



Management of Chordee Without Hypospadias

15

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15.1 Introduction

The literal interpretation word “chordee” is curvature, and the chordee without hypospadias (CWH) is applied “when the urethral meatus is at the glans penis tip, a ventral penile curvature coexists, and the prepuce is well-formed” [1]. Congenitally, the abnormalities are of the skin, fascial coverings of the penis, corpus spongiosum, or combined. Synonyms for the chordee without hypospadias are the congenital short urethra, congenital penile curvature, Hypospadiasm without hypospadias, and corporeal disproportion [1, 2]. The most commonly used among these terms is congenital penile curvature. But Devine and Horton preferred the term chordee without hypospadias as the most suitable and accurate for the anomaly

description [3]. The earliest depiction of penile curvature dates back to Galen (130–199 AD) [4]. Siever first reported the entity in 1962 and described the cause of penile curvature because of “the skin tethering implicating subcutaneous tissue” [5], since then, various classifications have been advocated for it. This is a comparatively rare condition, and its incidence varies from 4% to 10% of cases of hypospadias. “Chordee without hypospadias” has recently been grouped in two, and the term used for it helps to clarify these groups. The first group is “hypospadias variants” (type I, II, or III), and in the second group, the urethra is normal but has a chordee, and the term is used “congenital ventral penile curvature.” They present late in adolescence and adulthood with penile curvature during erection.”

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15.2 Embryology

Embryologically, the condition is missed hypospadias, where the curvature persists without displacement of the urethral meatus. The exact etiology of congenital curvature is not well described to date. However, various anatomical changes related to chordee with and without hypospadias are well accepted. Penile development starts at 9 weeks of gestational age. The genital tubercle undergoes enlargement to form the penis. The glans become distinguishable by the appearance of coronary sulcus with the growth of the phallus. The prepuce is created by

reduplication of the ectoderm covering the distal part of the phallus. The formation of the urethra starts as an epithelial groove in the middle of the ventral surface of the developing penis. As the genital tubercle enlarges, two sets of tissue folds develop on its ventral surface, on either side of a developing trough, the urethral groove having two folds. The fusion of the more medial endodermal urethral folds in the ventral midline forms the male urethra. The lateral ectodermal urethral folds merge over the developing urethra and form the penile shaft skin & the prepuce. The fusion of the urethral tube and formation of the urethra eventually reaches the tip of the glans penis during normal development. Proliferating mesenchyme surrounds the urethral tube, separates it from the skin, and differentiates to form the corpus spongiosum, Buck fascia, and Dartos fascia. These two layers fuse from posterior to anterior, and they leave behind a skin line forming the median raphe. In chordee without hypospadias, there is a fusion of both endodermal and ectodermal urethral folds. There is some problem with the proliferation of mesenchymal tissue between the endodermal and ectodermal folds leading to major hypoplasia of tissues forming the ventral surface. The molecular mechanisms that regulates this mesenchymal differentiation likely depending on epithelial-mesenchymal interaction. The development of the mesenchymal tissue in the penis may be deficient or abnormal and result in dysgenetic and in-elastic fascial layers. As fusion is posterior to anterior, any anomaly with fusion may lead to disproportional development of dorsal and ventral surfaces, which may be responsible for chordee without hypospadias.

A recent theory in the development shows that ventral chordee is a normal stage of embryogenesis, & the arrest in penile development represents the chordee without hypospadias. Human demonstrated in their fetal studies a ventral curvature is a normal state of penile development at the 16th week of gestation and resolves during the 20–25th week [6]. Currently, three main theories of penile curvature are (1) Abnormal development of urethral plate; (2) Abnormal fibrotic mesenchymal tissue at the urethral meatus; (3)

Differential growth of dorsal and ventral corporal tissue. The genital tubercle becomes cylindrical and is now called the phallus. The spongiosum division is the key criteria to define the severity of this congenital penile anomaly. The urethral defect in this anomaly is missing. The causes of ventral chordee, i.e., tethering the hypoplastic glans to the underlying hypoplastic urethra, tethering the hypoplastic urethra onto the underlying corpora cavernosa & a split corpus spongiosum. The cause of the curvature may reside in the skin, facial covering, short spongiosum segment or short corpora or because of a combination of the factors.

15.2.1 Incidence

The incidence of hypospadias in the general population is approximately 1 in 300 [7], and one-fourth of them will have chordee. The true incidence of chordee without hypospadias varies from 4% to 10% [8]. We found an incidence of 7.69% and among these type I 32%, type II 44% and 24 % had type III cases [1] while Tang et al. reported type I 35.4%, type II 27.8%, type III 12.7%, and type IV 24.1% in a study of 79 children [9]. Donnahoo et al. reported etiology in 87 patients of isolated chordee and found the skin tethering (32%), fibrotic fascia (33%), dorsoventral corporal disproportion (28%), and a congenitally short urethra (7%) [10].

15.2.2 Associated Anomaly

Common anomalies associated with hypospadias are undescended testis, inguinal hernia, webbed penis, penoscrotal transposition, hydrocele and penile torsion. Rarely the upper tract anomalies and urethral diverticula are found.

15.3 Classification

Chordee without hypospadias is classified according to etiological factors and the degree of curvature.

15.3.1 Congenital

Devine and Horton, and Kramer [3, 11] (Fig. 15.1) classified into:

1. Type I: Corpus spongiosum, Buck's and Dartos fascia distal to the division of spongiosum are Deficient
2. Type II: The Bucks and Dartos fascia are deficient, and the urethra is surrounded by normal corpus spongiosum.
3. Type III: Deficient Dartos fascia, and the corpus spongiosum and Buck's fascia are normal
4. Type IV: Discrepancy in development of the dorsal and ventral aspects of corpora cavernosa
5. Type V: Congenital short urethra

The mentioned classification was widely adopted until 1998, But Donnahoo et al. [10] grouped the 87 patients with penile curvature without hypospadias according to the structural defect and surgical steps. The step-wise treatment algorithm defines the cause of isolated chordee in chordee without hypospadias and thus minimizes the need for urethral replacement.

15.3.2 Modified Donnahoo Classification

Group 1 (Type II & III) When chordee is corrected by simple penile skin degloving, the patient is considered to have "skin chordee." The cause is abnormal dartos fascia tethering of the skin and Buck's fascia. This corresponds to type II and Type III of the Devine Horton classification.

Group 2 (Type I) When penile curvature persists, any dysgenetic chordee tissue is excised, and the whole urethra is mobilized if necessary. Patients in whom chordee is corrected at this step are considered to have fibrotic Bucks and dartos fasciae as the etiology of chordee. This is the same as that of Type I, according to the Devine and Horton classification.

Group 3 (Type IV) Patients with residual chordee after the steps mentioned above and no evidence of urethral tethering are treated with a procedure to correct corporeal disproportion with either dorsal placcation or ventral corporotomy with grafting.

Group 4 (Type V) Patients having a truly tethered urethra after complete urethral mobilization; they need urethral division and a tubularized preputial interposition graft, which is called a congenital short urethra.

