

# Is tubularization of the mobilized urethral plate a better alternative to tubularization of an incised urethral plate for hypospadias repair?

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## Abstract

**Introduction** Trial of a new procedure of hypospadias repair based on the incorporation of the entire available innate urethral tissue for the formation of neo-urethra in patients with hypospadias.

**Materials and methods** Fifteen consecutive children, nine with distal hypospadias and six with proximal hypospadias (all with severe chordee), whose parents consented to application of a new procedure of hypospadias repair, were the study subjects. This procedure is inspired by Cantwell Ransley procedure for epispadias repair and Snodgrass procedure for hypospadias repair. The entire urethral plate was mobilized (i.e., lifted off the corpora) distal to the urethral meatus and was tubularized in two layers; inner urethral skin and outer spongiosal tissue, in Duplay fashion. The repair was reinforced with dartos vascularized flap. The skin incisions on the urethral strip are guided by the disposition of the spongiosal tissue underlying the urethral plate (rather than the conventional U-shaped incision on either side of hypospadiac urethral meatus). In the patients with proximal hypospadias with severe chordee urethral advancement was combined to achieve orthoplasty and a single stage hypospadias repair. The catheter was removed on tenth postoperative day.

**Results** Even in patients with proximal hypospadias with severe chordee, good single staged repair was achieved without resorting to dorsal plication that would have been

necessary had any other methods based on the preservation of urethral plate was performed in these subjects. Therefore, the procedure was found to have an extended applicability to even those patients where tubularized incised urethral plate urethroplasty is not advised. All patients had good results (in 1 year follow-up), except in three early subjects of the series; two of whom developed minor urethrocutaneous fistulae (probably due to frank urinary leak secondary to repeated catheter blockade) and one developed partial glanular wound dehiscence.

**Conclusions** Though the authors have an initial limited experience with this procedure, the procedure is likely to have a promising future due to its versatility and utilization of the entire urethral tissue.

**Keywords** Hypospadias · Urethral plate mobilization · Urethral advancement · Neo-urethra · Tubularization · Urethral plate

## Introduction

Recent literature on the hypospadias repair lays great stress on two points. Firstly, an increasing trend towards a single stage repair. Secondly, preservation of the urethral plate (UP) even in the patients with severe chordee, whereas the earlier concept was to divide the urethral plate to release the chordee. This drastic change in the approach has been due to the observations made by a few workers that the urethral plate does not contribute to chordee [1, 2]. This observation was supported by the histological evidence that the urethral plate is a well vascularized tissue rather than fibrous tissue as was earlier thought to be [3]. These concepts have revolutionized the increasing utilization of the onlay flaps (while preserving the urethral plate) for the

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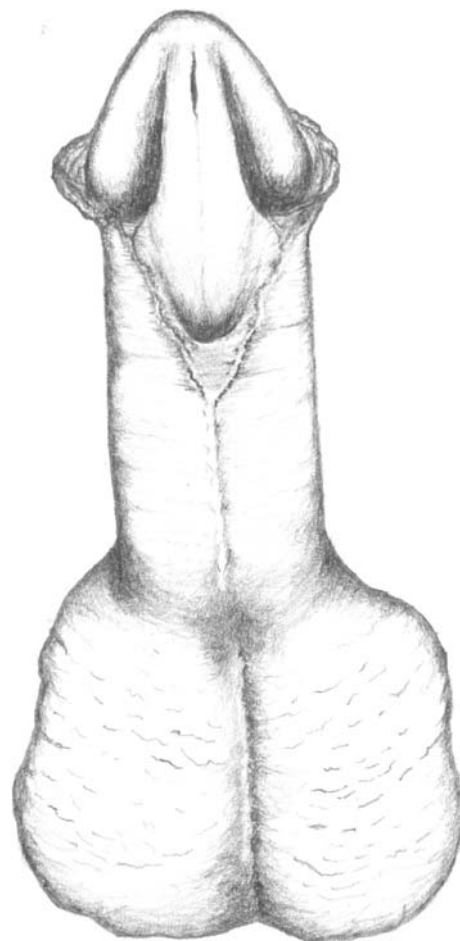
hypospadias repair and in the last decade, tubularization of the incised urethral plate (TIPU) [4]. TIPU was initially contemplated for distal hypospadias repair [5]. A perusal of the initial article by Snodgrass on this technique, we realized that the need for incising the UP was felt to provide generous mobility for tubularization without the use of the supplemental flaps. He argued that the procedure almost recapitulated the normal closure of the urethral folds.

