# 10 Tubularized Incised Urethral Plate Urethroplasty in Severe Hypospadias

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## 10.1 Introduction

Tubularized incised urethral plate urethroplasty is the choice of procedure in distal and middle hypospadias [1]. But there is significant variability in preference of the procedures to proximal hypospadias with chordee. The available techniques for proximal hypospadias repair are TIPU, with or without dorsal inlay and on lay flap urethroplasty and urethral plate transection procedures and replacement urethroplasty are Duckett's repair, Asopa's I & II, Double island urethroplasty, Koyanagi, Hodgson's X, Hodgson's XX, Glassberg–Duckett technique, Bhat's modification of Glassberg–Dukette technique and two-stage procedures [2]. Among these transverse island procedures, Duckett and Asopa are commonly practised. Complications are more in these replacement urethroplasties than in on lay flaps urethroplasty and TIPU. In the modern approach of hypospadias repair, the urethral plate is to be preserved as far as possible [3]. Results of two-stage procedures and single-stage have been reported similar [4]. The choice, whether to go for a single stage or two, depends on the training and experience of the surgeon. But single-stage repair with excellent results will be preferred by the parents or patients because of the greater convenience to the patient, decreased cost, anaesthesia risk, decreased separation anxiety and psychological impact. This will give better results because of the availability of healthy and unscarred urethral plate and skin [4]. Long-term complications like spraying of urine, post-void dribble, the dribble of the ejaculate, milking of the ejaculate and retained ejaculate with two-stage are very high (33–42.5%) [5, 6]. Neourethra devoid of with spongiosum is the leading cause of these complications. Tubularized urethral plate urethroplasty with spongioplasty reconstructs near-normal urethra and is likely to reduce these complications. Complications of TIPU in proximal hypospadias are comparable to other procedures of hypospadias repair in severe hypospadias [7]. The main limitation in the application of TIPU repair is presence of chordee. Mild to moderate curvature correction is feasible by the mobilization technique preserving the urethral plate making these cases suitable for TIPU.

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## 10.2 Surgical Technique

Main steps of the technique are

1. Penile de-gloving and chordee correction.
2. Incising the urethral plate and its tubularization with or without the dorsal inlay.
3. Spongioplasty and glanuloplasty.
4. Scrotoplasty.
5. Skin closure.

### 10.2.1 Penile De-gloving and Chordee Correction

A stay suture is placed on glans, and 1:100000 adrenaline solution is injected at the planned site of the incision. A circumferential circumcoronal incision is given and is extended down on the shaft as an inverted U-shape at the margins of the urethral plate encircling the meatus and then extended in the midline in the scrotum. Penile skin de-gloving is done at Buck's fascia up to the root of the penis (Fig. 10.1a) for chordee correction. Then, the Gittes test is done to assess the chordee correction (Fig. 10.1b). Dissection plane is created just proximal to the meatus at tunica albuginea, the urethral plate and corpus spongiosum is mobilized (Fig. 10.1c) distally into the glans. The spongiosum is mobilized lateral to the medial. If there is no curvature and parents demand prepucioplasty, partial ventral penile de-gloving is done (Fig. 10.2a, b). The mobilization of the urethral plate is done medially just inside