Group 5 (Type V) Urethra is normally developed but short and is called the congenital short urethra. Surgical correction requires division of the urethra to correct the chordee and reconstruct the urethra.

Group 6 (Type I, IV, V) When multiple factors like hypoplastic urethra and coverings of penile shaft with or without dorso-ventral corporal disproportion coexist and requires division/resection of the hypoplastic urethra. Resection of chordee tissue with ventral corporoplasty or dorsal plication.

15.3.3 Acquired

The original word chordee originated from ventral bending of the penis because of urethral stricture following gonococcal urethritis. The causes of secondary chordee are fibrosis after trauma, stricture, and degenerative causes like Peyronie's disease.

Degree Chordee is classified as:

1. Mild up to 30 degrees
2. Moderate 30–60 degrees
3. Severe more than 60 degrees

15.4 Assessment of Curvature

External genitalia of the child is examined during the erection of the penis, and adults should be asked to have a photograph during erections.

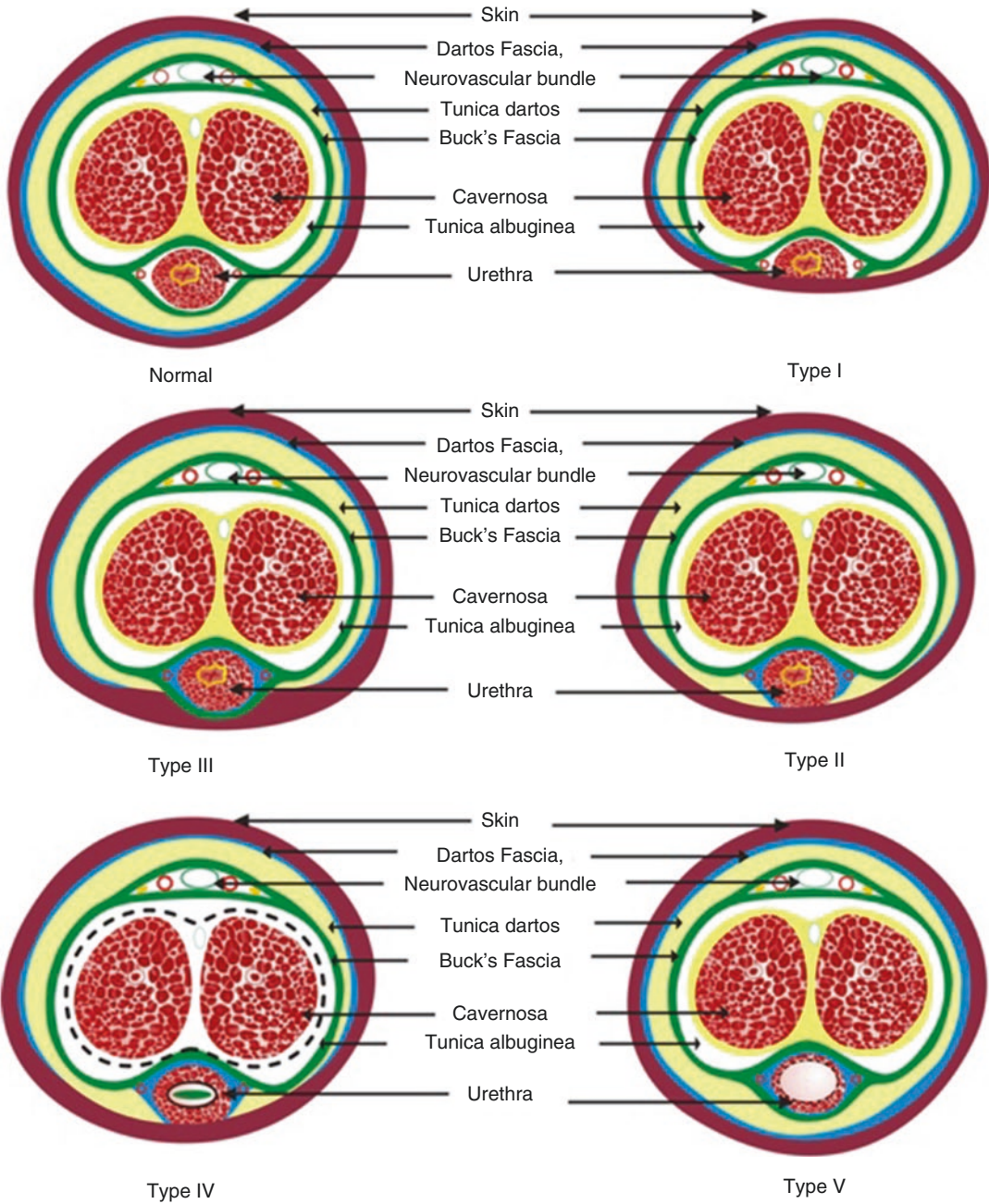


Fig. 15.1 Classification of chordee without hypospadias

The degree of curvature is assessed and recorded. During surgery, the erection test is performed either by artificial erection or pharmacological erection. Maclaghlin and Gittes first described the artificial erection test in 1974

and is now universally accepted for artificial erection during surgery [12]. The test is performed by injection saline into corpora by piercing the needle into one of the corporal bodies or through glans (Fig. 15.2).



Fig. 15.2 Showing the Gittes test with moderate chordee

Injection through glans avoids hematoma in the penile shaft. The test is done at the beginning of surgery and the final correction of curvature. Pharmacological erection is done by injecting the arterial vasodilator prostaglandin E1 intracavernously during hypospadias surgery. The erection is more physiological, allows an accurate and continued assessment of chordee before, during, and after chordee correction.

15.5 Clinical Presentation

Healthy young men of chordee without hypospadias usually present between the ages of 18 and 30 years. Many of these patients have had noticed chordee before puberty but have presumed it to be normal. However, in adolescence, when they become sexually aware and active, discover that the curvature impedes their efforts, they observe an abnormal curvature. Patients with true congenital curvature usually have a long phallus, and curvature correction is recommended in the case

of functional impairment. The parents bring children with severe curvature to the hospital. Examination of these patients is very important, and erection may be created in children by gently stimulating the penis. The parents may be asked for pictures during erection at the next visit. Careful examination of prepuce dorsally and bifurcation/deviation of median raphe may give a hint about the severity of chordee without hypospadias (Fig. 15.3a–f). Retraction of the prepuce provides a clue about the shortening of the skin and covering of the penile shaft.

