Management of Hypospadias Cripple

22

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22.1 Introduction

The complications are inevitable in any surgery. The hypospadias surgery is a complex one, having more chances of complications, and requires multiple surgeries. The repair goals are to reconstruct an adequate size & straight penis for successful intercourse with a forward-directed projectile urinary stream. These can be achieved by chordee correction, urethroplasty, meatoplasty/glansplasty, scrotal transposition repair, and skin coverage. Choosing an inappropriate and poor surgical technique, postoperative infection, wound dehiscence, urine extravasations, hematoma, ischemia, and necrosis of the flap or graft are responsible for increasing the complications [1]. These factors lead to poor healing of the reconstructed tissue. The theory is that the neourethra (a man-made tube) likely fails to grow adequately compared to the rest of the genital tissues during puberty and may create a narrow or short tube. The complications may appear during puberty due to rapid genital growth. It is also assumed that the neourethra's congenital lack of spongiosal cover may not provide adequate vascular support to the urethra during puberty growth. Urethra without spongiosum cover support is unlikely to tolerate the trauma sustained during erections and sexual activity [2]. The exact extent, number, nature, and range of complications seen in adulthood after childhood hypospadias surgery remain poorly defined. When multiple surgeries fail, it will lead to functional loss of the penis, landing in the problem of "hypospadias cripple" [3]. In 1981, Stecker et al. first used the term "hypospadias cripples" to emphasize the complexity of the deformities faced during the repair of difficult hypospadias cases [4]. Horton and Devine used the term hypospadias cripple for the patient who had undergone multiple unsuccessful hypospadias repairs [5]. Multiple attempts for repair in such patients result in significant resultant penile deformity. Therefore, surgical repair in these complicated cases is less likely to succeed. The exact prevalence of the hypospadias cripple is unknown, but the best available estimate shows it occurs in 5–7% of patients after multiple failed attempts of repair [6, 7].

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A. Bhat (ed.), *Hypospadiology*, https://doi.org/10.1007/978-981-16-8395-4_22

Hensle et al. reported the adulthood complications 37.5% in the patients without previous hypospadias surgery, 41.67% in the patients who had one or more surgical procedures in childhood but local tissue was relatively intact, and 63.6% in the patients who underwent multiple unsuccessful hypospadias repairs with various degrees of penile deformity and loss of local tissue [8]. Others have opined that although the number of surgeries for the correction of primary hypospadias is a risk factor, the stricture length is more significant than the number of surgeries [9]. Complications after the hypospadias repair are a difficult population to treat. They are likely left with deformities significantly worse than the primary disease itself [2]. The complications are considerably more significant for re-operations as compared to primary repairs using the same surgical procedure. These facts guide us to careful patient selection, modification of methods for re-operation, and consideration of novel procedures not commonly used for primary repair. Redo-surgery in patients with hypospadias crippled has very high complication rates. Multiple surgeries are often required to have improved and successful outcomes, even in the best of hands. Multiple studies have noted that 24–32%, 7–12%, and 3–4% of patients needed approximately two, three, and even four repairs, respectively [7, 10, 11]. Whether this can be achieved in a single surgery or multiple depends on the severity of problems, availability of tissue and experience of the operating surgeon.

