28 Urethral Advancement for Treatment of Distal Hypospadias

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Abbreviations

DYG	Double Y Glanulomeatoplasty
MAGPI	Meatal Advancement and Glanuloplasty Technique
TIP	Tubularized Incised Plate

28.1 Introduction

Distal hypospadias comprise the largest group of children with hypospadias (Fig. 28.1). These forms are generally considered as mild forms of hypospadias because they are not associated with the physical inability of having a successful sexual intercourse and/or being unable to reproduce [1, 2]. Despite the fact that mild penile curvature is occasionally present also in distal hypospadias, the existence of true fibrous chordee is rare, and the potential need for division of urethral plate for correction of the curvature would be extremely unusual. Having stated this, it is the hooded appearance of the foreskin, the common downward deviation of the urinary stream, and last but not least the stenotic appearance of the hypospadiac meatus, which usually urges parents to seek treatment for their children with glanular, coronal, and/or subcoronal hypospadias, responsible for around 70% of all boys with hypospadias [3].

The correction of distal hypospadias has the ultimate surgical goals of (1) straightening of the penis by correction of the penile curvature, (2) reconstruction of the absent most distal part of the urethra, (3) formation of the neomeatus at its normal position at the tip of the glans, and (4) circumcision or foreskin reconstruction, depending on the availability of tissues and parent's wishes. Seldomly also penile rotation must be corrected. These goals seem easy to achieve, but it is exactly the surgical failure which led to despair of both parents and surgeons and therefore description of many surgical techniques for correction of distal hypospadias and innumerable modifications of those during the past 150 years [4–10]. Boys with distal hypospadias often needed many surgical interventions instead of only one, and in many cases a worse situation had finally to be accepted than was the initial situation prior to the first surgery [5]. Because of this, not all patients with distal hypospadias were offered surgical correction in the past. However, the abnormally situated urethral meatus and the hooded appearance of the foreskin often cause psychological stress in boys at latest in their ado-

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Fig. 28.1 Coronal and subcoronal hypospadias examples with nice distal urethra. Notice in all three cases a good skin coverage of the distal urethra, leaving an impression of well-developed corpus spongiosum. Furthermore, in all these examples, no significant chordee is present, and they all had a successful hypospadias surgery by urethral advancement

lescence, leading to later requests for surgical correction [6, 7].

The main complications of hypospadias repair with the most common techniques of tubularization of the local tissues, like Thiersch-Duplay [8, 9] or Mathieu [10], are fistulas, stenoses, and/or repair disruption. The high incidence of such complications requiring further surgical interventions have been the basis for the idea of the urethral advancement technique described firstly by Beck in 1897 [11]. Shortly after the first description of this technique, other authors reported good results with its use in boys of various ages [12, 13]. Furthermore, excellent results with the use of the urethral advancement were repeatedly reported throughout the last century and even in the first decades of the twenty-first century, making this technique a valuable option in the armamentarium of surgical procedures published for the correction of distal hypospadias [14–28].

Since the first description of the urethral advancement by Beck [11], this technique has been postulated to be easy to perform and to deliver excellent results as a single-stage repair technique for boys with distal hypospadias. Even after the introduction of the tubularized incised plate urethroplasty [29], which due to its simplicity and excellent immediate results spread worldwide, a number of institutions where urethral advancement was a standard for repair of distal hypospadias continued to perform urethral advancement on a regular basis [15, 23–27]. The main advantages of urethral advancement were defined as no need for reconstruction of neourethra; minimal risks of stricture, fistula, and/or meatal stenosis; and often no need for postoperative catheter placement. Even though editorial comments on the excellent results in these reports praised the value of the urethral advancement technique, still they were consistently reluctant to support the general use of this technique for boys with distal hypospadias. The editors pointed out the high potential dangers of inadequate length gain after urethral mobilization due to dysplastic urethra, ventral shortening, curvature, and urethral injury and that this technique indeed requires meticulous and extensive dissection of the urethra for a relatively short distance to be bridged which is much easier done by other techniques applying local skin flaps [14, 17, 25–27]. In some cases such editorial skepticism was also based on editor's personal bad experience with the technique of urethral advancement [14, 17].