15.6 Controversy

There is no consensus and agreement on both the etiology or surgical management of this congenital. Young opined this anomaly due to congenital short urethra and advised to be managed by transection of the hypoplastic urethra and replacement urethroplasty [13]. In contrast to it, Devine and Horton in 1973 thought it to be due to abnormal development of fascial layers of the penis. The majority of these could be treated with resection of fibrous tissue for chordee correction; the transaction of the urethra is rarely required [3]. Nesbit expressed a dilemma in these cases “whether to lengthen the short ventral surface or shorten the longer dorsal one,” and he opted for the shortening one and described the excisional plicating procedures [14]. Hurwitz et al. [15] thought that the paper-thin urethra of type I with an abnormal meatus requires excision of the entire dysplastic urethra, and replacement urethroplasty. If the meatus is normal, clinical judgments dictate the type of urethra that may be preserved or reconstructed [9]. In the lack of uniformity on management guidelines of chordee management, controversy continues whether to shorten the dorsal surface or lengthen the ventral surface and transect/resect or preserve the hypoplastic urethra. The management dispute is almost resolved in the management of chordee without hypospadias by the step-by-step management approach.

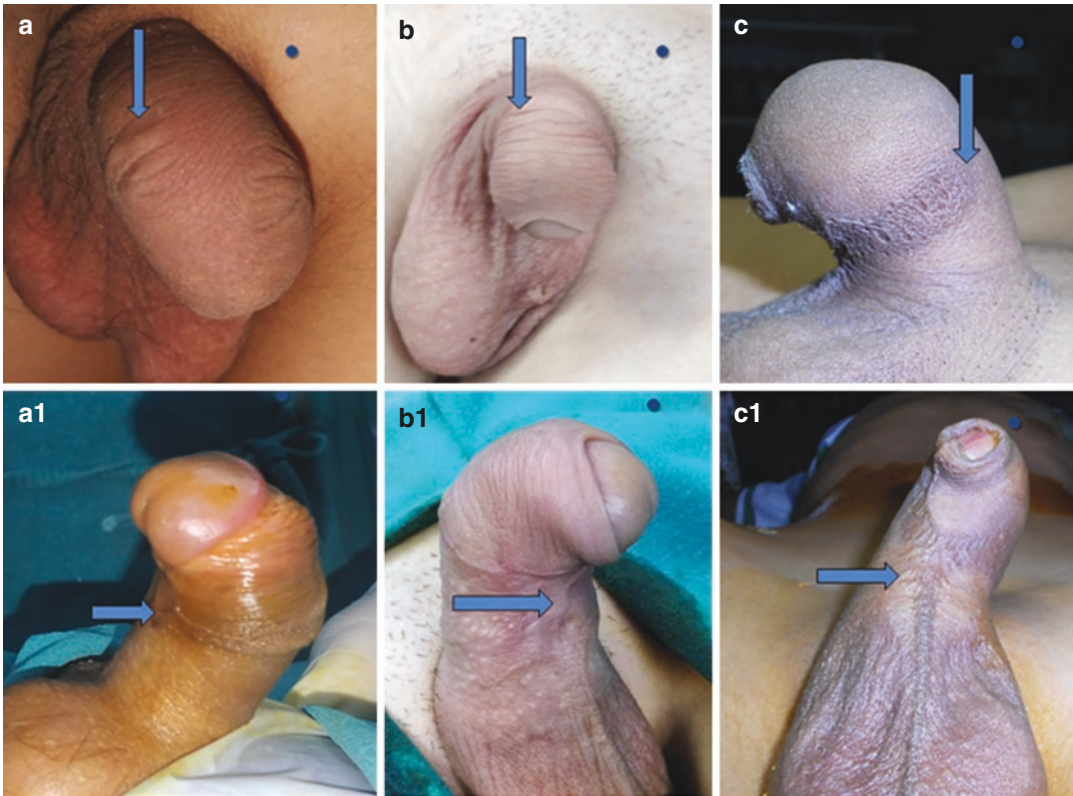


Fig. 15.3 Showing the site of embryological event. (a, b, c) Dorsal surface showing Bull's eye, (a1, b1, c1) Ventral surface showing bifurcation of the median raphe

15.7 Management

15.7.1 Goals

Surgical management of the anomaly aims to provide a straight penis without migration of urethral meatus proximally. The cause of the underlying defect is ascertained accurately. Accordingly, an appropriate and specific surgical procedure is planned to achieve the goal. Since the main aim in chordee without hypospadias repair is to correct the curvature, the causes of curvature are to be identified in the individual case. Various causes of penile curvature are skin tethering, short-covering of the penile shaft, hypoplastic spread out corpus spongiosum, bowstring effect of the hypoplastic urethra, and corporal disproportion. The step-by-

step approach by Bhat et al. resolves the question: whether to go for dorsal shortening or ventral lengthening and preserve the hypoplastic urethra or resecting it [1].

15.7.2 Indications and Age of Surgery

More than 20 degrees curvature is considered significant by most pediatric urologists and is an indication of surgery. A dorsal approach of dorsal plication is preferred in cases of less than 30-degree curvature, while the ventral approach of penile lengthening manages cases of chordee more than 30-degrees. The penile development process begins in fetal life and continues until the

end of puberty. Cendron and Melin proposed the surgery is to be done after puberty [16]. They believed that the curvature would improve spontaneously with age, and early surgery might disturb the growth of the penis by altering the tunica of corpora cavernosa. But others advocate that if diagnosed in childhood, correction should be at the time of the first diagnosis. In Type III chordee without hypospadias with mild to moderate chordee, it is logical to wait but type II and type I should be operated in the same age group as hypospadias or whenever the child presents to the hospital [1].

15.7.3 Methods of Chordee Correction

The methods for chordee correction are:

1. Penile degloving
2. Dorsal Shortening Procedure
 - (a) Nesbit' technique
 - (b) Tunica Albuginea Plication (TAP)
 - (c) Dorsal Midline tunica Plication
 - (d) Multiple Parallel Suture tunica Plication (MPP)
 - (e) Essed Schroeder Technique
3. Ventral Lengthening Procedures
 - (a) Corporeal Rotation
 - (b) Division of Hypoplastic Urethra
 - (c) Extended Urethral mobilization
 - (d) Perovic partial Penile Disassembly
 - (e) Ventral Grafts
 - Tunica Vaginalis Free Graft
 - Dermal Graft
 - Small intestine mucosal graft

But most commonly used methods are penile degloving, dorsal tunica plication, transection and resection of the hypoplastic urethra and replacement urethroplasty. The application of the mentioned procedures is not according to the etiological factors. However, the step-by-step approach deals with the etiological factors, so it

is a preferred approach in managing this entity. The Steps of the approach are:

1. Penile de-gloving
2. Hypoplastic urethra with spongiosum mobilization up to the corona
3. Hypoplastic urethra with spongiosum mobilization into the glans
4. Proximal urethral mobilization
5. Midline dissection of corporal bodies
6. Lateral mobilization of Buck's fascia
7. Superficial ventral corporotomy(ies)
8. Corporal rotation/Dorsal plication
9. Transection and or Resection of Hypoplastic urethra
10. Penile disassembly/Corporoplasty.

