


# Modified Tubularized Incised Urethral Plate Urethroplasty

# 8

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## 8.1 Introduction

Most of the innovations claimed today are described in the history of hypospadias. The principle of tubularization was described by Professor C. Thiersch (1869) in a child of epispadias. Later, the same was used for hypospadias & is known as the Thiersch-Duplay urethroplasty [1]. King (1981) tubularized the urethral plate for distal hypospadias [2]. The glanular approximation procedure described by Zaontz (1989) is based on the same principle and is suitable for coronal and glanular hypospadias with a deep glans groove [3]. Snodgrass (1994) added the dimension of relaxing incision in the urethral plate and deserved the credit of making it the most popular and commonly used technique world over [4]. There have been many

modifications to the original description of TIP described by Snodgrass to improve the results. These modifications have led to significant improvement in the outcome and a few reports appearing in the literature with nil fistula rate. The technique described here is with few modifications to improve the results of TIPU.

## 8.2 Modified TIPU Surgical Technique

The important steps of our modified TIPU are:

1. Partial/Total penile degloving
2. Mobilization of spongiosum and urethral plate
3. Incising the urethral plate
4. Tubularization of the urethral plate
5. Spongioplasty
6. Glanuloplasty
7. Frenuloplasty
8. Dartosorrhaphy
9. Prepuceoplasty

### 8.2.1 Penile Degloving

Surgical technique I: 1,000,000 solution adrenaline solution injected at the planned site of the incision after taking a stay suture on the glans and inserting the urethral stent. A Y-shaped incision is given by the side of the urethral plate

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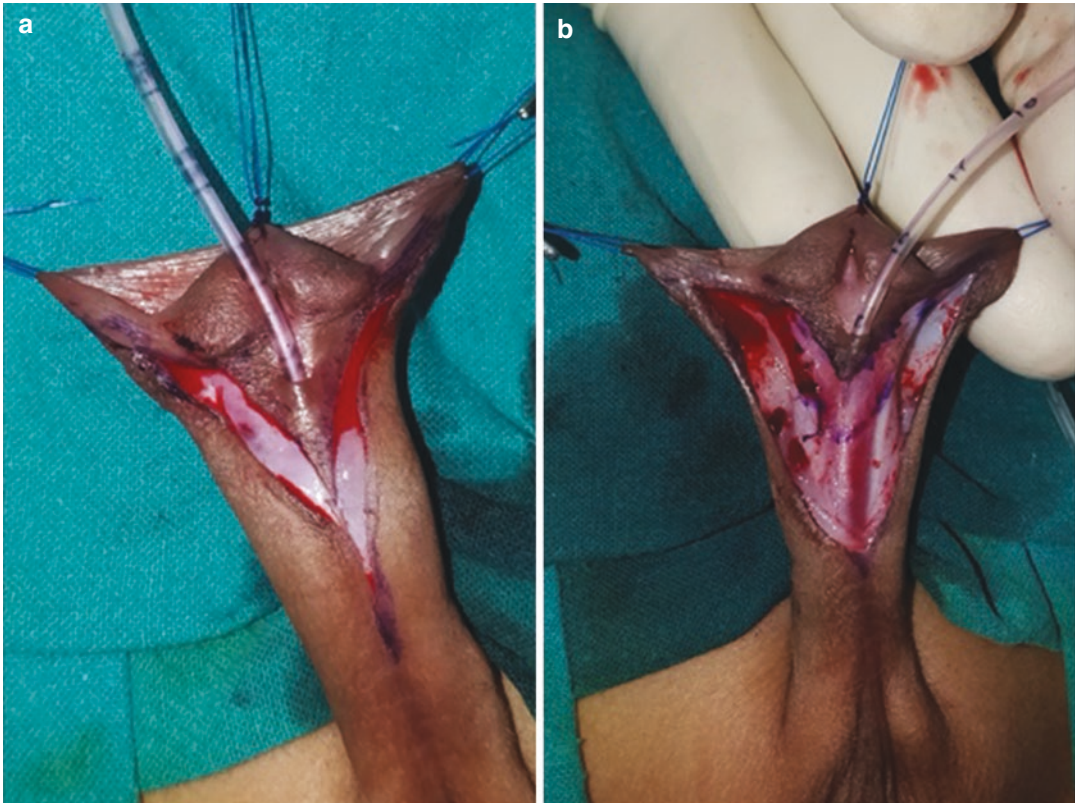
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**Fig. 8.1** Partial Penile degloving. (a) Distal penile hypospadias Y-shaped incision. (b) Partial Penile degloving

encircling the meatus midline extension on the penis' shaft (Fig. 8.1a). The wings are extended into the dorsal hood in patients having no chordee and circumferential circum-coronal incision in cases with chordee. Skin and dartos are incised, and partial penile degloving is done (Figs. 8.1b and 8.11a–c). A complete penile degloving is done down up to the root of the penis to correct chordee in cases with chordee. The level of dissection is kept at Buck's fascia. Then, the chordee correction is evaluated by Gitte's test.