22.2 Assessment of the Patient

Patients with hypospadias cripple may present to the hospital with complaints of penile deformity, complex psychosexual problems, and urinary or ejaculatory problems [12]. Though the detailed history of previous surgery, previous surgery records, and reasons for the surgery's failure are to be sought and are very important for surgical planning. But many a time, these are not available with the patients. Careful and systematic evaluation is an essential step in the workup of the crippled hypospadias. The penile and glans size, location and size of the meatus are noted. Multiple openings suggestive of fistulae, presence of scars, the flexibility of the tissue, chordee, torsion, prepucial hood or residual prepucial skin, palpable thickening of the urethra, ballooning of ventral side during micturition are recorded. The meatus is calibrated for the size of the meatus. If the stricture and diverticula are suspected, then the urethrogram is done to locate the stricture and diverticula's site, size, and length. Patient/parents may be asked to take a photograph in erection position in all directions to understand the residual curvature/recurrence of curvature or torsion. Clinical examination and an artificial erection with pharmacological agents and curvature measurement may help decide the plan plication procedure or ventral lengthening procedures. In the patient with urinary complaints, history of hematuria, and repeated urinary tract infection; cystoscopy is done to evaluate for stricture, prostatic utricle, diverticula, urethral hairs, and urethral stones. The patient should be counseled before surgery, considering their aspirations and realistic expectations about the penile size and shape, urinary and sexual functions. Other issues are frequently seen in seemingly simple cases, such as fistulae, scarring, recurrent chordee, and an abnormal meatus, often related to a small glans and nearly always with a deficiency of the dartos layer often with underlying associated psychosexual problems [2]. The assessment helps in the planning of the surgery and alternatives in the surgical approach.

22.3 Management

Depending on the type of previous surgeries, hypospadias cripple are likely to have multiple issues to be solved. Pre-decided protocols may have to be changed to manage these patients. Management has to be tailored to the individual patient. The problems of hypospadias cripples can be categorized into five major groups, and treatment is tailored accordingly in one stage or multiple:

1. Correction of Residual Chordee/Penile Torsion
2. Reconstruction of the urethra

3. Adjuncts to urethroplasty/Healthy tissue cover.
4. Resurfacing of the skin
5. Reconstruction of penile part loss

22.3.1 Chordee Correction

Recurrent curvature in hypospadias cripple is likely to be due to the peri-urethral and skin fibrosis, shortening of the reconstructed urethra and disproportionate ventral corpora by the relatively poor growth of the hypoplastic ventral corporal wall. The causes may be single or combination in the individual case. The surgical correction of chordee either by ventral lengthening or dorsal shortening procedures will depend on the severity of chordee after penile skin degloving. Chordee due to skin fibrosis is likely to be corrected after penile skin degloving itself, but it is to be confirmed by Gittes test before proceeding further. The urethra/urethral plate is examined to see whether it is healthy or fibrotic. If the urethra/urethral plate is healthy, then the urethra/urethral plate is mobilized to correct the chordee and confirmed by the Gittes test. The urethra/urethral plate is utilized for urethral reconstruction (Fig. 22.1a–f). A fibrotic urethra/tethered urethral plate causing the chordee to be transacted or resected to correct the ventral curvature. The corporal disproportion is managed by dorsal plication if the penile length is adequate and the chordee is less than 30 degrees. In cases with a short penis with chordee of less than 30 degrees, and the patient wants a penile lengthening procedure, superficial corporotomy is done. If the chordee is more than 30 degrees, then corporoplasty is done. The urethral plate is reconstructed by the Buccal mucosal or skin graft to be tubularized in the second stage. If needed, ventral shortening of the skin can be covered by Z plasty, double Z plasty, or multiple Z plasties. This may lengthen ventral skin up to 2–5 cm as required according to the patient's age: will help correct