In one of the largest recent reports on the results of urethral advancement in 158 cases, the authors claimed this technique to be excellent for

both primary and redo cases, in children and adolescents, reporting an overall incidence of postoperative fistula of 0.6%, incidence of postoperative chordee of 0.6%, and incidence of meatal stenosis or retraction of 6% at 2-year follow-up [27]. Comparison with other publications on urethral advancement shows the incidence of postoperative chordee of 0–11%, incidence of meatal stenosis and/or retraction of 0–25%, and incidence of postoperative fistula of 0–2.1%, with the majority of papers reporting the "0" side of the range [14, 15, 17–27].

Haberlik et al. [15] modified Beck's technique by using a zick-zack opening of the ventral penile skin, reducing the possibility of postoperative longitudinal scar formation with excellent long-term cosmetic results. In addition, no tunneling of the glans tissue was performed but formation of two widely mobilized glanular wings with adequate excision of glanular tissue in between the wings to accommodate for mobilized urethra.

28.2 Operative Technique

- At the beginning of the operation, a glans suture is placed for retraction, and an urinary catheter is put into the bladder. Alternatively, a metallic urethral bougie can be placed to facilitate urethral mobilization. A zick-zack or alternatively longitudinal submeatal midline incision of the ventral penile skin up to the penoscrotal junction is performed. A subcutaneous injection of a 1:200,000 epinephrine solution can be used to facilitate local vasoconstriction and therefore reduce bleeding during the dissection (Fig. 28.2).
- A transverse subglanular and oval submeatal incision is made, the dartos fascia is mobilized together with the ventral skin on both sides of the midline, and the superficial chordee is removed so that the urethra is freely mobilized to the penoscrotal junction. The meatus is then incised with the scissors in the oval longitudinal way, lifting the glanular urethral plate tissue between 11 and 1 o'clock together with the meatus. A traction suture is applied to the meatus. The urethra with the surrounding corpus spongiosum is then mobilized from the corpora cavernosum. It is extremely important to enter immediately the correct plane for urethral dissection, because that plane is avascular and allows easy and safe urethral mobilization. In some cases it is easier to enter the right plane by mobilizing the urethra from its sides as shown by Waterhouse and Glassberg [17]. This makes the mobilization of the proximal urethra to the bulbar part easier (Fig. 28.3).
- Once the urethra is fully mobilized, the erection test can be performed and any deep chordee may be easily removed from the ventral side of the exposed corpora. Glanular wings

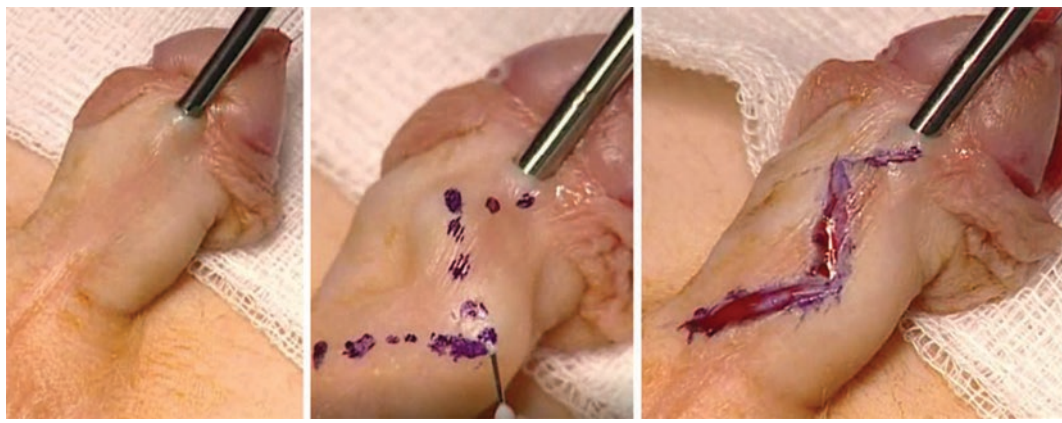

Fig. 28.2 A case of recurrent hypospadias with subcoronal fistula. A metallic urethral bougie is placed to facilitate urethral mobilization. A zick-zack submental incision of the ventral penile skin is performed after a subcutaneous injection of a 1:200,000 epinephrine solution