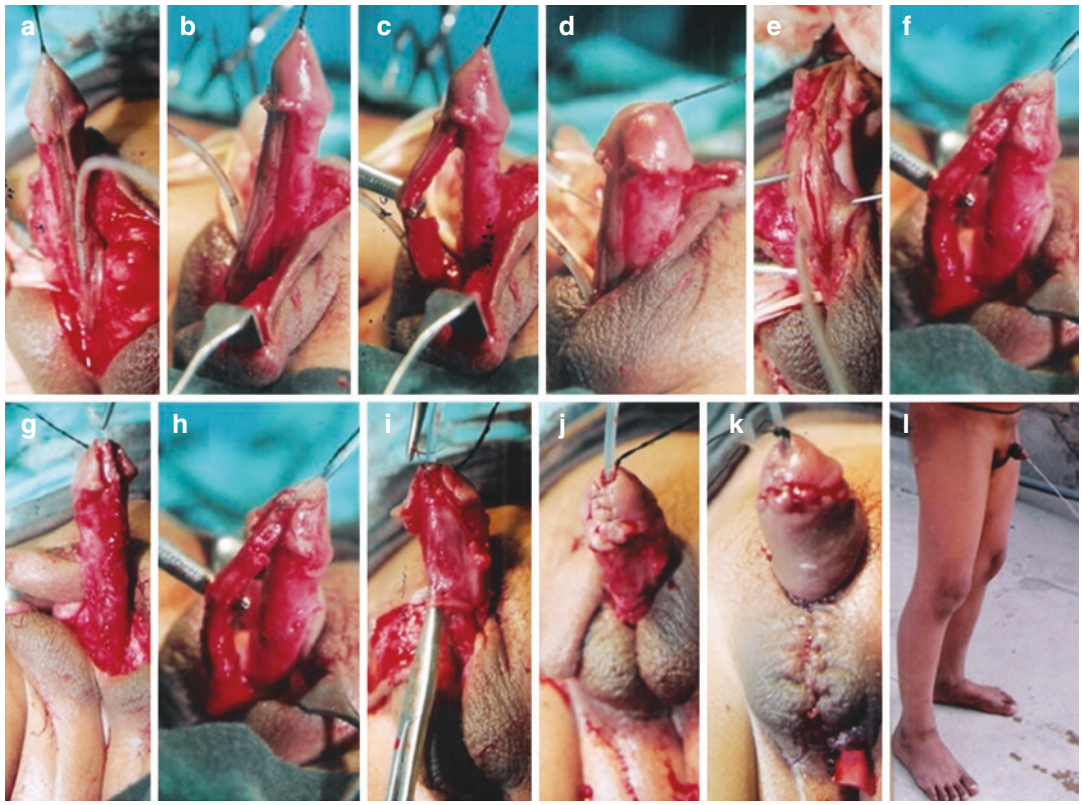


**Fig. 10.1** Steps of tubularized incised plate urethroplasty in perineal hypospadias. (**a**) Penile de-gloving. (**b** and **c**) Urethral plate with the corpus spongiosum mobilization. (**d**) Gittes test showing correction of the chordee. (**e**) Incision of the urethral plate. (**f**) Tubularization of the urethral plate. (**g** and **h**) Spongioplasty. (**i**) Coverage of the neourethra with a dorsal dartos flap. (**j**) Glanuloplasty. (**k**) Skin closure. (**l**) Patient projecting the urinary stream from the tip postoperatively. {with permission Bhat et al. [7] copyright @Elsevier}