15.8 Surgical Technique: Hypoplastic Urethra and Spongiosum and Proximal Urethral Mobilization [1]

1 in 100,000 solution of adrenaline is injected into the proposed site of the incision and stay suture. An infant feeding tube is passed, and a stay suture is taken in the glans. Assessment of chordee is done with the Gittes test (Fig. 15.4a, b). A circumferential circumcoronal incision is given, and penile skin degloving (at the level of Buck's fascia) is done up to the root of the penis. Then the Gittes' test is repeated to see the degree of correction achieved (Fig. 15.4c, d). Then, a plane of dissection is created just proximal to the hypoplastic urethra. The spongiosum is mobilized up to the corona (Fig. 15.4e), and the Gittes test confirms chordee correction (Fig. 15.4f). If chordee persists, the urethra is mobilized into the glans, and the penile erection test reassesses the chordee to confirm chordee correction (Fig. 15.4g, h). The urethra is further mobilized proximally up to the bulbar urethra in case of the persistence of chordee, and correction is assessed by Gittes test. A single stitch dorsal plication is

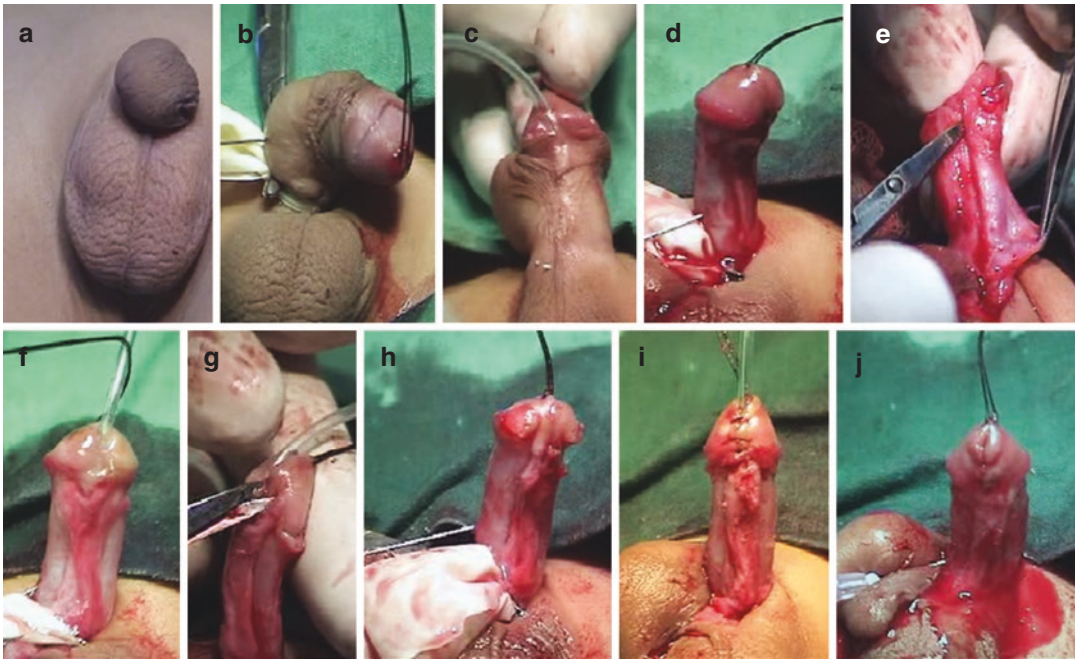


Fig. 15.4 Steps of chordee correction for type I without hypospadias with torsion. (a) Type III chordee without hypospadias with torsion. (b) Severe chordee on Gittes test without hypospadias. (c) Skin adherent to the hypoplastic urethra. (d) Moderate chordee on Gittes test after penile degloving. (e) Mobilization of urethra and corpus spongiosum. (f) Minimal glanular chordee after mobiliza-

tion of the urethra with corpus spongiosum on Gittes test. (g) Mobilization of the urethra into glans. (h) Complete correction of chordee after mobilization of the urethra into glans. (i) Glanuloplasty and spongioplasty. (j) Complete correction of chordee on Gittes test after glanuloplasty and spongioplasty (with permission Bhat et al. [1] © copyright Elsevier)

done if the chordee is less than 30 degrees and the ventral transverse superficial corporotomies/corporoplasty, when it is more than 30 degrees. With the complete correction of chordee, the meatus recedes down, so glanular wings are raised, the urethral plate is tubularized, and spongioplasty is done by suturing the mobilized corpus spongiosum over the hypoplastic urethra, starting from the normal urethra to the tip of glans. The Y-shaped corpus spongiosum is sutured in midline I shape, reconstructing a near-normal urethra. Glanuloplasty is done by approximating the glanular flaps with interrupted sutures. That brings the meatus to the tip, and the final Gittes test confirms chordee correction (Fig. 15.4i, j). Then skin closure is done by utilizing the prepu-

cial skin to cover the deficit of the short ventral skin. The prepuccioplasty is performed whenever feasible, and the pressure dressing is done. The per-urethral stent is put in and kept for 3–5 days.

The extent of the proximal urethral mobilization depends on the degree of curvature and the type of chordee without hypospadias. Mild to moderate chordee in type III chordee without hypospadias, can be corrected by penile degloving at the level of tunica albuginea up to the penoscrotal junction and mobilization of hypoplastic urethra only (Figs. 15.5a–h and 15.6a–f). Similarly, type II chordee without hypospadias with moderate curvature mobilization of urethral up to penoscrotal junction proximally and up to mid-glans distally may correct the curvature

