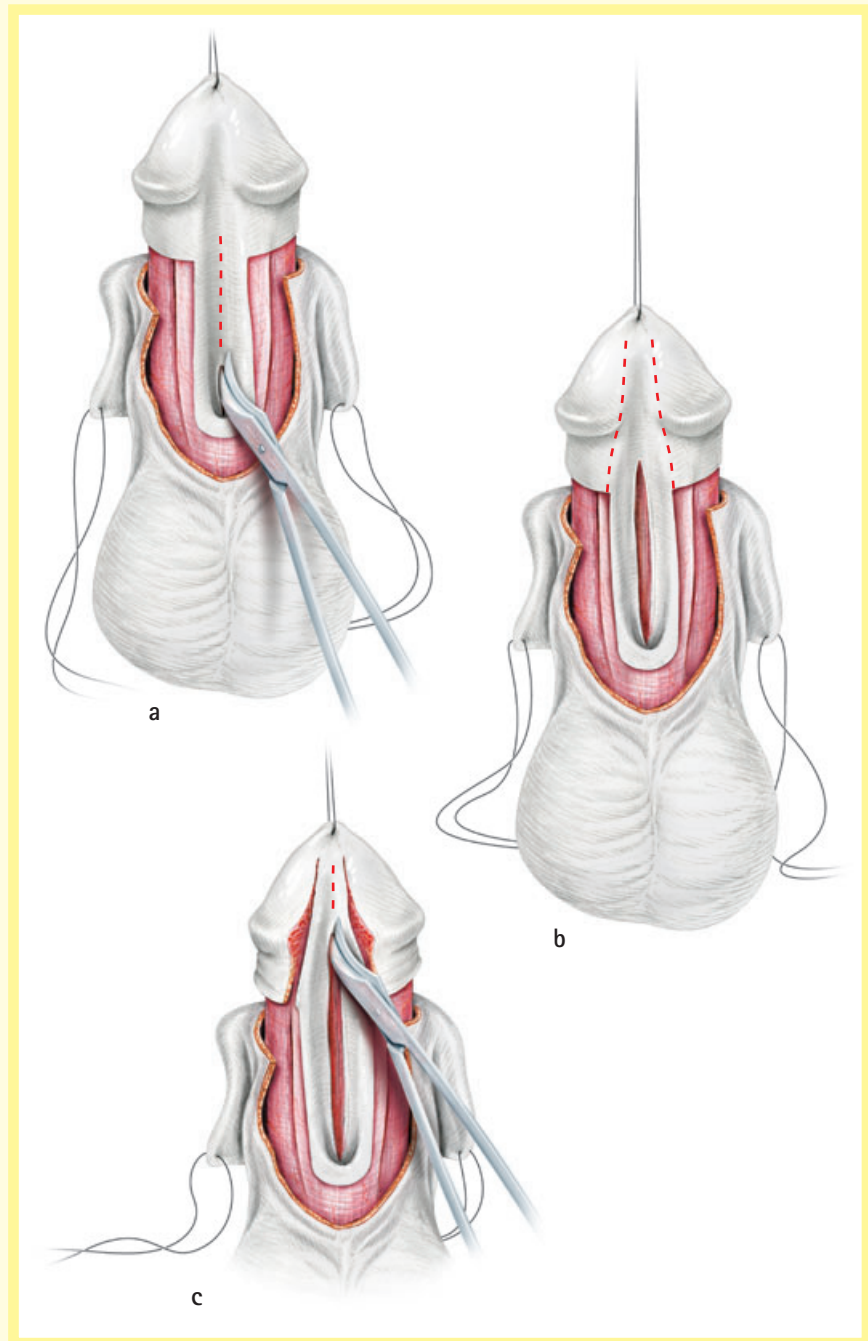
Similarly, the foreskin also can be preserved at the beginning of surgery as curvature is assessed, although in many patients it will be necessary to completely deglove the penis and ultimately circumcise it. My experience with foreskin reconstruction in boys with proximal defects is limited, and a desire to avoid circumcision should not outweigh the need to correct significant ventral curvature that might later impair sexual function.