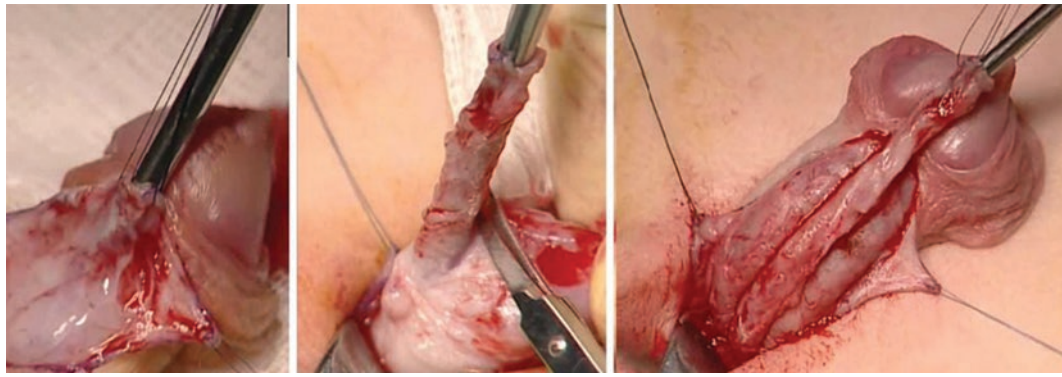

Fig. 28.3 The meatus is incised ovally, a traction suture is applied, and the urethra is then meticulously sharply mobilized from the corpora in the correct avascular plane

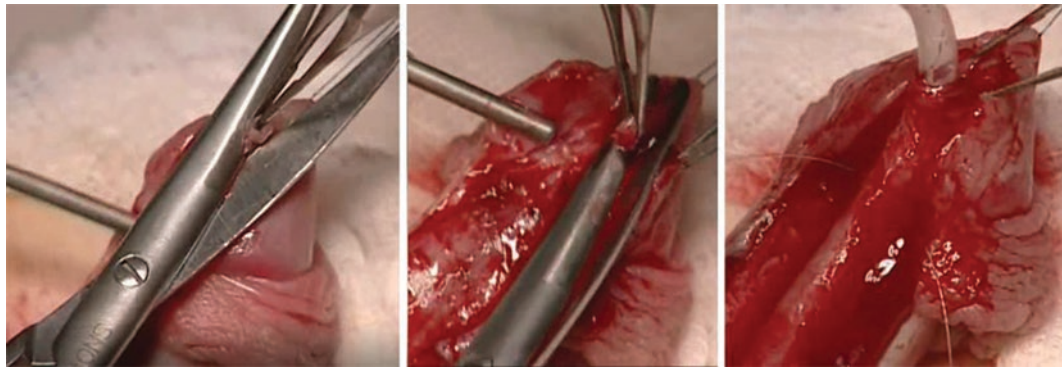

Fig. 28.4 The glanular wings are widely dissected; a part of the glanular tissue at the tip of the glans is excised to accommodate the neomeatus. A strip of glanular tissue is removed longitudinally from the midline of the glans and from both sides of the glanular wings to make space for the mobilized urethra. The neomeatus is sutured to the tip of the glans

are now widely dissected, eliminating any glanular tilt. A strip of glanular tissue is removed longitudinally from the midline of the glans to make space for the urethra and allow tensionless closure of glanular wings over the urethra. After oblique excision of the most distal part of the mobilized urethra, the dorsal part of the urethra is sutured with three interrupted stitches 6-0 to the tip of the glans at 11, 12, and 1 o'clock (Fig. 28.4).