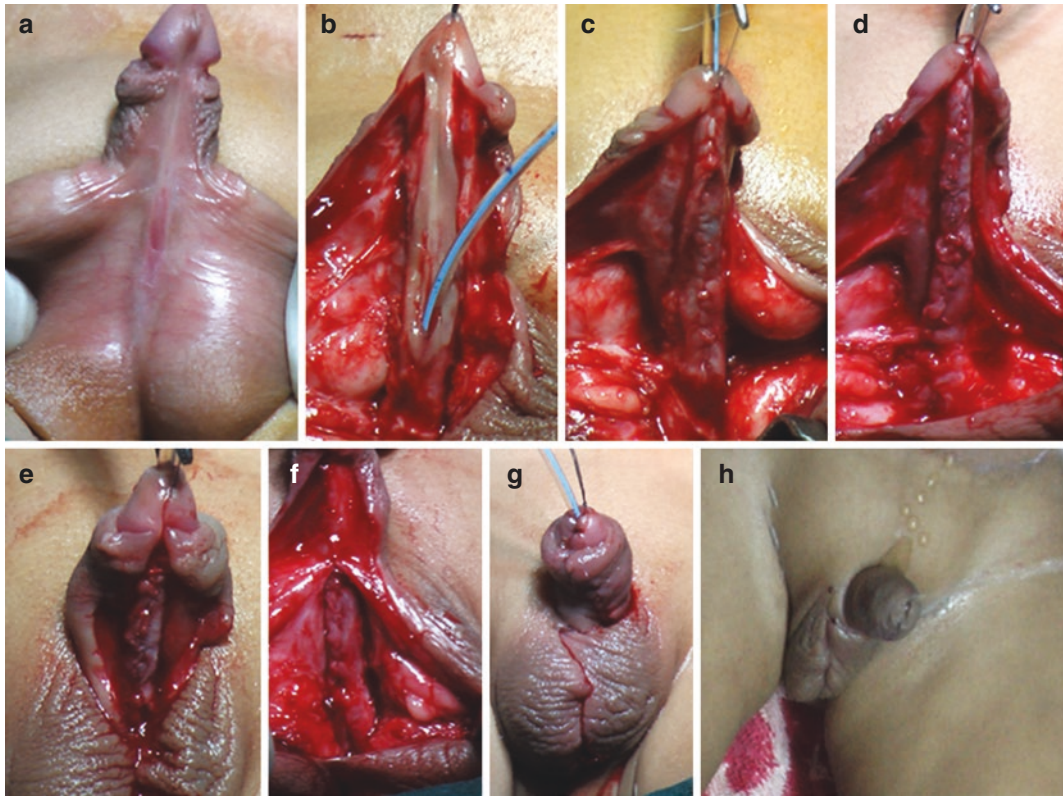


**Fig. 10.2** Steps of tubularized incised plate urethroplasty with preputioplasty in perineo-scrotal hypospadias. (**a** and **b**) Penile de-gloving and urethral plate mobilization. (**c**) Tubularization of the urethral plate. (**d**) Spongioplasty. (**e**) Glanuloplasty. (**f**) Coverage of the neourethra with a ventral dartos flap. (**g**) Skin closure and prepucioplasty. (**h**) Patient projecting the urinary stream from the tip postoperatively. {with permission Bhat et al. [7] copyright @ Elsevier}

the margin of the urethral plate in case chordee has been corrected by penile de-gloving or cases with no chordee but under the urethral plate where chordee persists after penile skin de-gloving. Proximal urethra is mobilized on the persistence of chordee, and Gittes test is done to confirm its correction (Fig. 10.1d). If chordee continues, then the single-stitch dorsal plication is made.

Mobilizing the urethral plate into the glans and glanuloplasty is done after raising glanular wings to correct the glanular chordee. The Gittes test confirms the final chordee correction. However, in cases with the spongiosum segment's tethering after mobilization or persist chordee after dorsal plication, the urethral plate is transected at the corona to correct the chordee, and the plan is changed to inner prepucial flap repair or two-stage repair.

### 10.2.2 Incising the Urethral Plate and Tubularization of it with or Without the Dorsal Inlay

The urethral plate is incised in the midline, taking care not to cut through the urethral plate (Fig. 10.1e) and proximal urethra is calibrated with the largest acceptable catheter to get the size of the urethral stent. The incision in the urethral plate is avoided if the urethra is wide enough to tubularize it over an adequate size urethral stent. Depth of incision depends on the width and development of the urethral plate and spongiosum. The patients whose required width is more; then we supplement it with a dorsal inlay graft (Fig. 10.3) or buccal mucosal graft. Tubularization of the urethral plate is done using 6/0–7/0 PDS

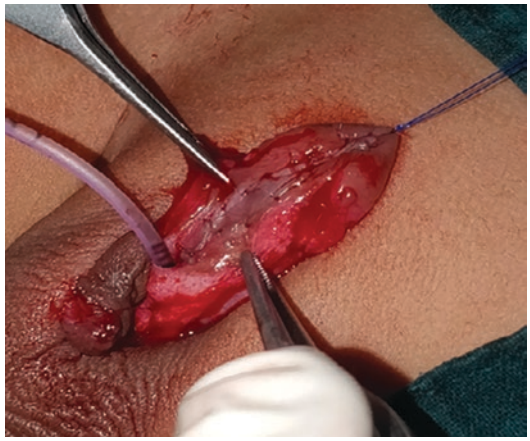

**Fig. 10.3** Showing the dorsal inlay skin graft

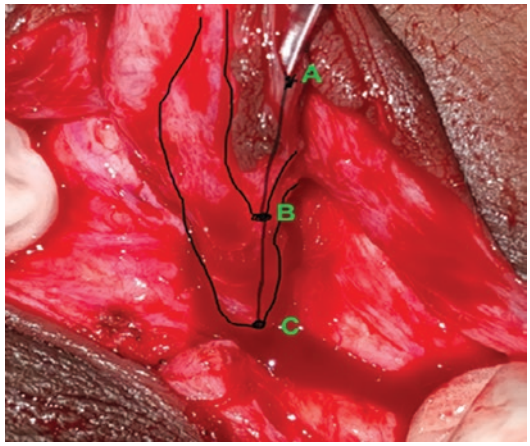


**Fig. 10.4** Showing the demarcation and margins of the urethral plate and spongiosum (**a**) Meatus, (**b**). Bifurcation of urethral plate, (**c**). Bifurcation of Spongiosum