It is well known that the male urethra is an extension of the urogenital sinus and results from the fusion of the urethral folds in the midline. The mesenchymal tissue of the corpus spongiosum develops subsequently [6]. Also that the hypospadias develops due to an incomplete fusion process that causes the meatus to be present in different locations, depending on the point where the fusion process finally got arrested. Furthermore, the corpus spongiosum under the opened UP also fans out distal to the hypospadiac meatus. This together with the skin lining constitutes what is known as urethral plate plaque or more commonly as UP [6, 7]. Thus more distally one progresses from the urethral meatus, more is the distraction between the two edges of the UP as the corpus spongiosum anlagen fan out laterally under the unfused urethral strip till they reach the glandular region (Fig. 1). This implies that the distraction of the UP edges is maximum at the region of corona (since the origin of the glans is different from the remaining urethra).

With this background knowledge, we wondered why the incision of the UP should at all be required before tubularization in order to simulate the natural phenomenon of urethral formation and construction of a neourethra. The tubularization of a mobilized urethral plate should be an easier option, as the mobilized UP edges would have sufficient coaptibility (in absence of its fixity to the underlying corpora on its dorsal aspect). This would therefore, obviate any need of dorsal incision of UP in order to gain sufficient width for a good calibered urethra. This would also take care of the few known complications of TIPU arising due to an unpredictable healing of the incision of the UP [8, 9].

## Materials and methods

Fifteen consecutive children, nine with distal hypospadias (six with severe chordee more than 100°, three without chordee) and six with proximal hypospadias, of which three were penoscrotal (all with severe chordee), whose parents consented to application of a new procedure of hypospadias repair, were the study subjects. The new repair method used is being described below. The principle of the procedure was that the incisions on the UP for tubularization are guided by the disposition of the spongiosal tissue underlying the urethral plate (rather than the conventional U-shaped

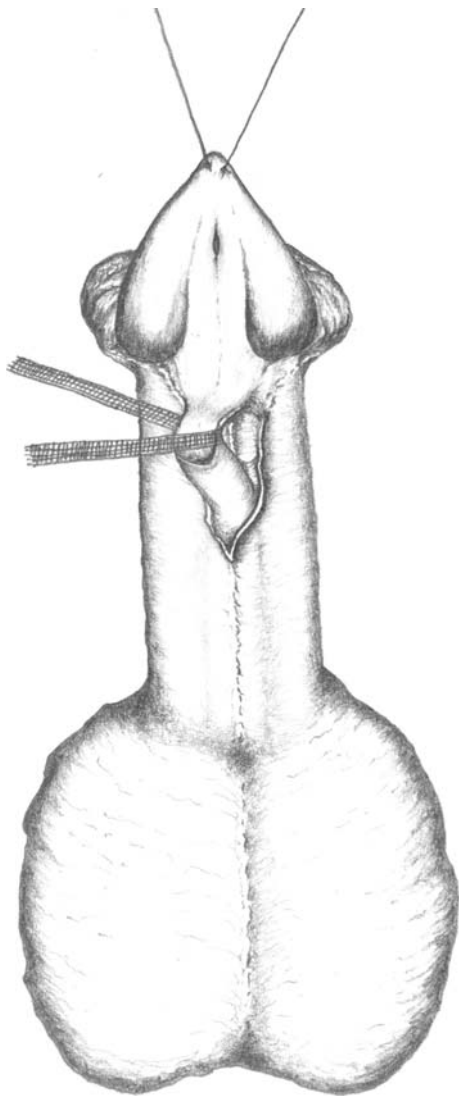


**Fig. 1** The diagram showing distal hypospadiac meatus with urethral skin disposition as 'urethral delta' that overlies a splayed out spongiosum

incision on either side of hypospadiac urethral meatus). When combined with urethral advancement in selected cases, the procedure was sufficient to take care of the chordee; and only a few patients required dorsal plication. The catheter was removed on tenth postoperative day.