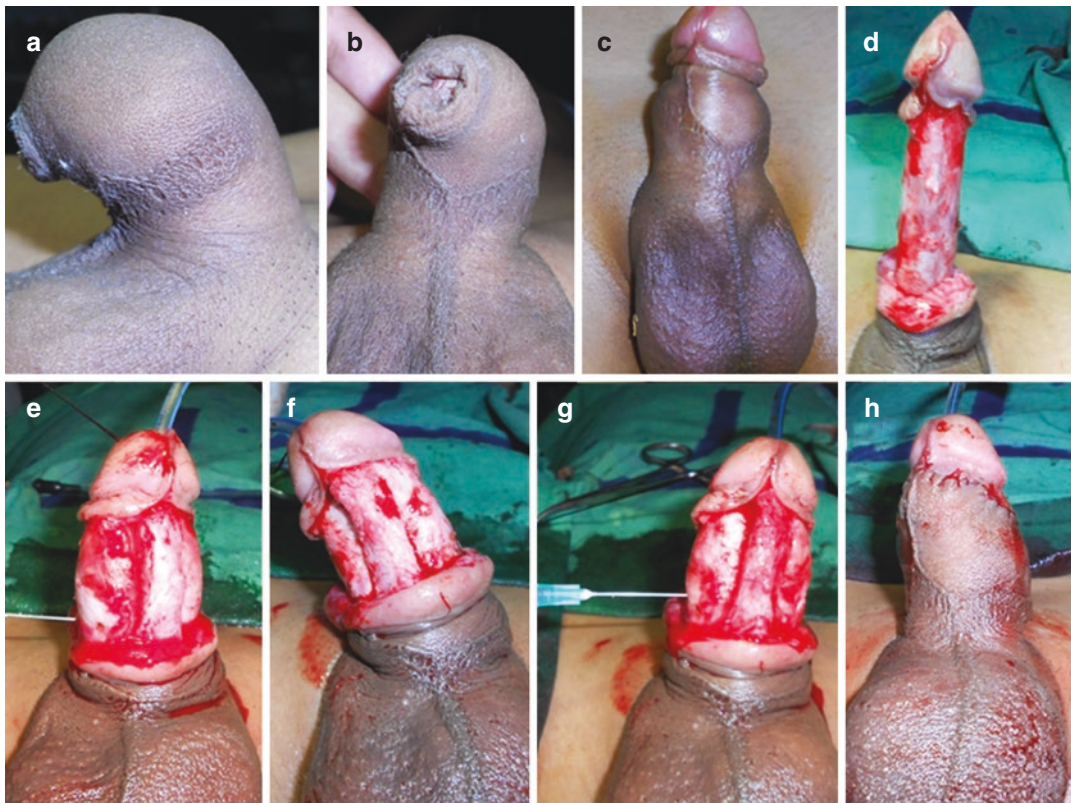


Fig. 15.5 Correction of moderate chordee in type III chordee without hypospadias. (a)–(c) Showing chordee without hypospadias (type III) with moderate curvature. (d) Gittes test showing mild curvature after penile skin

degloving. (e, f) Showing hypoplastic urethra with spongiosum mobilization. (g) Gittes test showing correction of curvature. (h) Skin closure

(Fig. 15.7a–i). But if curvature persists, then dorsal plication is needed. (Fig. 15.8a–p). Type IV and V chordee without hypospadias with congenital short urethra and/or dorso-ventral corporal disproportion may require the transection (Fig. 15.9) or resection of the hypoplastic urethra and replacement urethroplasty with or without corporoplasty. In most cases, after mobilization of the proximal urethra, the residual curvature is less than 30 degrees which can be managed by single stitch dorsal plication. Torsion associated with the chordee without hypospadias can also be managed with the technique of hypoplastic urethra and spongiosum mobilization (Fig. 15.1). Based on the etiological factors, an algorithm is

proposed for the management of chordee without hypospadias (Fig. 15.10).

15.9 Methods of Penile Curvature Correction in Chordee Without Hypospadias

15.9.1 Penile De-gloving

Skin tethering may be the only factor in chordee without hypospadias is called skin chordee and is type III of Devine and Horton classification. Penile degloving is a simple and easy technique that can be done even by the beginner and is

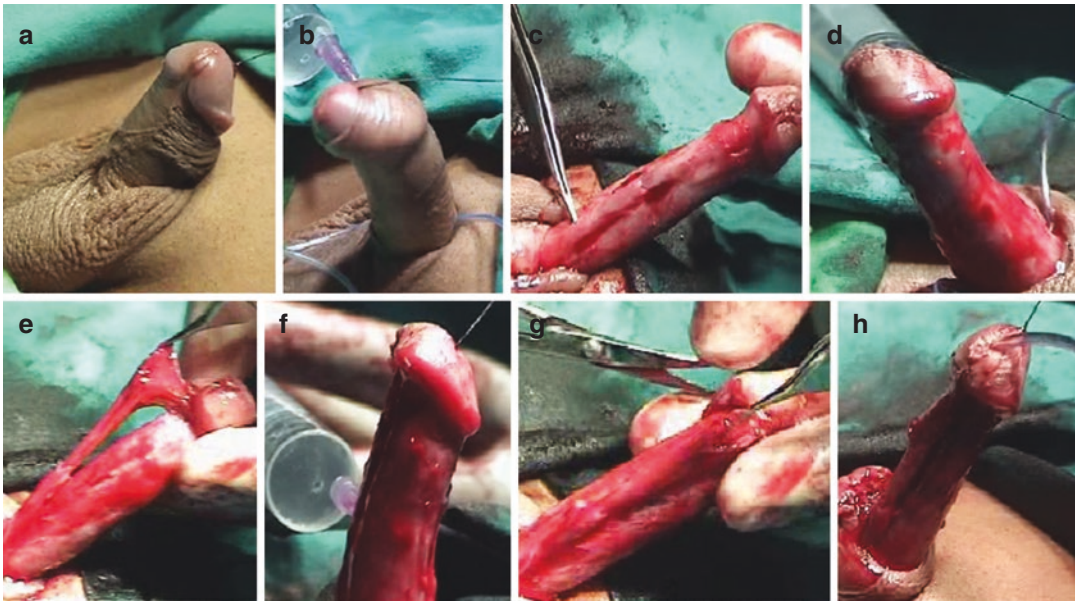


Fig. 15.6 Correction of chordee in type III chordee without hypospadias. (a) Showing chordee without hypospadias Type III with moderate curvature. (b) Gittes test showing Moderate curvature. (c) Penile skin degloving. (d) Mild glanular chordee on Gittes test. (e) Urethra and

corpus spongiosum mobilization from corporal bodies. (f) Gittes test showing complete chordee correction. (g) Raising of glanular flaps. (h) Glansplasty done with complete correction of chordee (with permission Bhat et al. [1] @copyright Elsevier)

effective in such cases. If ventral skin is short, then the ventral transfer of skin after penile degloving corrects the curvature. In patients with severe curvature requiring the transection of the hypoplastic urethra, ventral transposition of skin helps correct curvature and is utilized for urethroplasty in the second stage. The limitation of the technique is its effectivity only in mild curvature. This falls under type III of Devine Horton classification and group 2 Donnahoo.

15.9.2 Release of Dartos

Dartos is released during penile degloving in most cases if the dissection plane is kept between the dartos and Bucks fascia dorsally and ventrally between the dartos fascia, whatever coverings of the urethra. In some cases, the skin may be stuck to Buck's fascia with no intervening dartos, while skin is directly adherent to the skin in type I. The skin is very thin, and there are chances of injury and buttonholing during the dissection. Often

these thin areas of skin require excision. Saline injection at the site of adherent skin may help dissect the adherent urethra (Fig. 15.11a–f). Dissection and resection of the thickened, tethering, inelastic dartos bands are carried out until the penis is free. A more extensive ventral dissection is needed in some cases, especially along the urethra and corpora cavernosa. If the curvature is corrected by releasing the dartos, then these cases may be of type II and grouped in group 2.