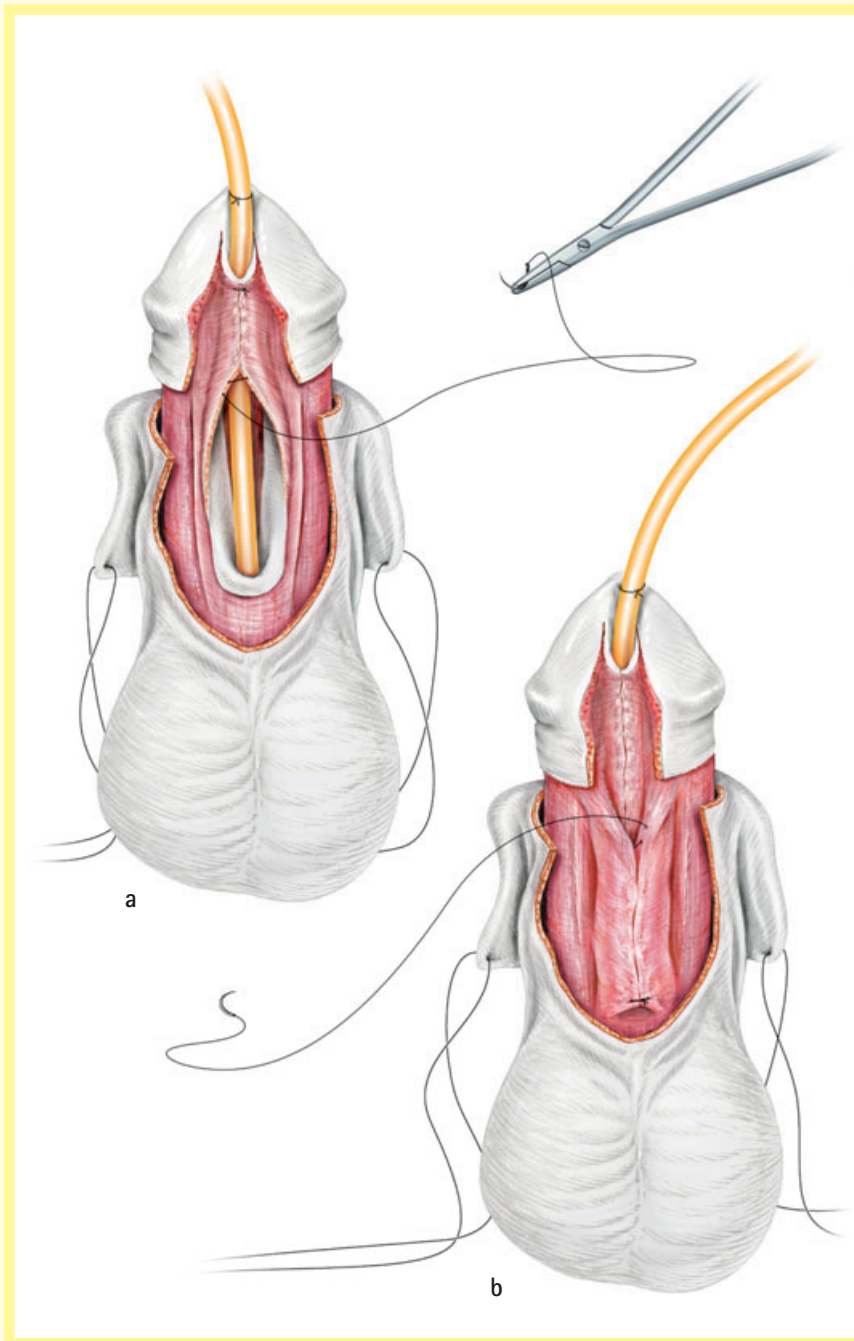
After degloving, the corpus spongiosum alongside the urethral plate is dissected off the underlying corpora cavernosa. This tissue later will be approximated over the neourethra as a barrier layer against fistula, and its mobilization sometimes also lessens the extent of ventral penile bending. Then an artificial erection is created; persistent mild curvature is corrected by midline dorsal plication, as described above. More severe bending next leads to dissection under the entire urethral plate, and if it still persists, to transection of the plate and, in my hands, a staged urethroplasty.

**Figure 8**

A midline incision of the penile aspect of the urethral plate is made to assess the 'health' of this tissue. In a very few cases the incised plate has appeared less supple and poorly developed, and this finding has led to excision of the unhealthy plate and a staged repair. Note that the glans is left undisturbed until this point, as even when the penile urethral plate has seemed undesirable for urethroplasty, the glandular aspect has been supple and could still be incorporated into the neourethra.