- The glanular wings are wrapped around the new urethra and sutured together with three interrupted or back-and-forth stitches using 6–0 sutures. In the most distal glanular suture, spongiosal urethral tissue is incorporated at 6 o'clock without entering the urethra. The neomeatus is completed with two more sutures 6-0, attaching the urethra to the glans at 4 and 8 o'clock, paying attention that the sutures are on the inner aspects of the glans. In this way the meatus takes a vertical shape in the glanular groove. Next, 3-4 supportive stitches 7-0 can be placed between the spongiosal urethral tissue and the tunica albuginea in the midline to fix the urethra to the corpora. The dartos fascia is reconstructed from proximally to distally covering the urethra. The ventral penile skin is reconstructed tensionless, mobilizing the skin laterally if needed so that there is enough penile skin on the ventral side of the straight penis (Fig. 28.5).
- After completion of the operation, the penis looks almost normal with the meatus at the tip of the glans and the preputial skin surrounding

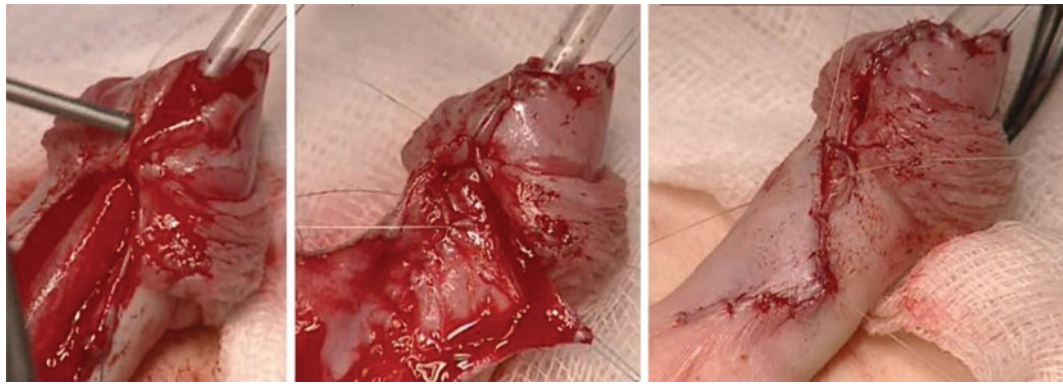

Fig. 28.5 The glanular wings are closed over the urethra, the tunica dartos is reconstructed, and the ventral penile skin is closed

the glans only dorsally. At this stage a circumcision can be performed, which makes this procedure a potential single-step repair. If parents wish a foreskin reconstruction, and the tissues left allow for it, we suggest doing it in a due time in the frame of any other potential surgery or as a two-stage procedure. We hesitate to cover the fresh glanuloplasty with the foreskin. The indwelling catheter can be removed immediately postoperatively or left in place for up to 5 days depending on the preference of the surgeon.

28.3 Discussion

One of the characteristics of this technique is the lack of need for complete degloving of the penis. One will notice that solely surgical steps on the ventral penile side are described. A complete degloving of the penis is of course possible at any time also during this procedure. However, there is no need to have a completely degloved penis to be able to perform a successful erection test, if that would be the only reason for complete penile degloving.

Careful selection of cases for this technique is needed. The urethra can be elongated to bridge a gap of up to 1.5 cm but only in well-developed penis (Fig. 28.1). In some cases the corpus spongiosum is divided in the distal part (Fig. 28.6).

Also, in such cases, the urethra can be nicely completely mobilized and the corpus spongiosum sutured in the midline. In patients with subcoronal hypospadias but with a very thin distal urethra with lack of corpus spongiosum over more than 1 cm, usually presenting clinically with a very thin ventral skin over the distal urethra, it is better to use another technique for hypospadias repair because one can be con-