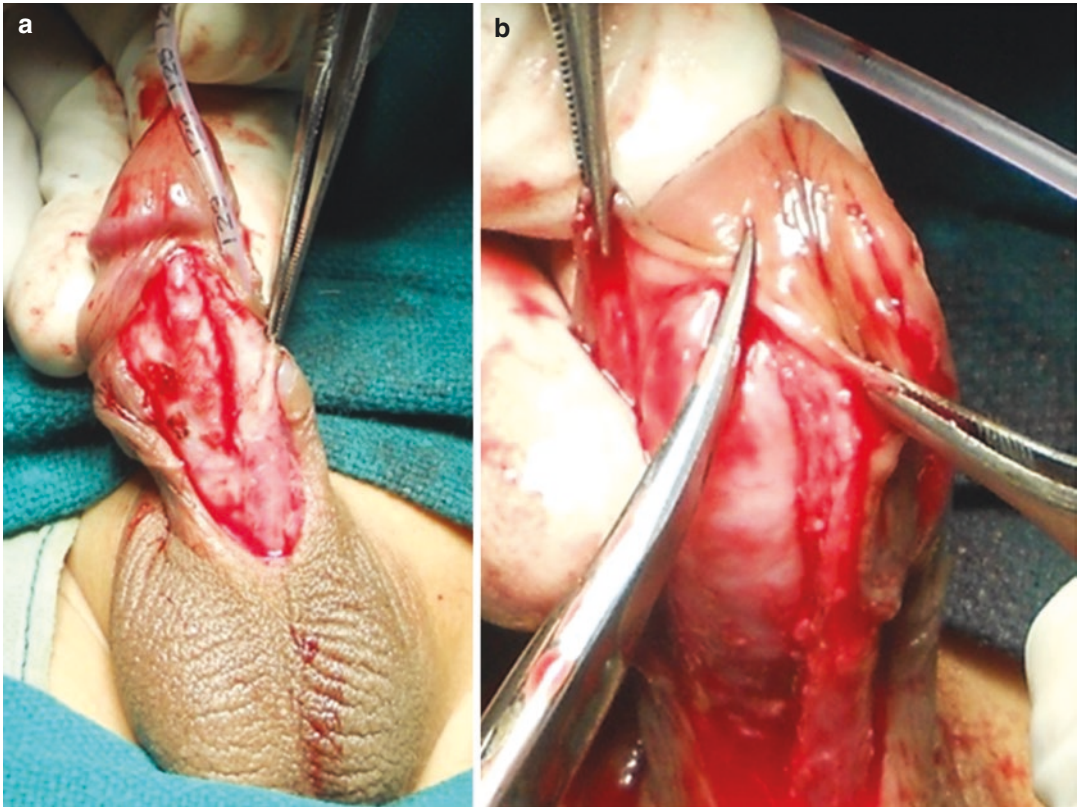
### 8.2.2 Mobilization of Urethral Plate and Spongiosum

After creating a dissection plane at the tunica albuginea level proximal to the meatus, the urethral plate and corpus spongiosum are mobilized starting just proximal to the meatus up to corona (Figs. 8.2a, b and 8.11c–d). Partial mobilization

is done for the patients without chordee. This mobilization helps in tubularization of urethral plate and spongioplasty with tension-free sutures. The spongiosum is then dissected into the glans in the same plane of dissection beyond mid-glans (Figs. 8.3a, b and 8.11e–f), and the glanular wings are raised. Glanular wings are dissected adequately on both sides and deep up to the tip of corporal bodies. This will help get done the spongioplasty up to neo-meatus covering the sub-coronal area with spongiosum to prevent sub-coronal fistula. Deep and adequate mobilization of the glanular wings allows tension free glanuloplasty even in cases of small glans.

### 8.2.3 Incising the Urethral Plate

The urethral plate is incised with the knife starting just inside the meatus to glans (Figs. 8.4a and 8.11g). The incision's depth is done according to