continuous/interrupted sutures over a 5–8 Fr stent according to the child's age (Figs. 10.1f and 10.2c). The bifurcation of the spongiosum and the urethral plate is well demarcated and is about 1–2 cms proximal to the meatus (Fig. 10.4) (Urethral plate Bifurcation is marked 'B' and the spongiosum 'C'). The first suture is taken in the glans creating an adequate size meatus. The tubularization is started about one centimetre proximal to the meatus (Fig. 10.5a) and continued up to mid-glans using 6/0/7/0 PDS/Vicryl interrupted/continuous sutures to complete urethroplasty. (Figs. 10.1g and 10.2d). Care is taken not to leave any everting margin of the urethral plate and not to buckle neo-urethra.

### 10.2.3 Spongioplasty and Glansplasty

Suturing of mobilized spongiosum is started proximal to the limit of the tubularization of the urethral plate (Fig. 10.5b) and continued up to neo-meatus through the glans (Figs. 10.1g, h and 10.2d). Reconstructed neourethra by urethral plate tubularization with spongioplasty anatomically resembles a normal urethra with a urothelial layer covered by spongiosum. The neourethra is again covered with a dorsal dartos flap in cases without prepucioplasty (Fig. 10.1i), ventral dartos with prepucioplasty (Fig. 10.2f) or with a tunica vaginalis flap. Thus, neourethra is covered by two healthy interposing tissues, which help prevent fistula and maintain a better blood supply. A 6–10 Fr urethral catheter/infant feeding tube is left in situ depending on the patient's age, smaller than the native urethral calibre. The glanular wings are mobilized deep up to tunica to have wide glanular flaps. Glanuloplasty is done in two layers with 6/0–7/0 PDS suture. The second layer of sutures can be used either subcuticular (Fig. 10.2e) or through the glans (Fig. 10.1l, j). Care is taken to have adequate space between the neourethra and glans wings while ensuring no compromise in blood supply.

### 10.2.4 Scrotoplasty and Skin Closure

Midline scrotal sac is mobilized, and the scrotoplasty is done in two layers (Figs. 10.1k and 10.2f). The scrotoplasty covers the proximal part of the neourethra, which helps in the prevention of fistula. The prepucioplasty is done depending on the available prepucial tissue and patients' or parents' desire. First, prepucioplasty is done in three layers: inner prepucial skin, dartos and outer skin closure. Then skin closure is done (Figs. 10.1k, 10.2f, g), and a pressure dressing is done.