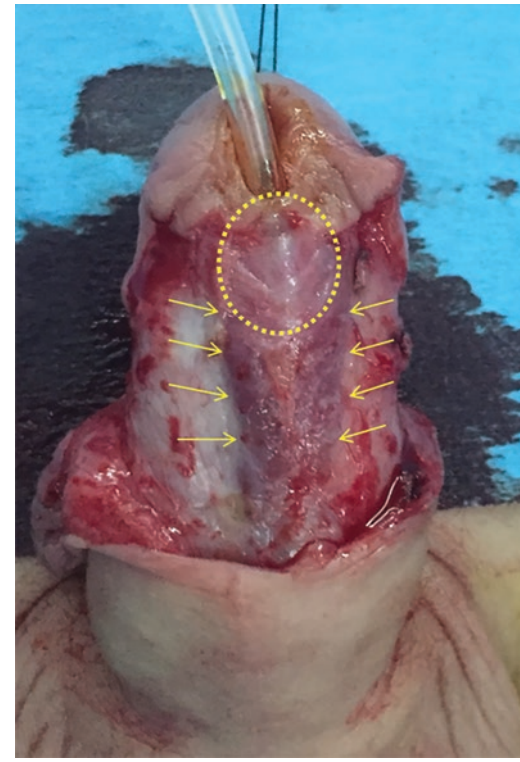

Fig. 28.6 Division of the corpus spongiosum (arrows) over the most distal part of the urethra (circle) in a patient with coronal hypospadias

fronted with insufficient length gain for intended repair due to hypoplastic urethra. Although, also in such cases, a single-step repair is possible by combining urethral mobilization with another technique, for example, the preputial skin tubularization, as described by Duckett [1]. Alternative option would be creating a distal hypospadias situation which has to be corrected at the second stage by one of the known flap techniques, such as Mathieu [10, 26]. In addition, other alternatives for such situations have been described [30, 31].

The technique of urethral advancement can be applied as a primary repair technique or after a failure of any other technique applied for correction of distal hypospadias. On the other side, also potential failure of urethral advancement can be repaired by other techniques for correction of distal hypospadias, which allows hypospadiologists to primarily use the techniques they find that work best in their hands.

Nowadays, the majority of hypospadias surgeons will prefer to use techniques which are simple to teach, simple to learn, and offer immediate good results without a need for extensive urethral mobilization [32]. Only long-term evaluation of boys after hypospadias reconstruction can show the success of one technique. The natural selection of the best techniques for our children should win [33–35]. It is amazing to see that despite of huge improvements in the microsurgical instruments, magnification, and development of fine absorbable suturing material, all allowing much finer tissue handling and much less possibility for failure, the technique of urethral advancement despite the fact that it has been described more than 120 years ago still stands strong.

28.4 Editorial Comment by Dr. Patrick McKenna

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I appreciate the opportunity to comment on the urethral mobilization technique.

As pointed out in the chapter, rarely are there new procedures in reconstructive surgery. Urethral mobilization even predates the early article cited.

The urethra is a unique organ, actually made up of two structures, the urethra and the spongiosum. The characteristics that make it unique are its mucosal lining, elasticity, and blood supply. The mucosal lining is most important because it holds up to urine exposure for a lifetime, but its elasticity and ability to be mobilized while keeping vascular integrity make it ideal for hypospadias surgery. No other structure in the body has similar characteristics (Fig. 28.7).

Few would argue against the urethra being the best material for urethral reconstruction, because it is what was designed to be a urethra, and results in a suture-free repair. The concept of mobilization was utilized during my residency for correcting urethral stricture disease by excision of the stricture and urethral mobilization, both proximal and distal, followed by tension-free primary end-to-end anastomosis. Over the last two decades, it has become part of almost all hypospadias and