**Fig. 8.2** (a and b) Mobilization of urethral plate and spongiosum up to the corona

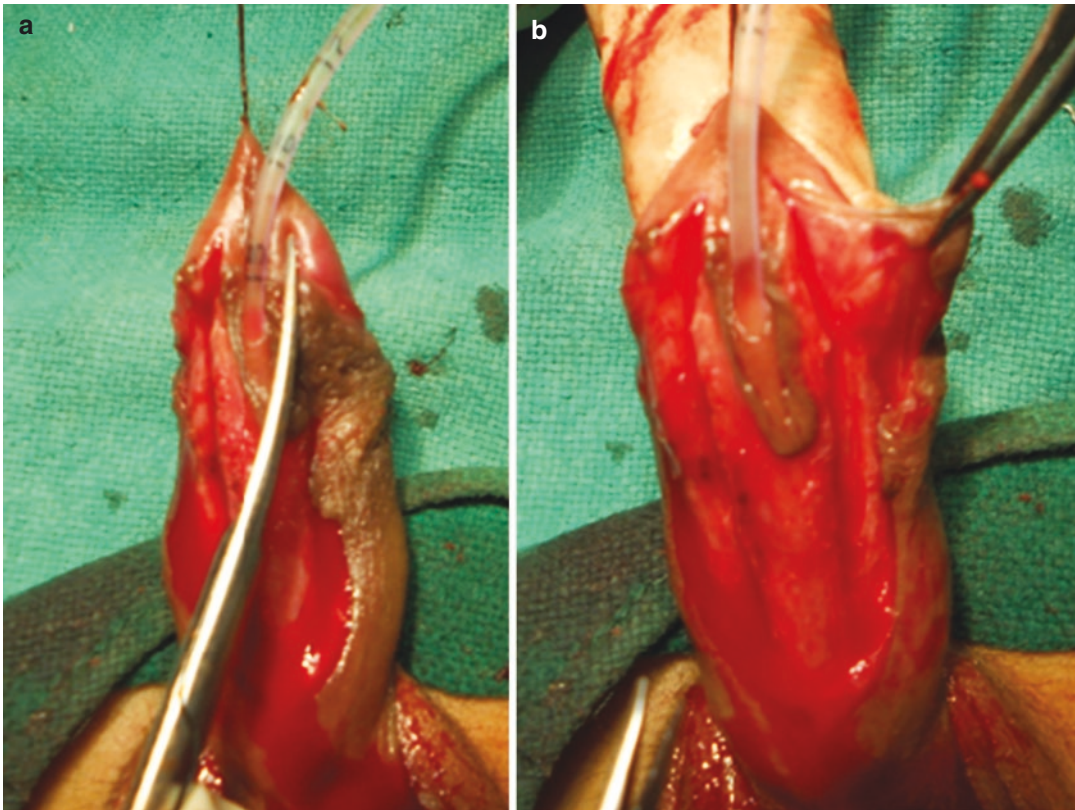
the urethral plate's width to tubularize the urethral plate with tension-free suturing. In case of the deep incisions, we prefer to place the dorsal inlay graft in the urethral plate (Fig. 8.11g, h). The care is taken not to extend the incision beyond mid-glans, but in cases of the narrow urethral plate with small glans incision may be extended up to the tip of glans and an inlay graft is placed to prevent the meatal stenosis (Fig. 8.4b).

#### 8.2.4 Tubularization of Urethral Plate and Spongioplasty

Skin around the meatus and adherent to the hypoplastic urethra is excised. A suture is taken at the distal end of the urethral plate to create a wide meatus. Tubularization of the urethral plate is

started proximal to meatus at the bifurcation of spongiosum and then continued distally with 6/0-7/0 PDS inverting continuous sub-epithelial sutures. Care is taken to avoid the sutures' passing through the epithelium, and there should not be buckling of the neo-urethra. Distal tubularization is done up to mid-glans to reconstruct a wide meatus. Then spongioplasty is done starting proximal to the urethral plate's tubularization, distally up to the tip of neourethra. Depending upon the development of the spongiosum, spongioplasty (Figs. 8.5a, b and 8.11j) or double breasting spongioplasty is done (Fig. 8.6a-c). Mobilization of the urethral plate and spongiosum allow the tension-free suturing of the spongiosum. The spongiosum is a vascular healthy tissue cover supporting the urethral plate and maintains the urethral plate's blood supply and reconstructs a near-normal urethra.





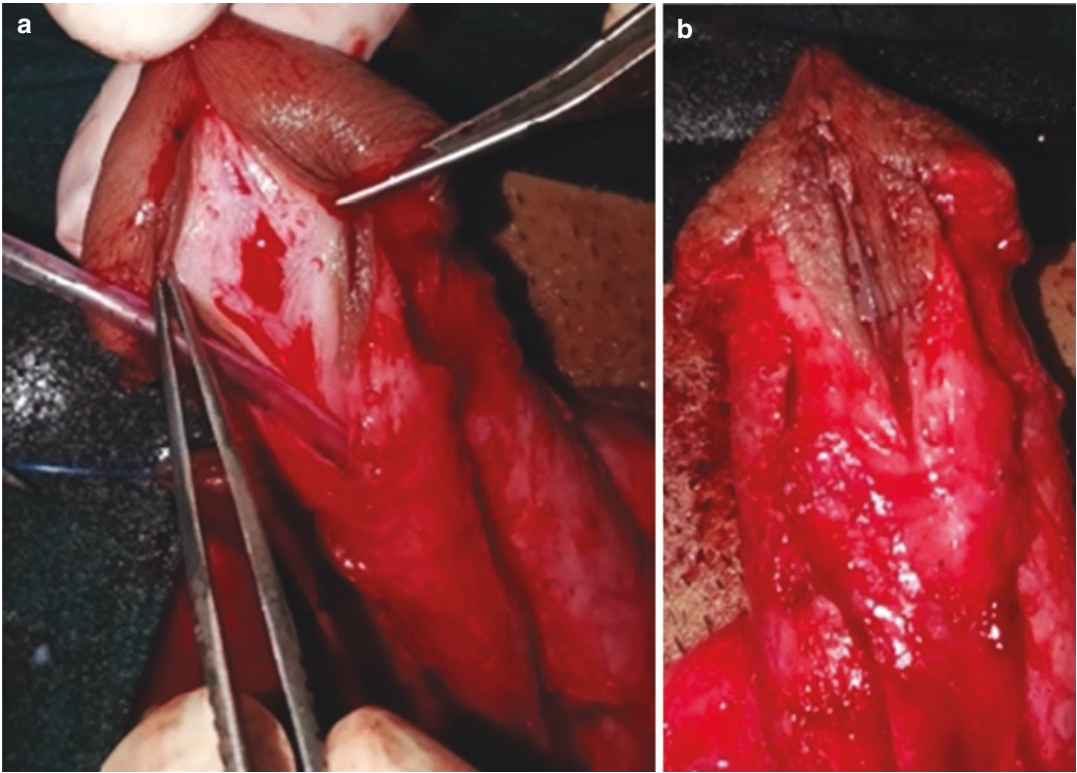
**Fig. 8.3** (a and b) Mobilization of urethral plate and spongiosum into glans