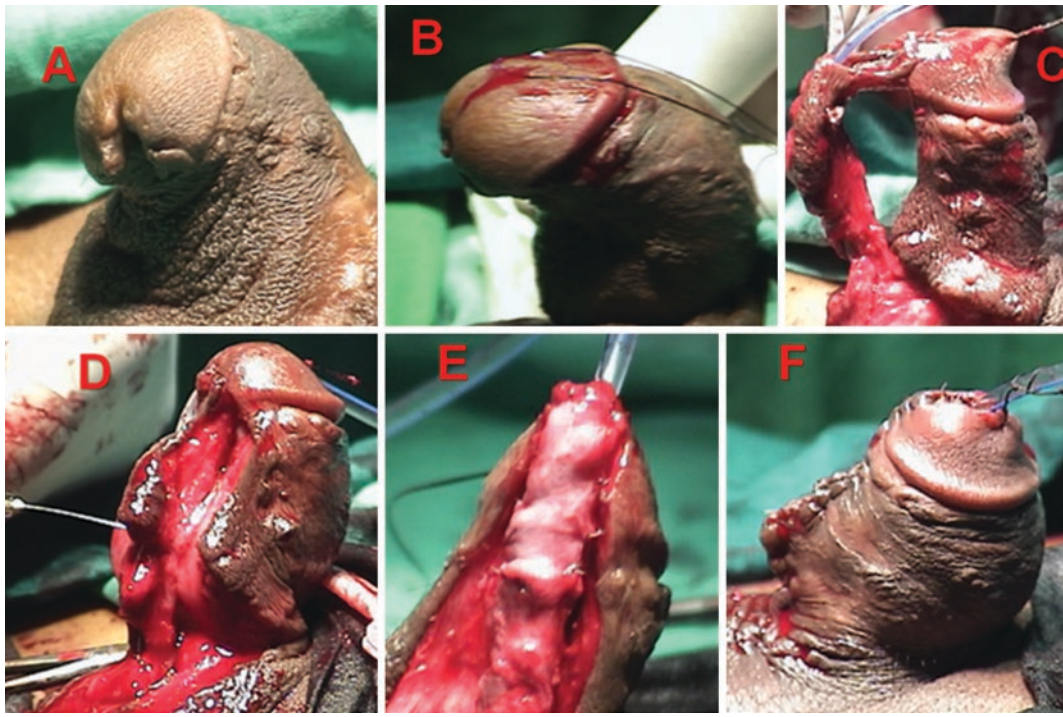

Fig. 22.1 Showing correction of chordee by urethral plate and urethra mobilization. (**a**) Hypospadias cripple after three previous surgery having chordee, glans scar, distal laid open urethra. (**b**) Gittes test Showing chordee. (**c**) Urethral plate with spongiosum and urethra mobilization up to the penoscrotal junction. (**d**) Gittes test showing correction of chordee. (**e**) Tubularized urethral plate perimeatal dartos cover. (**f**) Glanuloplasty and skin closure

the chordee and prevent the recurrence chordee. Hana et al. (2017) reported correction of ventral curvature in 59 cases of recurrent chordee. The correction was done with single-stage skin detethering and dorsal plication in 32, one-stage by mobilization of the urethra and corporal/dermal grafts in 12 patients, staged corporal/dermal graft and skin coverage followed by urethroplasty 8–12 months later in 15 patients [13].

22.3.2 Penile Torsion

Penile torsion is likely because of traction on the vascular pedicle of the inner prepucial flap, traction on the tunica flap used for interposing healthy tissue during previous surgery, or intrinsic corporal shortening. Unequal skin flap closure may also be responsible for penile torsion. Torsion is corrected by penile degloving and again assessed for the torsion (Fig. 22.2a–h). If there is traction on the vascular pedicle, that is released by mobilization of the pedicle. Still, it persists, then counter traction by dartos wrap, plication procedures, and final adjustment with skin closure is done [14].

22.3.3 Reconstruction of the Urethra

Urethroplasty in hypospadiac cripple is a real challenge to the surgeon as the patient had repeated surgery leading to fibrosis starting from the skin to corpora. Depending upon the available tissue, chordee, torsion, stricture, fistula, diverticula, the feasibility of chordee correction one-