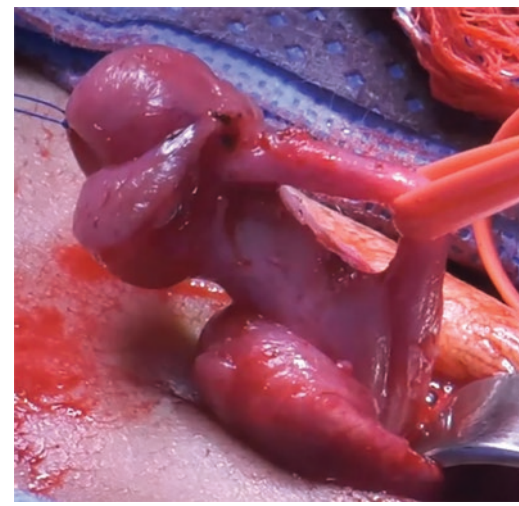

Fig. 28.7 The urethra is unique and elastic, and the corpus spongiosum is part of the urethra and should be mobilized with it (courtesy of Dr. McKenna)

chordee without hypospadias repairs that are done. It is especially advantageous in correcting stenosis from TIP procedures that represent the most common redo procedure in our practice.

There are as many ways to do a procedure as there are surgeons, and *our technique differs significantly from the technique presented*:

In most cases, the penis is degloved. Exceptions would be with very distal hypospadias with no chordee and some redo procedures with stricture and no chordee.

One of the key cosmetic refinements is the development of a 1.5–2-cm preputial collar around the glands. The initial markings should include *two triangular flaps* that will become the frenula repair and complete the collar ventrally. The preputial dissection is always started on the dorsum where the *avascular* plane is identified easily and carried around ventrally, so clean cuts can be made ventrally and the urethra avoided.

If an *atretic urethra* (a urethra above where the spongiosum splays and is "saran wrap" thin) is present, it is excised because it does not have the elastic characteristics of the normal urethra. It is critical to understand that the *spongiosum is part of a normal urethra*. This must be kept intact to maintain the blood supply and elastic characteristics (Fig. 28.8).

The mobilization *should start from the bottom up*, starting below where the spongiosum splays where there is normal spongiosum (Fig. 28.9).

It is important to keep the spongiosum intact circumferentially. The atretic urethra is atretic both ventrally and dorsally, so it is easy to get into with mobilization. The entire atretic area should be excised.

The chordee is corrected by various combinations of ventral dissection, corporal body separation, fairy cuts, and if required a dermal graft (Fig. 28.10). Dorsal plication is seldom utilized. There have been cases where deficits of 5–6 cm have been made up with this approach. It can be extended even farther by keeping a vascularized flap in the midline of the glans and advance this into the mobilized urethra. This is a composite repair and can result in up to two additional centimeters in length.

Once the mobilization has sufficient length, it is important to *make a space for the new urethra*

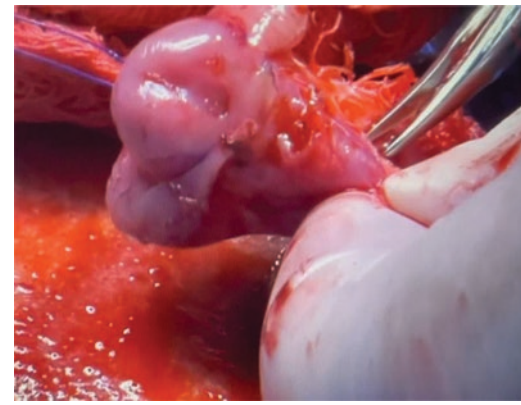

Fig. 28.9 Dissection should start proximally where the corpus spongiosum is healthy and vascularized to find the proper plane (courtesy of Dr. McKenna)