### 8.2.5 Glanuloplasty and Frenuloplasty

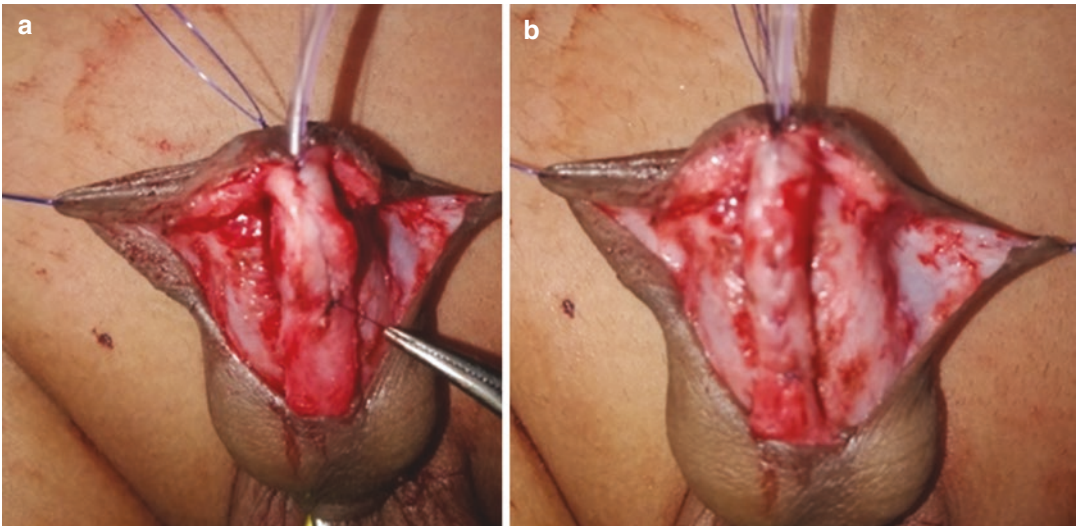
The first suture is taken at the meatus, creating a wide meatus (Fig. 8.11k). Adequate space is left between the neo-urethra and glans wings. Suturing is continued up to the corona to complete the first layer of glanuloplasty (Fig. 8.11l). Then the second layer is completed starting from meatus to corona. Sutures may be taken subepithelial or through the epithelium (Fig. 8.7a, b). The suture is taken in the inner prepuccial skin, and traction is applied towards meatus. Two to three sutures are taken to reconstruct the fraenum of an adequate length, (Figs. 8.8a, b and 8.11m), and the inner layer of the prepucioplasty is completed keeping a wide prepucial opening. The last suture is kept as a stay suture to apply traction (Fig. 8.11n).

### 8.2.6 Dartosorrhaphy and Prepucioplasty

The ventral dartos covers the neo-urethra. Approximation of the dartos is started from the proximal end of the incision keeping the traction on the prepucial stay suture. A thick layer of dartos is available if partial penile degloving is done by dissecting at Buck's fascia. This thick layer of the dartos is sutured over the neourethra as a healthy interposing tissue layer and dartosorrhaphy is completed starting from the proximal to distal up to the end of prepuce keeping traction on the prepucial suture. The closure of the dartos in prepuce completes the second layer of the prepucioplasty (Figs. 8.9a, b and 8.11o, p). The prepuce's outer layer is sutured to complete the prepucioplasty and skin closure done by sub-cuticular or through & through sutures (Figs. 8.9c and 8.11q, r, and s).