## Description of the procedure

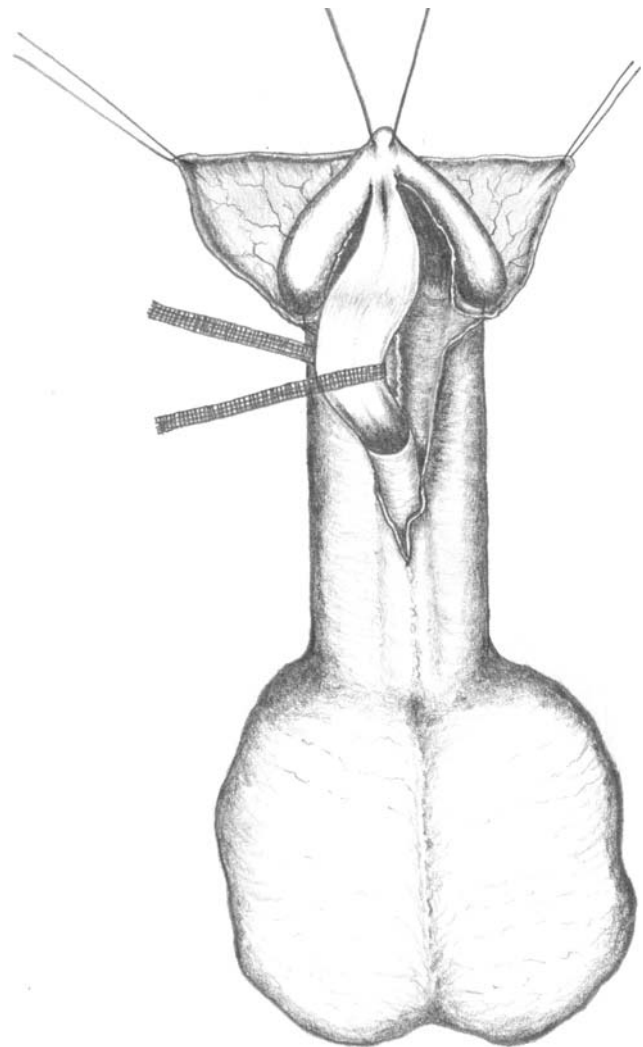
The first step is to take a traction suture dorsal to the glandular tip. The procedure begins by making a 1.5 cm long midline incision over the median raphe extending from the urethral meatus proximally (Fig. 2). Thereafter, the plane is developed between corpus spongiosum covered urethra and corpora cavernosa proximal to the urethral meatus. An umbilical tape is passed underneath the lifted up normal urethra. The dissection in this avascular plane is carried distally towards corona so as to lift the urethral plate connective tissue (the spongiosal tissue) off the neighboring corpora cavernosa (Fig. 3) As the spongiosal dissection proceeds the skin incisions are marked, being



**Fig. 2** Diagram showing that beginning of urethral plate mobilization finding the plane between the spongiosal tissue and corpora, starting proximal to the hypospadiac meatus. The skin incisions have not been marked as yet

guided by the limits of the mobilized spongiosal tissue. The idea is to identify the entire tissue that was destined to form urethra had all the embryological events gone off well. Once dissection at corona is complete, the urethral plate is lifted off in the area of glans in the same manner and is also laterally freed from the glandular hillocks on either side and simultaneously raising the glandular wings. The dissection stops short of the glandular tip, thereby, maintaining the glandular connection of the urethral plate.