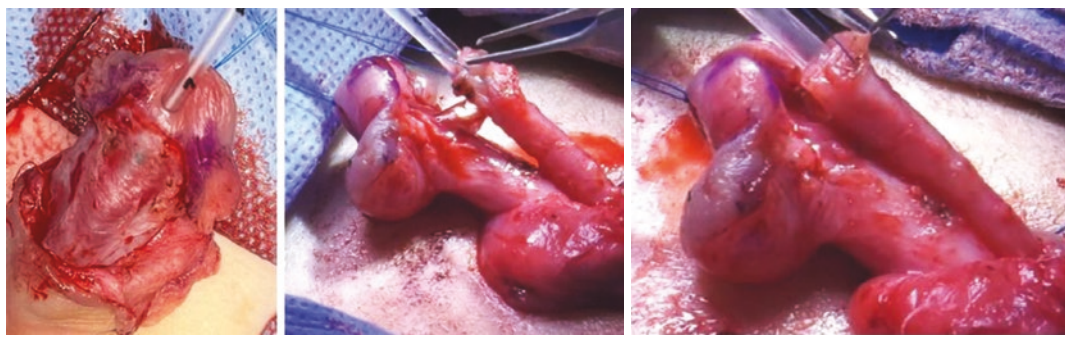

Fig. 28.8 The distal atretic part of the urethra must be excised because it is nonelastic and not well-vascularized (courtesy of Dr. McKenna)

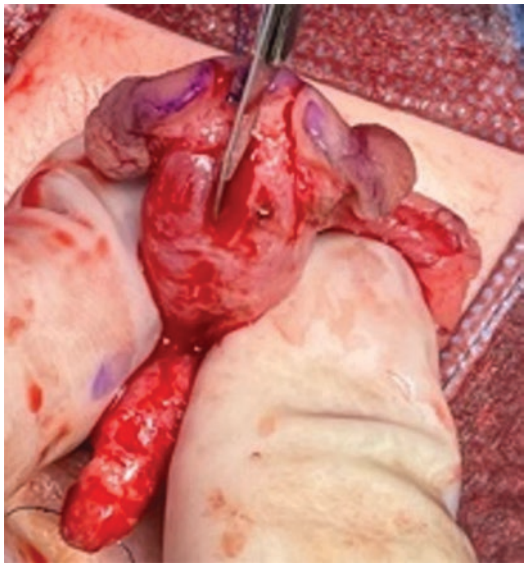

Fig. 28.10 The chordee is corrected by various methods including corporeal body separation (courtesy of Dr. McKenna)

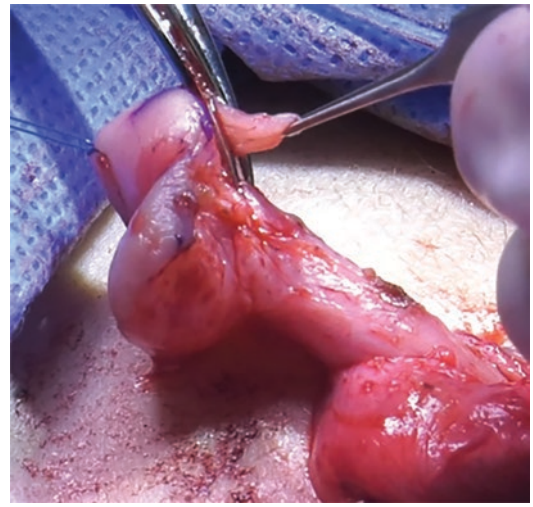

Fig. 28.11 A part of the glans core must be excised to create a space for the new urethra (courtesy of Dr. McKenna)

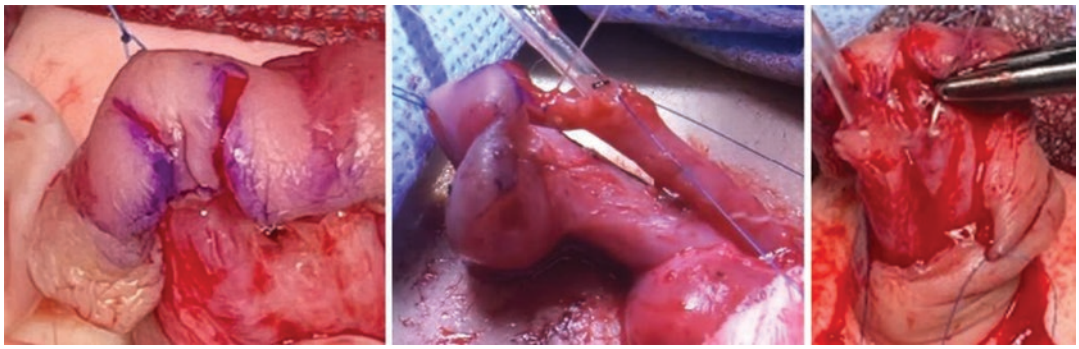

Fig. 28.12 The tip of the healthy urethra is spatulated and sutured to the glanular V flap. The proximal urethra is fixed to the body of the corporeal body to avoid tension (courtesy of Dr. McKenna)

(Fig. 28.11). This includes removing some central glans erectile tissue and skin where the urethra will be reconstructed. Wide glandular flaps with a hockey-stick incision are essential. The corporal bodies are incised and separated in the midline all the way to the tip to affect a greater upward bend and provide more space for the new urethra.