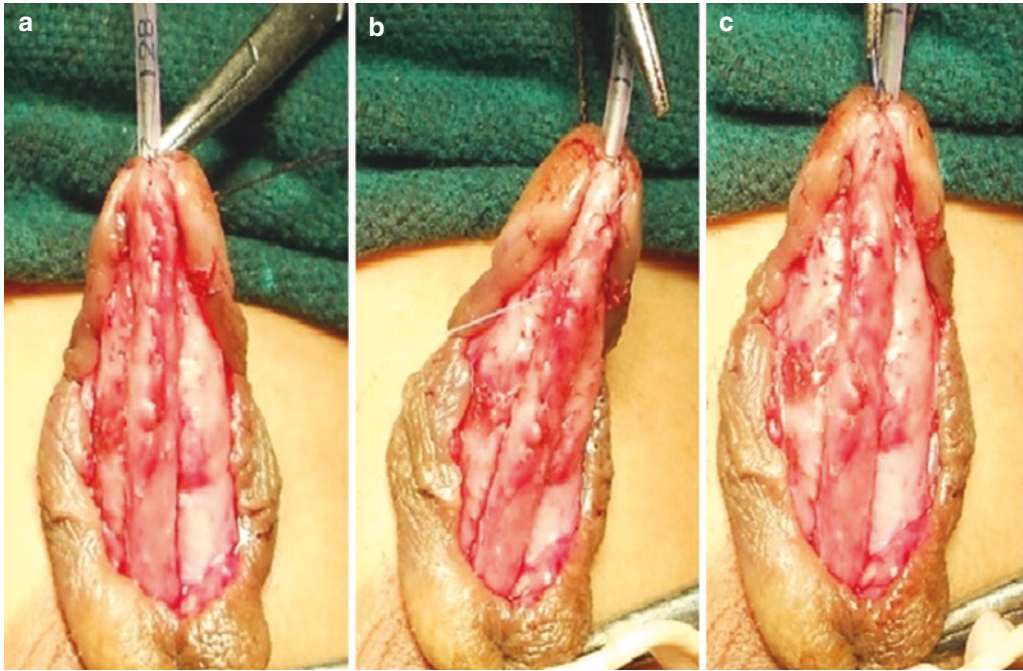


**Fig. 8.4** Incision up to the tip of glans. (a) Incising urethral plate up to the tip of glans. (b) Dorsal inlay graft

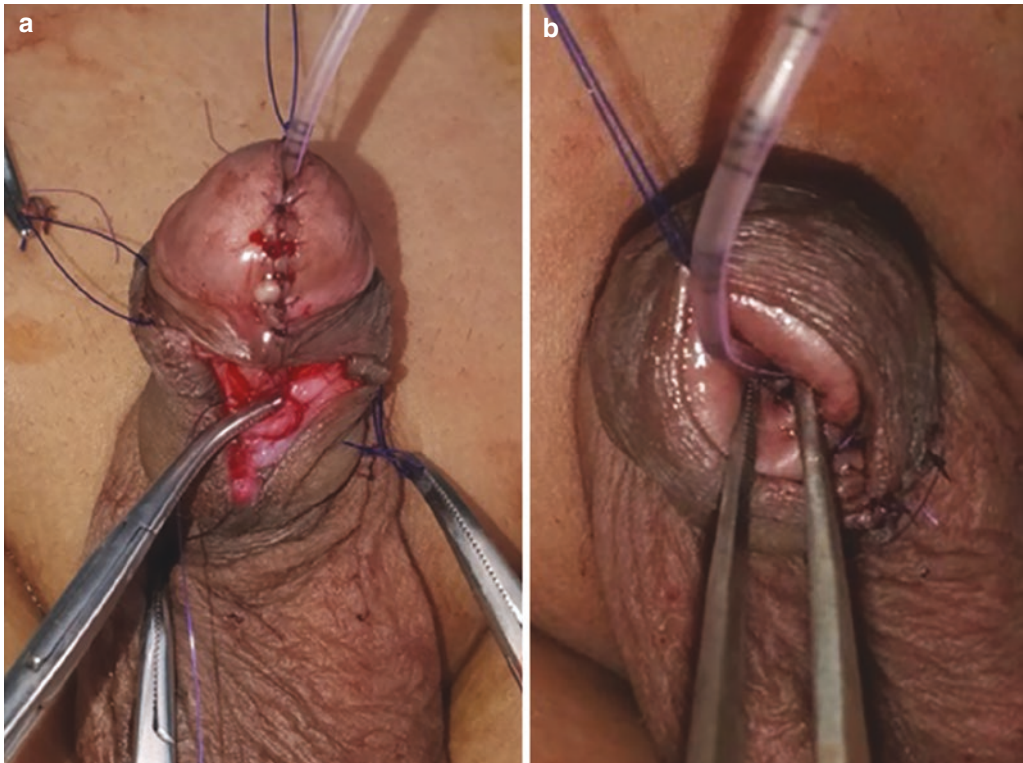


**Fig. 8.5** (a) Tubularization of the urethral plate and (b) Spongioplasty