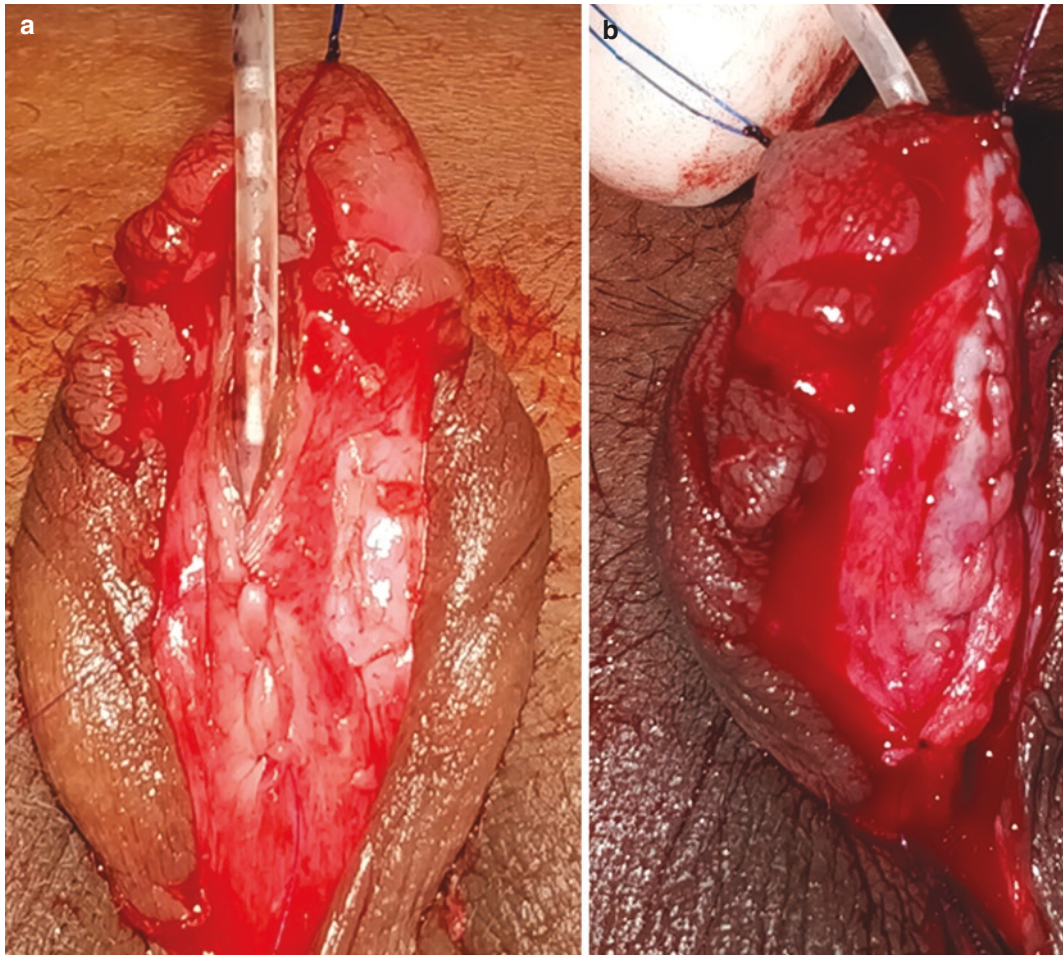


**Fig. 10.5** (**a**) The starting of tubularization of urethra plate proximal to the meatus, (**b**). Starting of spongioplasty proximal to the tubularized urethral plate

The urethral catheter is kept for 10–14 days. After that, the patient is called in follow-up at 1, 3, 6 and 12 months postoperatively, and then every year and evaluated for the appearance of the penis and glans meatal stenosis, fistula, stricture and other complications. The visual impression of voiding stream (Fig. 10.11) and urinary leakage from other sites than the meatus gives the impression of meatal stenosis, stricture and fistula. Besides, the urethra may be calibrated to rule out the urethral stricture and meatal stenosis.

## 10.3 Why TIPU in Proximal Hypospadias

A rational approach in the management is the application of a urethral plate preservation urethroplasty with spongioplasty. Choosing single-stage or two-stage procedures depend on the training, surgical experience and problems in the particular case of hypospadias. The single-stage technique is more suitable for the patients saving time, money visits to the hospital and less anxiety and mental trauma to the parents. Another

important factor that matters in the long-term follow-up is the quality of the urethra with the spongiosum. Aldamanhori and Chapple 2017 in a review article on the failed hypospadias surgery presenting in adulthood, narrated that a narrow or short tube may be created because the neourethra may fail to grow adequately, keeping up with the rest of the genital tissues during puberty [8]. The late complication like stricture may present late because of the rapid genital growth during puberty. Besides, it is assumed that the congenital lack of spongiosum or no spongiosal covering the neourethra during repair in those patients may not provide adequate vascular support to the urethra during the rapid growth of puberty. Similarly, it can be postulated that the neourethra does not tolerate any trauma during erection and sexual activity because of a lack of spongiosum support [8]. The reconstructed urethra with tubularization of urethral plate and spongioplasty in TIPU simulates with the native urethra [9], which is likely to grow with age as genital tissue being responsive to hormones. The urethral plate with spongiosum and proximal urethral mobilization is used to correct the mild to moderate curvature [1]. These steps deal with all the factors responsible for ventral curvature in skin, dartos, Bucks fascia and spongiosum segment [10]. The limitation of the technique is that chordee due to intrinsic corporeal disproportion cannot be corrected. However, further corporeal disassembly can be added to correct the chordee if required. So, patients of corporal disproportion are to be treated with corporotomy, corporoplasty, and penile disassembly. Perovic et al. reported straightening of the penis in 68% of the patients by penile disassembly alone. In 32% of patients, though the curvature's severity decreased significantly it required dorsal plication for corporoplasty. So, the penile shortening was limited [11]. The disassembly technique is extensive and requires the separation corpus spongiosum segment with glans and the neurovascular bundle from copora cavernosa and has the chances of nerve injury. Our technique only involves mobilizing the corpus spongiosum segment without separating the glans and the corpora cavernosa from each other or the neurovascular bundle. We could correct the curvature in 88% of cases which is better compared to penile disassembly [1].