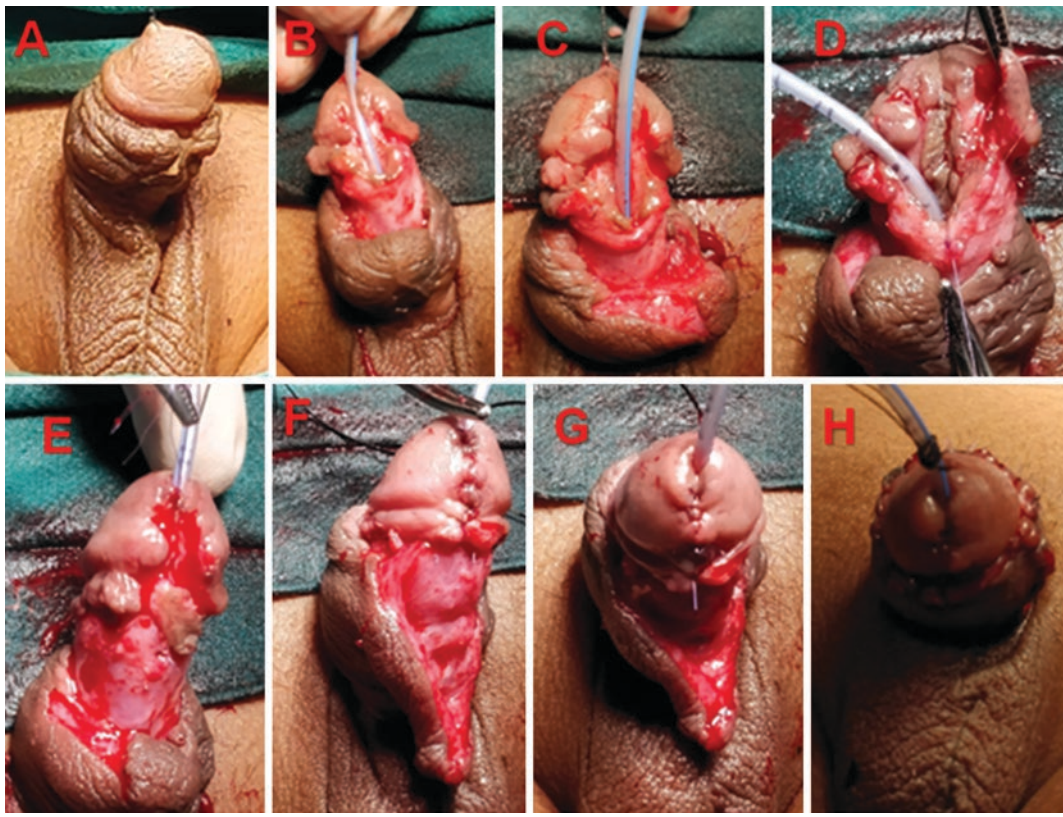

Fig. 22.2 Showing torsion correction in a 3-year male child with distal laid open urethra with TIPU and dartos cover. (**a**) Failed hypospadias repair showing torque. (**b**, **c**) Correction of torque after penile degloving. (**d**) Urethral plate tubularization started. (**e**) Urethral plate tubularization and spongioplasty. (**f**, **g**) Coverage with dartos flap and glansplasty. (**h**) Skin closure

stage or two-stage urethroplasty is planned [15]. The final decision about the single-stage or two-stage is taken on the operating table. The majority of the cases will need two-stage surgery. Strictures in hypospadias cripple are rarely amenable to visual internal urethrotomy [16]. The available options in stricture urethra management are excision and primary anastomosis, preputial skin flap, single-stage Buccal graft repair, and two-stage repair with buccal/Lingual mucosal graft, skin graft, bladder mucosal graft, and allografts. Small Strictures can be dealt with the end-to-end urethroplasty, but long and or multiple strictures require replacement urethroplasty. Suppose the segment is small and other associated problems like chordee or torsion have been corrected by the penile degloving and the urethral mobilization. In that case, one-stage repair may be an option (Figs. 22.1a–f and 22.2a–h), but the two-stage repair is preferable in most cases. Barbagli 2010 reported a success rate with single-stage urethroplasty in 90% in a largely failed hypospadias repair from Europe. 20% of the patients were done in the single-stage urethroplasty by a penile skin flap [11]. Myers (2012) has found that the utilization of either local penile