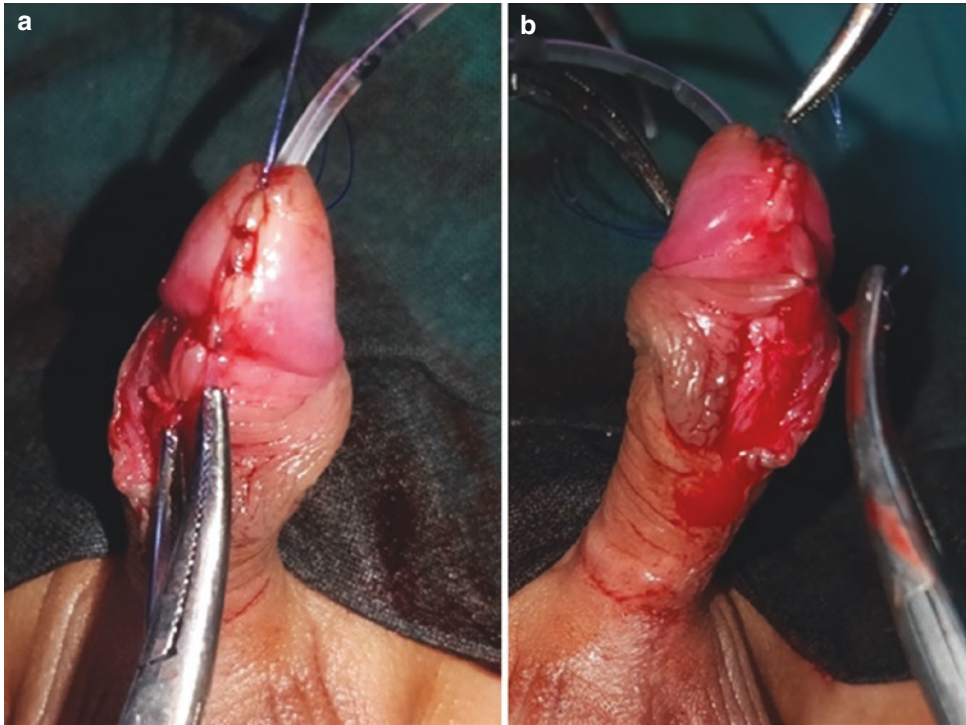




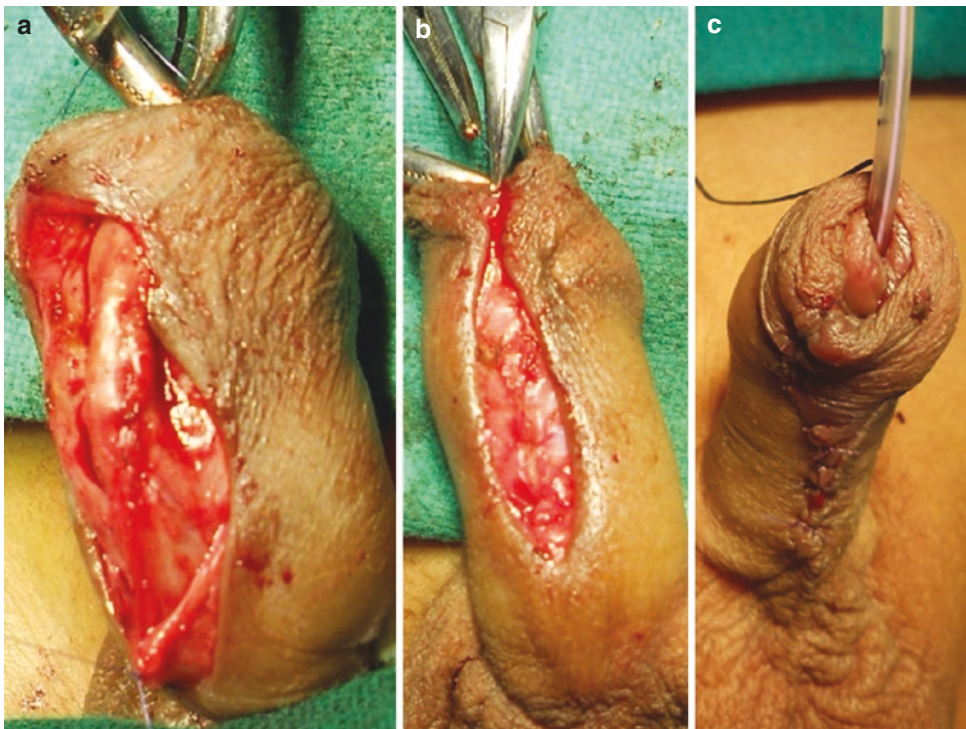
**Fig. 8.6** Double breasting Spongioplasty. (a) One side of spongius sutures to side of the suture line. (b) Measuring the flap for double breasting. (c) Spongius sutured to the other side