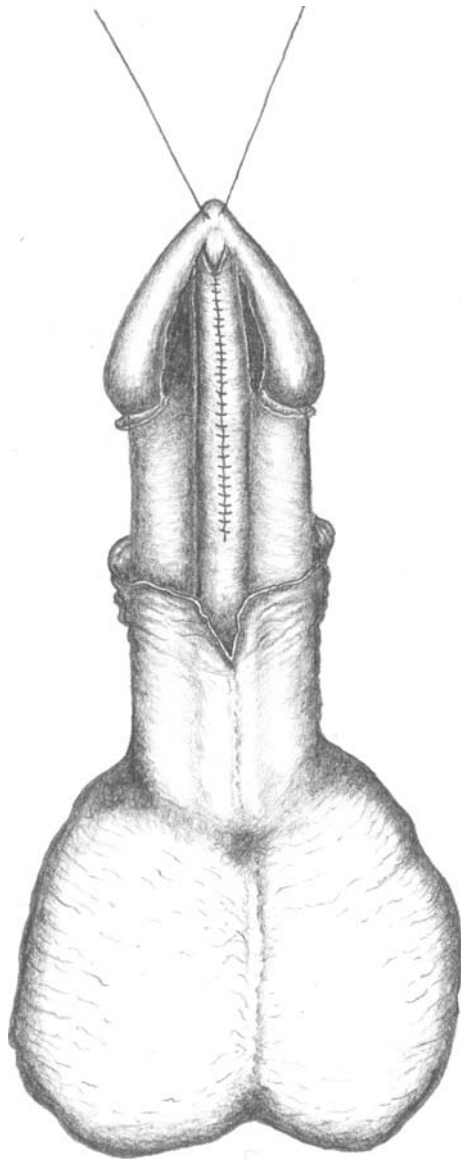
Next, a circumcoronal prepuceal incision is made and the subcutaneous dissection is carried all around the penis in order to release the subcutaneous tissue causing chordee. At this stage an artificial erection test is carried out to check the adequacy of chordee correction. Wherever necessary, a proximal urethral dissection (as described by



**Fig. 3** Urethral plate has been completely mobilized. The skin incision were marked in 'cut as you go' fashion. Note that the distal connection of the urethral plate with glans is not detached

Baker [10]) and urethral advancement (as described by Koff [11]) are done in order to achieve straighter penis. Rarely, dorsal corporeal plication may be required in cases of severe corporeal disproportion.

Thereafter, neourethra is formed over a no. 6F feeding tube by tubularizing the margins of the mobilized urethral plate in two layers: the inner continuous/interrupted skin sutures and outer layer of spongiosal tissue, using absorbable 6-0 vicryl (Fig. 4). We acknowledge to have preferred no. 8 feeding tube in our initial five patients, but later realized that using no. 6 feeding tube allows an easy glanular repair. The entire repair was buttressed by applying dartos flap. The first suture in the UP is taken about 3 mm proximal to the glandular tip so as to achieve an oval meatal configuration. The raised glanular wings were sutured distal to the neo-meatus thus formed so that the neo-meatus finally is located at the tip of the glans. In the



**Fig. 4** Urethral plate tabularized in Thiersh Duplay fashion in two layers

patients where an extensive proximal urethral advancement was done over a distance of 2 cm or more, we found that a few anchoring sutures between the spongiosal tissue and corpora were effective in maintaining the urethral advancement; albeit with great caution lest the urethral lumen should be entered. Thereafter, glandular wing approximation, penile skin suturing and preputioplasty are performed as per the technique described by Snodgrass [5].