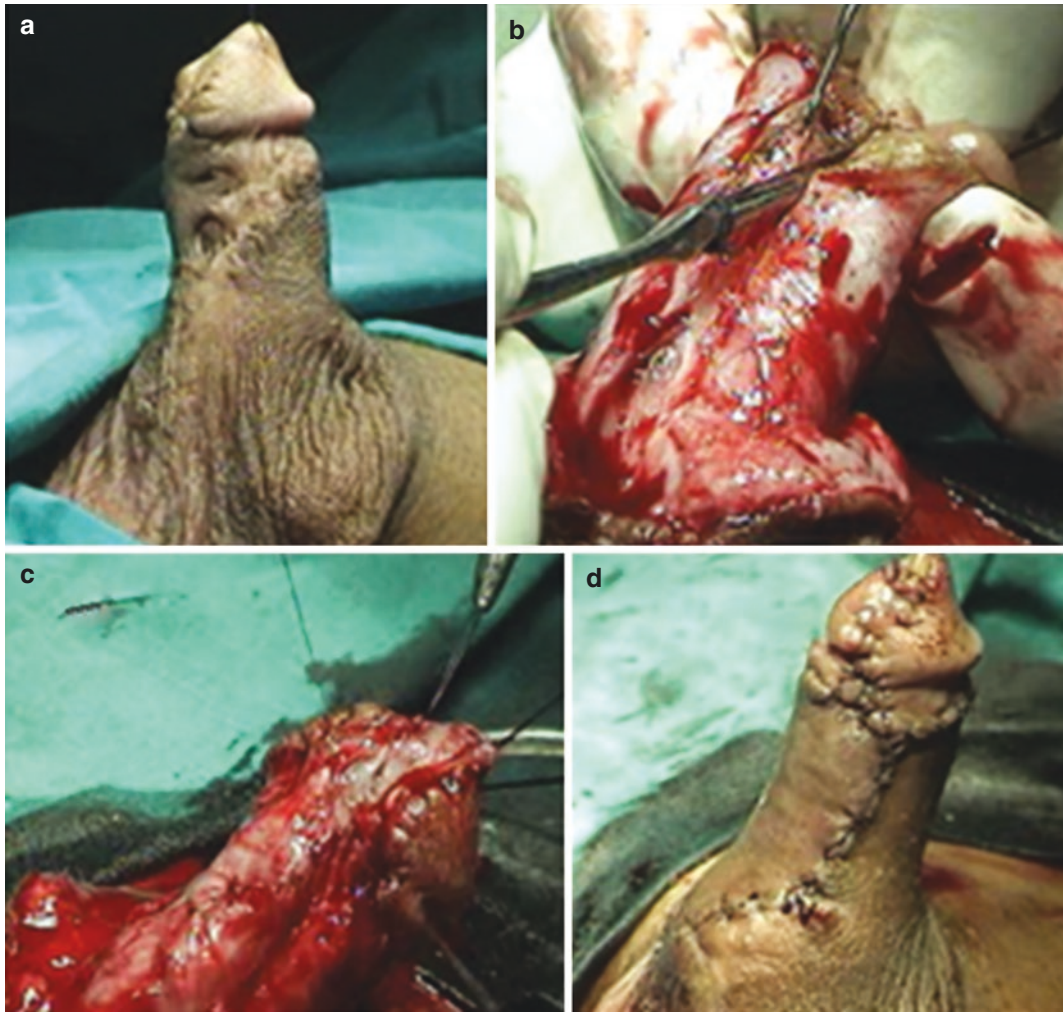

Fig. 22.3 Showing after five surgeries, multiple fistulae, glans dehiscence and glans scar. (**a**) Multiple fistulae with glans scar and dehiscence. (**b**) Penile degloving, laying open fistula create a urethral plate. (**c**) Urethral plate tubularization and dartos cover. (**d**) Glansplasty and skin closure

flaps or penile circular fascia-cutaneous flaps have a failure rate of 42% in the long-term follow-up [10].

If the available urethral plate is healthy or laid open multiple fistulae gives a healthy urethral plate (Fig. 22.3a–d). Then it either can be tubularized with or without augmentation of the urethral plate. The width of the urethral plate is narrow then can be supplemented with the dorsal Buccal graft or prepucial/penile skin available and tubularized tension free. Next, Neo-urethra should be covered with tunica vaginalis as an interposing healthy tissue (Fig. 22.4a–g). Another option is if partial/complete dorsal hood is available, then onlay flap urethroplasty can be done (Fig. 22.5a–f).