When the incised plate is satisfactory, glans wings are next dissected from the urethral plate as described for distal repairs. This aspect of the plate is then incised in the midline in preparation for tubularization.





**Figure 9**

A 6 F stent is passed into the bladder; occasionally there may be difficulty negotiating the catheter past an enlarged utricle, and in this situation a cystoscope is introduced under vision into the bladder and a wire placed over which the stent can be manoeuvred.

To create the longer neourethra in proximal repairs, I prefer a two-layer, 7-0 polyglactin subepithelial closure, the first using interrupted sutures and the second a running suture. Care is taken to turn all visible epithelium into the neourethral lumen. Then the previously mobilized corpus spongiosum is closed, followed by coverage of the repair by a dartos pedicle flap. Glansplasty follows and then skin closure. Significant penoscrotal transposition is also corrected at this point. Next a Tegoderm dressing is applied. After proximal repairs I further immobilise the penis with a mild compression dressing consisting of a small gauze square placed onto the ventral aspect of the penis that is held in place by a second, larger Tegoderm dressing against the lower abdomen.

## POSTOPERATIVE CARE

Dressings fall off spontaneously within a few days. Sponge bathing and antibiotic therapy with sulphamethoxazole-trimethoprim are advised until the stent is removed, which is usually a week after surgery. Children aged <2 years can be managed with acetaminophen and ibuprofen, while older patients are additionally prescribed hydrocodone for pain. Oxybutynin is also provided to boys aged >2 years to prevent bladder spasms from the stent. When the foreskin has been reconstructed parents are advised not to attempt to retract it until the surgeon has determined that oedema and tissue reaction have sufficiently subsided.

## SURGEON TO SURGEON

As with other techniques, the most common complication from TIP urethroplasty is fistulae. These can be largely prevented by turning epithelium into the neourethra, using sufficient barrier layers, and avoiding meatal stenosis. My incidence of fistulae with distal repairs is 2%, but initially was much higher with proximal TIP. At that time I was closing the neourethra with a single running suture through the epithelium. Since adopting a two-layer subepithelial closure and adding corpus spongiosum as an additional barrier layer, the number of fistulae after proximal

urethroplasties has diminished by more than half. After TIP re-operations fistulae have occurred most often when a dartos flap was not used, and the temptation to simply approximate adjacent dartos in the midline over the neourethra should be resisted. Consequently, now I create a ventral dartos flap to cover the neourethra, and if that tissue is not available, tunica vaginalis is used.

Meatal stenosis has been noted in some reports of TIP, but is a rare postoperative finding in my patients. Probably most important in avoiding this complication is taking care not to tubularize the neourethra too far distally. As mentioned above, the neomeatus should be oval and not round. Other key manoeuvres include incising the plate deeply to near the corpora cavernosa, so the neourethra will have an adequate diameter, and resisting the temptation to extend the relaxing incision into the glans, as this will also lead to tubularizing the plate too far distally. Meatal dilatation after surgery is not necessary.

During the past decade I have repaired all midshaft and distal hypospadias by tubularizing the urethral plate, and conclude that this technique can be used regardless of meatal configuration or urethral plate width and depth. The main limitation to TIP in more proximal hypospadias is the occasional need

to transect the plate to straighten curvature. Rarely the urethral plate can be preserved but its incised appearance is 'unhealthy', seeming thin and inelastic. Twice when confronted with this situation I nevertheless tubularized the plate, resulting in complete dehiscence once and contracture of the neourethra with ventral curvature in the other. TIP should only be considered when the penis is readily straightened with no tension on the urethral plate, and the incised plate resembles that in distal repairs. Similarly, TIP is an option for re-operations when the plate remains supple, even after previous incision, but otherwise should be avoided.

Within these limitations TIP urethroplasty is a versatile procedure with no more complications than other procedures used in hypospadias surgery. However, its widespread acceptance has arisen from the observation that tubularization of the urethral plate most reliably creates a vertical slit-like neomeatus. Consequently, currently it is the goal of hypospadias repair both to restore good function and normal appearance to the penis.

**Correspondence:** Warren T. Snodgrass, Department of Paediatric Urology, Children's Medical Center of Dallas and University of Texas South-western Medical Center at Dallas, Dallas, Texas, USA.  
e-mail: warren.snodgrass@childrens.com