## Results

We have applied this procedure in 15 patients till date, 3 with penoscrotal, 3 with proximal penile hypospadias with

chordee more than  $100^\circ$ , 6 with distal penile hypospadias with severe chordee (more than  $100^\circ$ ), and 3 with distal hypospadias without chordee. In all patients with severe chordee, urethral advancement was also required. The mean follow-up period was of 20 months. The mean time taken for the entire procedure was 58 min. The procedure was found to have a distinct advantage of easily correcting even the severe degrees of chordee without requiring dorsal plication. In our series, the dorsal plication was required in only three patients; two with distal hypospadias with severe chordee and one with penoscrotal hypospadias with chordee. Also it easily corrects the penile torsion, caused due to unequal disposition of urethral plate onto the corpora. Once the urethral plate is mobilized and tabularized into the urethral tube, the torsion generally corrects, unless caused by lateral corporeal length disproportion. In one patient with midpenile hypospadias with distal 1 cm urethra uncovered with spongiosal tissue, no back cut was required using this technique and only spongioplasty over this uncovered urethral tube portion was sufficient. The cosmetic results were good in all patients with oval good sized meatus. Only two fistulae were encountered during a 20 month follow-up (one patient who had blocked catheter developed a small fistula). One of our earlier patients developed glanular dehiscence. Two subjects developed meatal stenosis in early postoperative follow-up, which responded to meatal calibration regime over 2 weeks. None developed urethral stricture.

## Discussion

Any hypospadias repair deals with five aspects: orthoplasty, urethroplasty, glanuloplasty, preputioplasty, and meatoplasty. The end objective is to achieve a good urinary stream (without splaying) from the urethral tip, a conical glans, elliptical urethral meatus, normal preputial configuration, a straight phallus and, a uniform caliber urethra. Undoubtedly it implies too many expectations from any single hypospadias repair procedure. No wonder, none of the described procedures are foolproof, may be not the one proposed by us. However, if properly performed it fulfills many expectations of a good hypospadias repair and above all, can be widely applied.

The above described method has been inspired by Cantwell Ransley procedure for epispadias repair and Snodgrass procedure for hypospadias repair. In this repair method, a surgeon is required to start the dissection proximal to the urethral meatus and advance distally for mobilizing the UP. The circumcoronal incision in the preputial fold is made at a later stage in this procedure and distinguishes this procedure from those described earlier. Thus, the UP destined to be utilized for neo-urethral

construction is not only defined and isolated at an early stage of the repair but also is lifted off the bed so as to ensure its easier tubularization without the need of any incision. This step itself corrects chordee to a large extent as the adherence bands between UP and the corpora get released. The residual chordee is corrected with dorsal penile dissection, and urethral advancement and/or dorsal plication in selected cases. Thus, a single stage hypospadias repair based on UP is achieved in all subjects, with optimum results.

The versatility of the proposed procedure is due to fact that it aims at utilizing the entire native urethral tissue for creation of a neourethra (entire urethral skin overlying the spongiosal tissue is used). Thus a few complications that arise from the use of other tissues, as the preputial skin graft, bladder mucosa, penile/scrotal skin (due to difference in the nature of these tissues from urethral skin) are avoided [7, 8, 12, 13]; the commonest being, the stenosis at the junction of the anastomosis, meatal stenosis, urethral diverticulum formation, neourethral dilatation, etc., are less likely to occur with the application of this procedure. The only significant complications encountered in our series were meatal stenosis ( $n = 2$ ) and glanular dehiscence ( $n = 2$ ) in our earlier patients that were circumvented mainly by using no. 6 feeding tube (instead of using no. 8) and observing the precautions advised by Snodgrass [8]. Two more patients are awaiting urethral fistula repair which occurred at the original site of hypospadiac meatus. At an initial glance, our complication rates may appear comparable with the existing hypospadiac repair methods. However, if one takes into consideration the fact that most patients included in the series happened to be cases with either proximal meatus and/or severe chordee, where single UP based repairs were largely not feasible and other procedures, if applied, would have required a longer operating time with associated complications or multiple repair stages, the advantages of this procedure get obvious. Mastering this method alone helps the surgeon repair all variants of hypospadias with much greater ease, without having to resort to any alternative. We affirm that for distal hypospadias without chordee and with good UP, this method may not offer distinct advantage over Snodgrass procedure.