Snodgrass and Lorenzo had 22% fistula and overall 33% complications in mid-shaft to scrotal hypospadias with TIP, but 55% of the cases required dorsal plication for chordee correction [12]. But later on, the addition of spongioplasty reduced the fistula rate 33% to 10% and with tunica vaginalis had nil fistula. Snodgrass 2007 reported an overall 14% complication in 250 mid to proximal hypospadias [13]. Chen et al. reported an overall complication rate of 17.5% with TIPU in 40 cases of proximal hypospadias [14]. Besides, the spongioplasty gives almost a normal shape to the urethra, adds length, helps in chordee correction and the repair is more anatomical [15]. Finally, spongioplasty adds an extra layer of healthy vascular tissue, which helps to prevent fistula.

El Saket (2008) reported their results in 28 cases of proximal hypospadias where they could correct chordee by the mobilization technique in 80% of patients and 30% required the addition of dorsal plication and had overall complication 39% and fistula rate of 14% [16]. Therefore, they opined TIPU as a choice of procedure in mid and proximal hypospadias.

Mobilizing the urethral plate and spongiosum allows corporoplasty in patients of dorsoventral corporal disproportion, preserving the urethral plate. Kajbafzadeh et al. (2007) successfully preserved the plate for TIP urethroplasty in 13–18 cases (perineal six and penoscrotal 12) after correction of severe chordee by corpus spongiosum/urethral plate elevation combined with ventral corporotomy and tunica vaginalis grafting [4].

Snodgrass [2013] had a higher stricture rate 5/29 (17.24%) after the urethral plate and proximal urethral mobilization compared to 0/47 and stated that they have stopped mobilizing the urethral plate [17]. At the same time, stricture reported by Pfistermuller et al. (2015) in a review of 625 cases of proximal hypospadias was 2% (mean). Other complications were the mean fistula rate, 10.3%, meatal stenosis of 4.4% and reoperation rate of 12.2% in a mean follow-up of 16 months [18].

But Snodgrass applies the same principle of mobilization of the urethral plate and proximal urethra to correct curvature in STAG repair. He transects the urethral plate at the corona, mobilizes the urethral plate and urethra in the bulbar region to gain the length and re-attaches the urethra to corpora to correct the curvature. This shows the principle of mobilization is exemplary and should be followed. The blood supply of the urethral plate and urethra is from the bulbar artery, which is maintained as the urethral plate is lifted with the corpus spongiosum, and the proximal and distal ends are kept attached, maintaining the continuity of the corpus spongiosum. It is important not to damage the corpus spongiosum or corpus cavernosum. Care is to be taken not to damage the bulbar artery during the extensive bulbar dissection. We had the strictures in 14.28% of cases of proximal hypospadias repair with TIPU [19]. Our selection of patients with a well-developed wide urethral plate and spongiosum, proper mobilization of the urethral plate and spongiosum, taking care not to damage the blood supply of the urethral plate probably helped us to minimize the incidence of urethral strictures. The very fact that tubularization of the urethral plate without an incision was possible in 35% of cases shows better case selection [1]. Another critical point is not to damage the spongiosum; damage to the blood supply may also cause stricture urethra. A proper plane of dissection is created proximal to meatus at tunica albuginea and taking the deep layer of Buck's fascia with the spongiosum to prevent to damage the spongiosum. We covered the neourethra with spongiosum by spongioplasty and dorsal dartos/tunica vaginalis flaps, which helped us to reduce fistula formation. Similar were observations of Sarhan et al.; They reported a statistically significant lower fistula rate in spongioplasty with dartos in TIPU [20].

## 10.4 Conclusions

The objective of the hypospadias surgery is to reconstruct the functional urethra. TIPU is feasible in selected cases of proximal hypospadias with chordee, with an acceptable complication rate even in perineal and perineo-scrotal hypospadias, provided the urethral plate is wide, well developed and the corpus spongiosum is moderate to well developed. Chordee can be corrected by preserving the urethral plate with spongiosum and proximal urethral mobilization up to the bulbar region, spongioplasty and glanuloplasty: as it adds about the 2–3.5-centimetre length of to the urethra. The mobilization technique of chordee correction is simple, effective and safe, and enlarges the scope of TIP in proximal hypospadias with good results. Mobilization of spongiosum allows spongioplasty with tension-free sutures, and TIPU with spongioplasty reconstructs near-normal urethra.

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