15.9.3 Mobilization of Urethra & Spongiosum

Devine (1991) [17], Mollard (1994) [18], and more recently Bhat (2008) [1] advocate performing mobilization and preserving the hypoplastic urethra. Proximal urethral mobilization up to the bulbar region adds about 2–3.5 cm length to the spongiosal segment, which helps in chordee correction. Y-I spongioplasty after the divergent corpus spongiosum mobilization is done covering

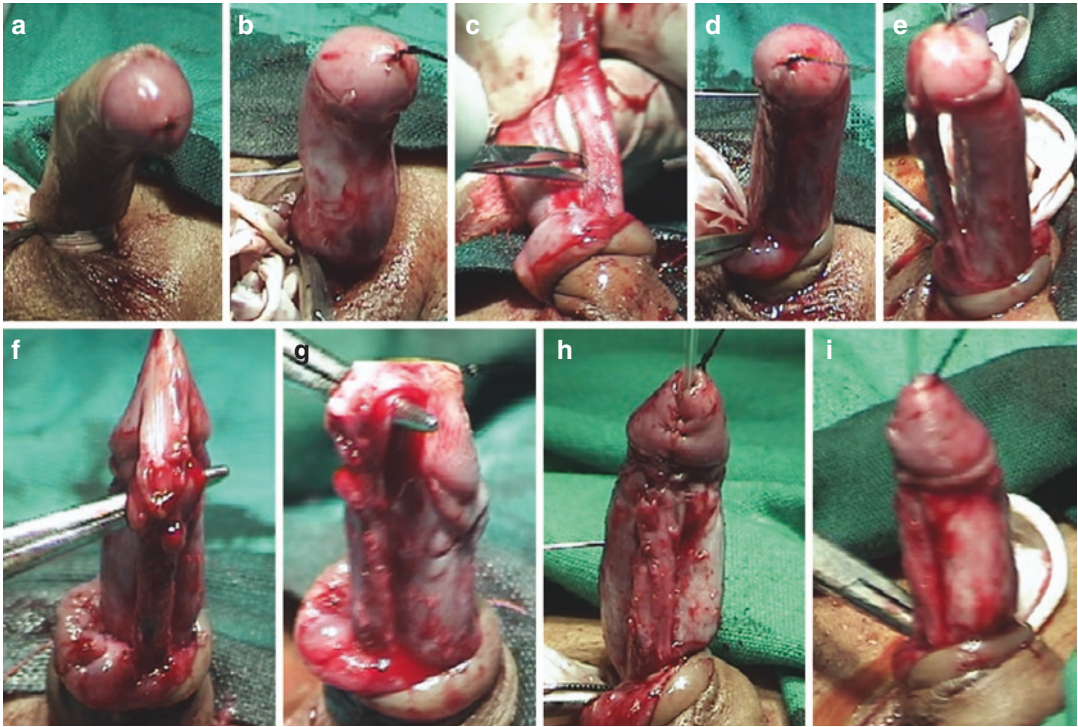


Fig. 15.7 Correction of chordee in type II hypospadias. Steps of chordee correction for Type II without hypospadias. (a) Moderate chordee on Gittes test. (b) Moderate chordee on Gittes after penile degloving. (c) Mobilization of urethra and corpus spongiosum. (d) Mild glanular chordee on Gittes test after mobilization of the urethra. (e) Mild glanular chordee on Gittes test after mobilization of

the urethra, lateral view. (f) Mobilization of the urethra into glans. (g) Corpus spongiosum segment longer than corpus cavernosum. (h) Complete correction of chordee on Gittes test after spongioplasty. (i) Complete correction of chordee on Gittes test after spongioplasty, lateral view (with permission Bhat et al. [1] @copyright Elsevier)

the hypoplastic urethra reconstruct a nearer to “normal” urethra. The main aim of spongioplasty is to obtain an anatomical reconstruction as well as prevention of fistulas formation and also helps in the correction of curvature. The extent of urethral mobilization is done to the penoscrotal junction or up to the bulbar region according to the length needed for chordee correction keeping the ratio of 4:1. However, Atala et al. recommended a 5:1 ratio to prevent blood supply compromise to the urethra in hypospadias [19]. But it is possible to mobilize a little more proximally since mobilization is with corpus spongiosum and the distal end of the urethra remains attached to the glans keeping both blood supplies intact in chordee without hypospadias. The penis can be straightened without transecting the hypoplastic urethra by applying the steps mentioned above.

Urethral mobilization can easily be carried out by dissecting directly on top of the tunica albuginea. The mobilization is started in the healthy urethra proximal to the hypoplastic urethra after creating a plane between Buck’s fascia and tunica albuginea. Mobilization of the urethra is difficult in type I as it is adherent to both corpora and the skin. There is a risk of urethral fistula in these cases because of injury to the hypoplastic urethra during dissection. Creating a plane of dissection around the normal urethra proximally and then dissecting distally helps in mobilizing the urethra along with corpus spongiosum, with less risk of bleeding and injury to the urethra. Injecting saline or adrenaline solution helps in the dissection of the skin from the hypoplastic urethra. Then extended distally into glans and proximally as required. Gross et al. [20] reported their

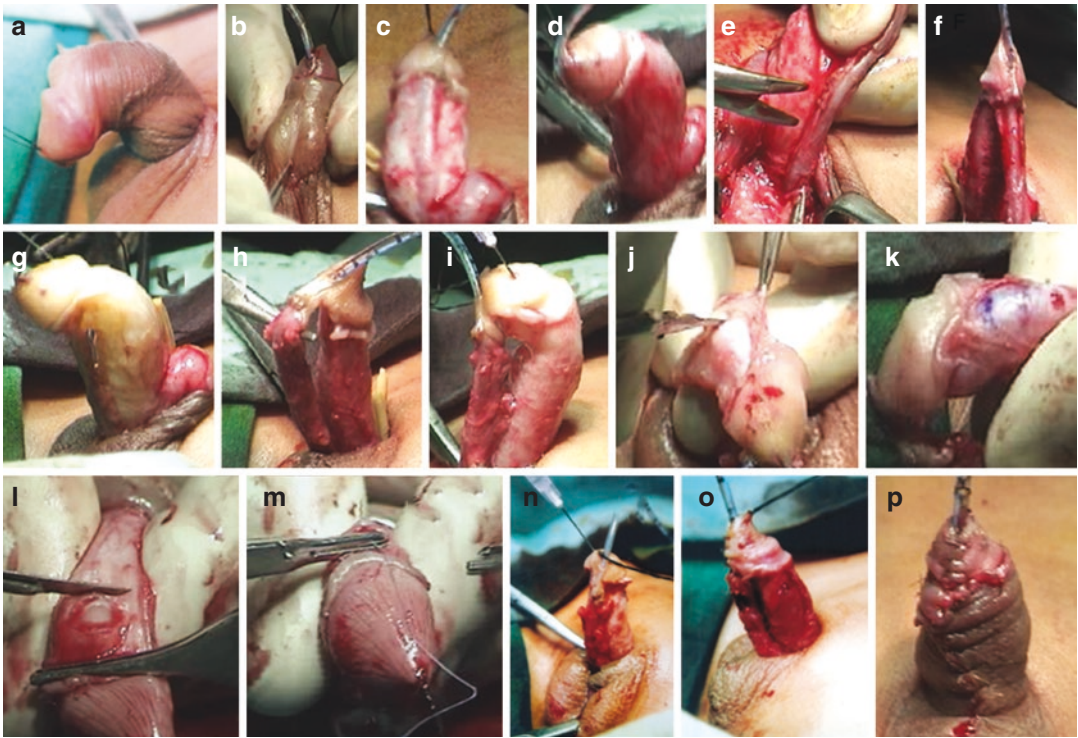


Fig. 15.8 Steps of chordee correction for Type II without hypospadias. (a) Moderate chordee on Gitte’s test without hypospadias. (b) Midline incision on the ventral surface. (c) Penile degloving and poorly developed corpus spongiosum. (d) Moderate chordee Gittes test after penile degloving. (e, f) Mobilization of the hypoplastic and proximal urethra. (g) Moderate chordee Gittes test after mobilization of the urethra. (h) Mobilization of the urethra into glans. (i) Minimal chordee after mobilization of the ure-

thra into glans. (j) Mobilization of the neurovascular bundle. (k) Site and size of incision for tunica albuginea plication. (l) Incision in tunica albuginea. (m) Suture for plication in tunica albuginea. (n) Complete correction of chordee after tunica plication on Gittes test. (o) Complete correction of chordee after spongioplasty and glanuloplasty. (p) Complete correction of chordee and skin closure (with permission Bhat et al. [1] @copyright Elsevier)