**Fig. 8.7** Glanuloplasty. (a) Glanuloplasty. (b) Wide meatus

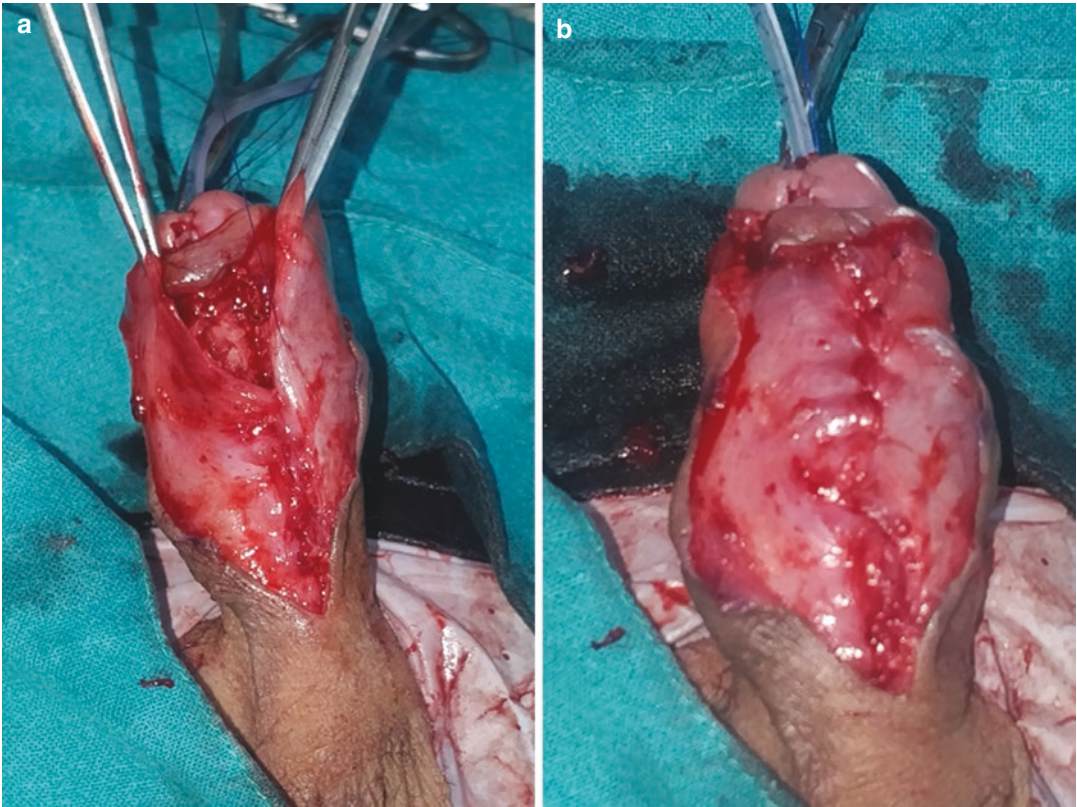


**Fig. 8.8** (a and b) Frenuloplasty



**Fig. 8.9** Reconstitution of dartos “Dartosorrhaphy”. (a) Dartos suturing started. (b) Dartos suturing completed. (c) Prepucioplasty and skin closure





**Fig. 8.10** Reconstitution of dartos “Dartosorrhaphy”. (a) Dartos suturing halfway down. (b) Dartos suturing completed

Even in cases of complete penile degloving, the thick dartos is available, and dartosorrhaphy is feasible (Fig. 8.10a, b). Then urethral stent is fixed, and a pressure dressing is done. All the steps mentioned above are depicted in Fig. 8.11a–s.

### 8.3 Modifications

Our Modifications to the original TIPU described by Snodgrass in 1994:

1. Partial penile degloving.
2. Mobilization of spongiosum and urethral plate from bifurcation of spongiosum to mid-glans.
3. Spongioplasty/Double Breasting spongioplasty.
4. Frenuloplasty.

5. Interposing healthy tissue ventral dartos-Dartosorrhaphy.
6. Prepuceioplasty.

Among our TIPU modifications, the mobilization of urethral plate and spongiosum and spongioplasty are the most important ones. The mobilization of urethral plate and spongiosum has the advantages of easy tubularization with or without incising the urethral plate, correcting mild chordee and spongioplasty without any tensions in the suture line. We could tubularize the urethral plate without an incision in 35% of cases [5]. Snodgrass incises the urethral plate deep up to tunica albuginea, but we modified its depth up to superficial spongiosum only, and deeper incisions are supplemented with inner prepuceal inlay graft. The incision in these patients of the narrow urethral plate is extended to the glans’ tip and covered





**Fig. 8.11** Modified TIPU with inner prepuce dorsal inlay graft. (a) Distal penile hypospadias. (b) Partial penile degloving. (c and d) Mobilization of urethral plate and spongiosum up to corona. (e and f) Mobilization of urethral plate and spongiosum up to mid-glans. (g) Incising the urethral plate. (h) inner prepuce dorsal inlay

graft. (i) Tubularization of urethral plate. (j) Spongioplasty. (k and l) Glanuloplasty. (m) Frenuloplasty. (n) Inner prepuce layer closed for the first layer of Prepuceoplasty. (o and p) Dartosorrhaphy. (q and r) Completion of Prepuceoplasty. (s) Oedema of prepuce on the fifth-day dressing. Post-operative normal looking penis

with a graft to have a wide meatus. This Modification of incising up to the tip of glans is similar to that described by Rama Jayanti. The spongioplasty reconstructs a near-normal urethra, and that is the objective in the hypospadias repair. We mobilize the urethral plate and spongiosum up to mid-glans and spongioplasty is done up to neo-meatus which covers the neo-urethra with spongiosum at corona and helps in prevention of fistula at corona, which is the commonest site of the fistula. We used the concept of mobilization of the urethral plate with spongiosum and proximal urethra and Spongioplasty. Our results of spongioplasty in 2007 in 34 cases of proximal hypospadias were very good and had an acceptable fistula rate of 9% [5]. Later (in 2010 and 2014) we published

our results of spongioplasty in all types of hypospadias with an overall fistula rate of 7.40% and 7.96%, respectively, and nil in distal hypospadias with well-developed spongiosum [6, 7]. Recently, we have added the double breasting spongioplasty that almost eliminates the chances of fistula, and the fistula rate was 1.66% only [8]. Snodgrass also added spongioplasty to his original description in 2013 [9]. The addition of frenuloplasty and prepuceoplasty reconstructs near-normal penis and operated child may not appreciate whether he has been operated or not and satisfy the parents and the patient (Fig. 8.12a–d). We do penile degloving keeping the plane of dissection at Buck’s fascia, So both layers of dartos are available for reconstituting the dartos “dartosorrhaphy”.