While TIPU (Snodgrass procedure) also uses the innate urethral tissue for neo-urethra formation, it may underutilizes the entire available tissue as the areas of urethral skin overlying the lateral most urethral spongiosal tissue are likely to be left from being incorporated in the urethroplasty (spongiosum actually has a lateral disposition, especially in the region of corona and as per our observation, the skin incisions intending to utilize the whole UP tissue more or less follow marking of 'urethral delta', described by Mueller). In our opinion it is this deficiency

that leads to the need of the incision on the UP to gain sufficient width. The healing of this incision is unpredictable and may lead to few complications of this procedure [8, 9]. This aspect, is therefore, taken care of by the procedure proposed by us as the UP is used in its entirety and its markings are guided by the disposition of the underlying spongiosal tissue. Secondly, TIPU is not advised for the patients with proximal hypospadias with severe chordee or those with shallow urethral plate; whereas the procedure proposed herein is applicable even in these circumstances [8]. In fact 12 of 15 patients in our study did not qualify for UP based Snodgrass repair. Contemplating TIPU for patients with severe chordee will definitely mean a loss of phallic length due to dorsal plication done to achieve chordee correction as the penile straightening is less likely to be achieved by skin or subcutaneous detethering alone. However, since the herein described procedure incorporates urethral plate mobilization with proximal urethral advancement whenever required for orthoplasty. Therefore, full chordee correction is ensured without compromising the penile length and dorsal plication is likely to be hardly required. We found that the vascularized dartos flap, as described in Snodgrass procedure; give a good support to the urethral skin layer suture line [5, 14]. For patients with very distal hypospadias, our procedure requires a short incision line after inrolling the glandular groove mucosa similar to that tried earlier by Van Horn and Kass [15]. They, however, tabularized in situ UP while we aim to tabularize a mobilized UP.

We observed a relative ease in inrolling a mobilized UP in the region of corona, that is usually encountered due to strong adherence of the splayed out spongiosal tissue of UP to the underlying corpora in this region. In our experience, a large majority of urethral fistulae are observed in the region of the corona and these are also very resistant to heal. We hypothesize that the distraction forces of the underlying spongiosal tissue might have a role in contributing to a delayed healing of these fistulae. Only future experience can tell if the proposed procedure can decrease the incidence of coronal fistulae. Both fistulae in our study occurred at the original site of the meatus. The procedure particularly has a better edge in instances of shallow UP though it may not confer any additional advantage in subjects with healthy UP or with deep grooved UP.

Achieving conical glans is another concern of any hypospadias repair. With the proposed procedure it is easily achieved once the UP is distally mobilized till the glandular tip, without cutting its distal connection. In fact, the first suture for repair is taken on the mobilized UP about 3 mm distal to the glandular tip and is wrapped loosely around no. 6 feeding tube, for a cosmetically pleasing meatus. The mobilization of the urethral plate is very simple once the right plane is reached and its vascularity is maintained from

the proximal spongiosal branches of the urethral artery [3]. Suturing the mobilized glanular wings by adjusting sufficient length below the neo-meatus allowed an apparent neo-meatal placement at the tip of the glans. At the end of the procedure, we achieved a circumcised appearance of the penis. We never ever required to borrow the skin from other sites to cover bared out corpora even after extensive dissection, once the dorsal penile skin was properly aligned ventrally. However, an endeavor for a more natural preputial skin cosmesis may be done in the subjects with redundant dorsal preputial skin, as in patients with distal hypospadias without chordee.

On review of the literature we find that a similar procedure to that described herein was advocated by Montfort for posterior hypospadias repair, albeit differing on a few points [10, 11]. They inrolled the marked U-shaped UP (rather than being guided by spongiosal tissue for marking skin incisions, as done in our proposed procedure). They also have not described the advancement of the urethra for achieving chordee correction in selected patients.

We feel that the proposed procedure incorporates the basic advantages of Snodgrass procedure with an advantage of an extended applicability even to those situations where Snodgrass procedure is not advised. It is easy to master and is highly versatile and may have fewer complications. However, more experience is required to test its long term results.

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