Fig. 15.9 Showing transection of the hypoplastic urethra for correction of chordee

experience with comprehensive mobilization of the urethra to correct the chordee and single-stage repair of chordee without hypospadias. Dipola et al. managed chordee patients without hypospadias with dorsal plication in type III, extensive mobilization of the urethra in type II, and vascularized neo-urethra in type I cases in a study of 26 cases [21]. We could correct the chordee in 76% of cases by mobilizing the urethra, and only 8% of patients needed dorsal plication [1]. There is less risk of shortening the penis if dorsal tunica plication is done after mobilization of the urethra, as partial correction of chordee is achieved by mobilization of the urethra. Only 16% required division of hypoplastic urethra and 4% of these were due to damage that occurred to the hypoplastic urethra during mobilization. We routinely do spongioplasty and glanuloplasty in

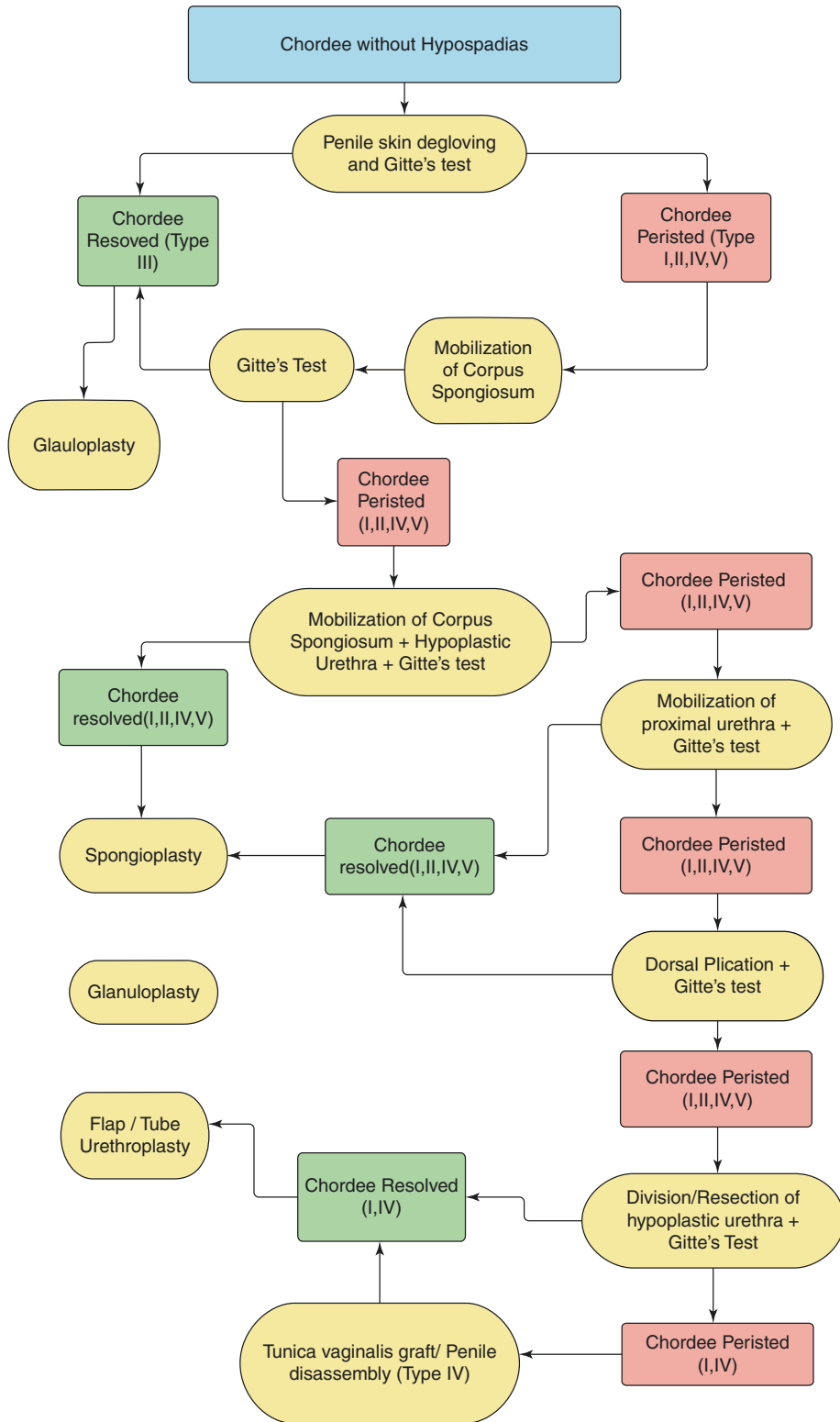


Fig. 15.10 Showing the algorithm for management of chordee without hypospadias

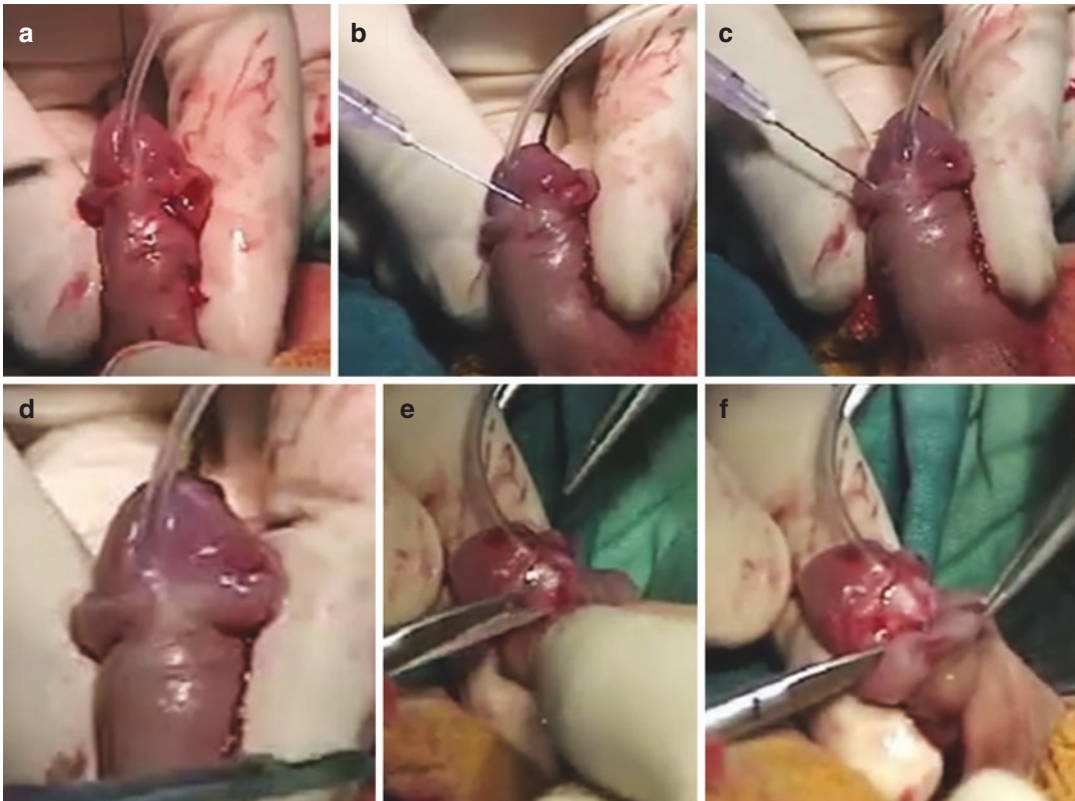


Fig. 15.11 Showing mobilization of adherent skin to the hypoplastic urethra. (a) Type I chordee without hypospadias. (b)–(d). Injection of saline to dissect the skin from

the hypoplastic urethra. (e, f) Dissection and separation of skin from the hypoplastic urethra

all cases. Spongioplasty adds to the length of the urethra and so helps in the correction of the chordee. Mobilization of the hypoplastic urethra and spongioplasty reconstructs a near-normal urethra, repairing as per anatomical principles of surgery, corrects the chordee, and helps prevent urethral fistulae [1]. Glanuloplasty has a dual advantage of correcting the glanular part of the chordee and giving a conical shape to the glans. Utilizing the advantages mentioned above, we propose an algorithm (Fig. 15.10) to manage chordee without hypospadias, which defines etiology and guidelines for managing this congenital anomaly according to the etiology. Mobilization of the urethra along with the corpus spongiosum for correction of chordee is the best option, eliminating the complications mentioned above and having the advantage of utilizing the hypoplastic urethra with spongioplasty.

15.9.4 Plication and Corporeal Rotation Procedures

The principle of plication and the technique is the simplest one for correcting the curvature, but unfortunately, the recurrence rate is high. The plication is done opposite to the point of maximum curvature marked after the Gittes test. The cut edges in incisional or excisional plication heal better and hold approximation tension better than the shortening without it; yields better results. Chertin et al. reported a success rate of 85–100% with the dorsal plication corporoplasty for correcting chordee. They claimed it to be a simple, effective method without injury to neurovascular bundles or a detrimental effect on erection [22]. The limitation of the techniques is only effective in mild to moderate curvature. The long-term

results reported by the others are contrary to it, with a high recurrence rate [23]. The disadvantages of the plication procedures are shortening of the penis, blood loss, chances of injury to corpora, and neurovascular bundle causing psychosexual problems. Corporal volume and elasticity of tunica may be compromised due to excessive folding or excision of tunica. More so, these are against the anatomical principles of surgery as rather than lengthening the pathological ventral surface, the normal dorsal surface is shortened. We use dorsal plication only when we find chordee less than 30 degrees after mobilization of the urethra by a single midline stitch or one or two sutures without much folding of the tunica.

15.9.5 Resection of the Hypoplastic Urethra and Replacement Urethroplasty