**Fig. 8.12** Post-operative picture normal looking penis and projectile stream. (a) Penis with prepuce. (b) Conical glans with normal-looking meatus at the tip. (c) Easily Retractable Prepuce. (d) Projectile stream

Which is the second layer of healthy tissue cover over neo-urethra. Using ventral dartos as interposing tissue, we can spare the prepuce for prepucio-  
plasty and avoid the vascular compromise of skin due to dorsal dartos mobilization. We reported our results of prepucio-  
plasty in proximal hypospadias 2010 without increasing the complications of urethroplasty [6] and later on in 2013. Snodgrass also reported similar results after adding prepucio-  
plasty with TIPU in distal hypospadias [9].

#### 8.4 Technical Modification by Snodgrass and Bush [9]

1. Changing from chromic to polyglactin sutures and epithelial to subepithelial suturing.
2. Two-layer subepithelial urethroplasty using interrupted polyglactin and continuous polydioxanone sutures, and adding spongioplasty. A dartos flap again covered the entire repair.



- Subsequent outcomes review showed a reduction to 10% fistulas in the next series of patients.
3. In the last published series, a tunica vaginalis flap replaced dartos as the barrier layer, and no fistulas occurred during a mean follow-up of 12 months.
  4. Extended dissection of the glans wings, not only at 3 and 9 o'clock but also distally from the corpora for approximately 4 mm diminishes tension subsequent approximation. This Modification reduced glans dehiscence in all primary and re-operative patients from 8% before the Modification to 4% after ( $p = 0.039$ , data not published). Technical modifications to improve outcomes have rarely been reported with other hypospadias repairs.
  5. Snodgrass in 2013 added foreskin reconstruction without any change in urethroplasty complications.

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### 8.5 Rama Jayanti Modification

These three modifications improved the results of TIPU [10]

1. The urethral plate is incised from the meatus to the tip of the glans.
2. The urethral plate is tubularized starting at the meatus and working proximally.
3. The meatus is calibrated larger to accept a 10 to 12 Fr Bougie, even before tubularization.

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### 8.6 Discussion

Most of the TIPU modifications had been on covering the neo-urethra with various interposing healthy tissue. The described variations are a local de-epithelialized skin flap, a lateral skin flap, a ventral-based dartos flap, & a double dartos flap. Fistula rate reported was 0 to 26% in various studies. Though a few studies reported reducing fistula rate the double-dartos flaps, Still, a statistically significant difference was only reported by Appignani et al. [11]. Maarouf A M et al. (2012) [12] reported that the fistula rate was higher with

a single layer dartos cover (8%) than with a double layer (none) However, the difference was not statistically significant ( $P = 0.1$ ). Elsayed et al. reported no considerable difference in subsequent urethrocutaneous fistula between a double-layered and single layer dorsal dartos flap cover of the neo-urethra in TIP urethroplasty for repairing hypospadias [13]. We use well mobilized ventral dartos as dartosorrhaphy. Belman (1988) used the de-epithelialized preputial skin flap as a vascular cover for hypospadias repairs. Belman reported a fistula rate of 3.5% after the wrapping of the neo-urethra with a de-epithelialized preputial skin flap brought ventrally by rotating to the ventrum from the dorsal aspect [14]. Canning and his group recommended antegrade dissection of the dartos pedicle to preserve the dartos fascia's vasculature for covering the TIP repair and the better vascular supply of the attached preputial flap for on lay hypospadias repair. The predominant arteries can be identified by transillumination and followed distally to preserve their fine branches; therefore, the maximum fascial vascularity is preserved [15]. Unification of all these factors in a well-designed prospective randomized and controlled study on sufficient patients followed for an optimal period could give a solid and evidence-based answer to whether multi-layered dartos interposition is superior to a single layer or not.

The most crucial modification has been the addition of dorsal inlay grafts for covering the raw surface of the incised plate with a preputial or buccal mucosal graft. Dorsal inlay graft urethroplasty was first described in redo cases by Kolon and Gonzales in 1998 [16]. Asanuma et al. in 2007 reported the results of dorsal inlay graft urethroplasty for primary hypospadias and achieved good results with a fistula rate of 3.6% [17]. Gundeti et al. 2005 reported good results with augmentation of the narrow urethral plate with dorsal inlay graft in primary cases [18]. Mouravas et al. in 2014 reported a lower rate of meatal stenosis and fistula rate in G-TIP on comparative analysis of TIP and G-TIP in 47 patients. They recommended it as the procedure of choice in patients in primary hypospadias [19]. Gupta et al. (2016) in a prospective study of 263 cases of primary hypospadias

incised at the tip of glans was reconstructed successfully in 96% of patients. Irrespective of glans size and degree of hypospadias and the urethral fistula was reported in 3.7% only [20].

## 8.7 Conclusions

Objective in congenital anomalies is to reconstruct the organ with the existing tissue or supplementation of tissue. The Modification of mobilization of the urethral plate with spongiosum helps in tension-free tubularization. Tubularization of urethral plate and spongiosum reconstructs a near-normal urethra with minimal complication. Long-term complications in middle and posterior hypospadias such as postvoid dribble and retained ejaculate are because of the urethra devoid of spongiosum. Spongioplasty will help to reduce these complications. Adding Frenuloplasty and Prepuceplasty reconstructs prepuce giving the penis a normal appearance. Spongioplasty with dartosorrhaphy is a perfect healthy interposing tissue layer based on sound surgical principles.

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