The distal urethra is attached to the glans. Another crucial step is to *advance the urethra more proximately and fix it to the corporal bodies taking all tension* off the tip (Fig. 28.12).

The glans is closed by placing a subcuticular stitch of a long-lasting absorbable suture over a hemostat. The hemostat confirms sufficient space in the glans with no pressure on the urethra and prevents glans separation. The pre-planned frenular flaps are reconstructed to provide the ventral portion of the glans collar. Dorsal skin is rotated ventrally, adding additional length to the ventral skin and closed in the midline. A drippy tube is used because it minimizes any voiding issues after surgery. In all cases a tourniquet is avoided.

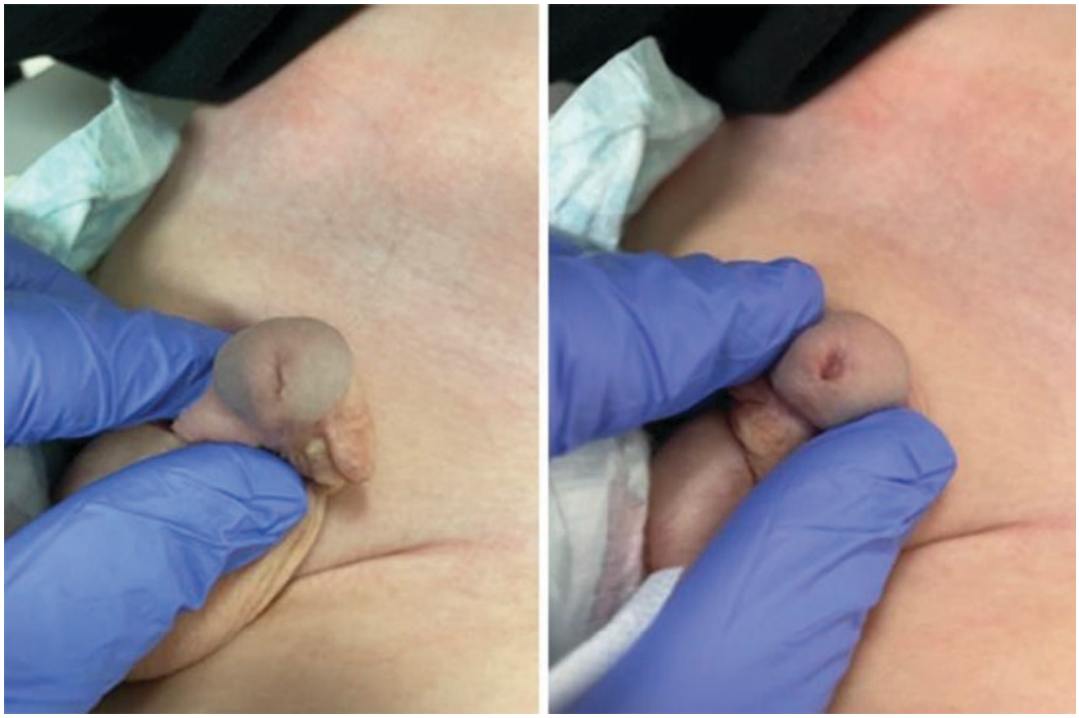

Fig. 28.13 Final appearance after healing. Observe the slit-like and wide meatus (courtesy of Dr. McKenna)

After two decades of utilizing this option, the complications associated with distal repairs have dropped close to zero (Fig. 28.13).

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