The resection of the hypoplastic urethra and urethroplasty is one of the options for managing chordee without hypospadias. Young advocated the resection of the hypoplastic urethra and replacement urethroplasty. But the disadvantages are it being an extensive procedure having higher complications. Urethral fistula, stricture, diverticula, penile torsion, stenotic and retrusive meatus are seen in flap procedures and chances of graft contracture if the free graft is used for urethroplasty.

15.9.6 Penile Disassembly and Corporoplasty

In case of the persistence of chordee even after the hypoplastic urethral transection or resection, the option of superficial corporotomy with or without corporoplasty may be considered. First, Corporotomy is done by fairy cuts, the superficial transverse incisions through the deep layer of the tunica. Snodgrass and Prieto reported good results with these fairy cuts without any recurrences. Then, they advocated performing three transverse ventral corporotomies at the point of maximal curvature, cutting through the

tunica albuginea, but not into the erectile tissue, without any additional ventral grafting [24]. The next step is the Corporoplasty with dermal, tunica vaginalis graft, and SIS graft as ventral lengthening. The complications like erectile dysfunction due to venous leak, aneurysmal dilatation, penile instability, predisposition to penile fracture are reported in corporoplasty [25]. Penile disassembly is the last resort, which with/without corporoplasty corrects the curvature in almost all types of curvature. But this is an extensive procedure and requires vast experience. In our experience, we did not need penile dis-assembly for chordee correction in chordee without hypospadias.

15.10 Conclusions

The chordee without hypospadias is a group of conditions where the urethral meatus is at the glanular tip and has a variable degree of ventral penile curvature. Type III chordee without hypospadias with mild to moderate chordee may be operated at adolescence, but type II and type I should be operated in the same age group as hypospadias or whenever the child presents to the hospital. Mild chordee (30 degrees) is managed by dorsal approach while moderate to severe one with ventral lengthening. Surgical management with a single correct approach is difficult as the surgery is influenced by preference and opinion. The surgeon must be trained in hypospadias surgery and must understand the expected complications during and after surgery while mobilizing the hypoplastic urethra. At the same time, the step-by-step approach from simple to more complex solve the problem in most cases. The complexity of the problem will become apparent only after exposure of the urethra for mobilization. The surgery may turn out to be quick and straightforward or a long and complicated repair. Mild to moderate curvature in chordee without hypospadias may be corrected simply by penile degloving or with the addition of the hypoplastic urethral mobilization. Moderate to severe chordee requires extensive procedures like extended urethral

mobilization, dorsal plication, or corporoplasty. Dorsal plication should be chosen in cases less than 30 degrees after urethral mobilization. Corporoplasty/corporotomy is preferred in more than 30 degrees cases to prevent penile shortening. The hypoplastic urethra and proximal extended urethral mobilization add length (2–3.5 cm) to the spongiosum segment, that helps in chordee correction. Spongioplasty with the mobilization of divergent corpus spongiosum and glanuloplasty reconstructs an anatomically near-normal urethra, adds length to correct the chordee, and eliminates the fear of preserving the hypoplastic urethra. An algorithm is proposed to preserve the urethra in a step-by-step approach.

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