Most of the time, a group of patients who had diverticula with other associated complications can be managed in a single stage. The diverticula usually occur following flap repairs and two-stage repairs. Etiology and causes are discussed in Chap. 21 of chronic complications. The diverticula maybe with a narrow neck or dilation of the reconstructed urethra as a whole. These cases may be associated with other complications like urethral stone due to stagnation of urine. Diverticular neck excision and supporting the urethral with dartos will suffice in arrow neck cases, but others require reduction urethroplasty with pseudospongioplasty [17, 18] (Fig. 22.6a–g). It is often feasible to deal with multiple problems diverticula, fistula, and torsion in a single stage (Fig. 22.7a–k).

Sometimes patients with multiple problems like chordee, torsion, fistula urethral stones can be repaired in a single stage (Fig. 22.8a–f). But most of the time, multi-staged surgery remains the only choice.

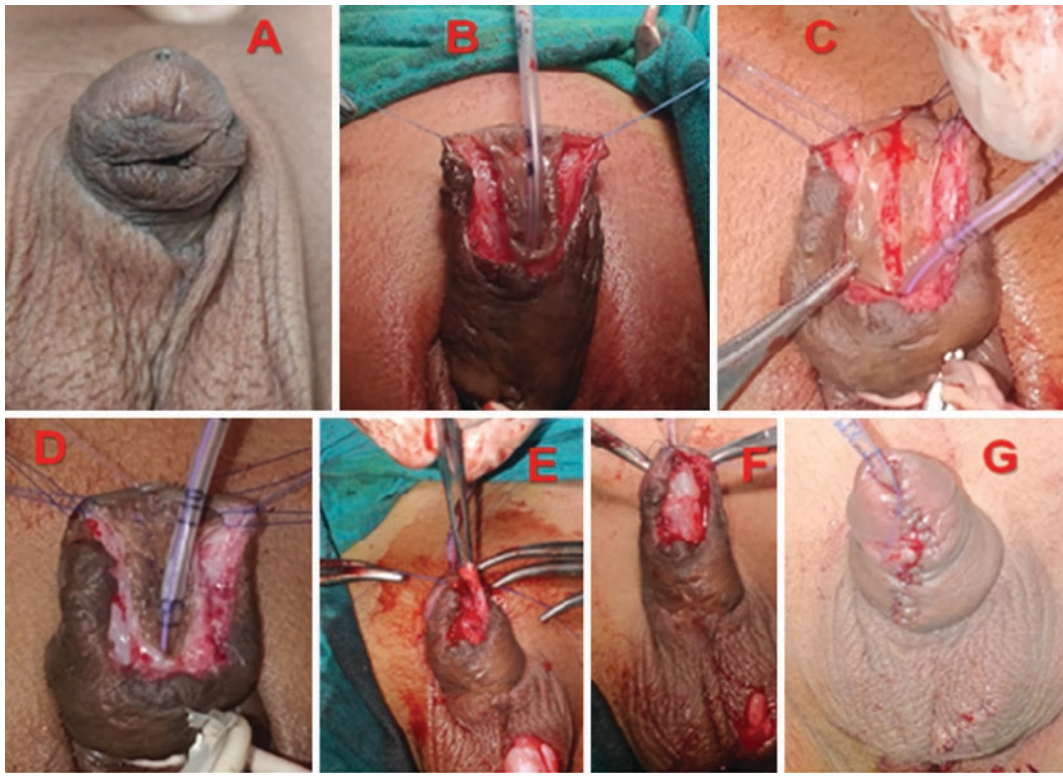

Fig. 22.4 TIPU with Spongioplasty in retrusive meatus with fistula. (**a**) A large fistula with glans dehiscence. (**b**) Urethral plate and spongiosum mobilization after incising the skin ledge. (**c**) Incising the urethral plate. (**d**) Dorsal inlay graft placed. (**e**) Tubularization of the urethral plate and mobilized tunica vaginalis flap tunneled to the site. (**f**) Covering neourethra with tunica vaginalis flap. (**g**) Glansplasty and skin closure

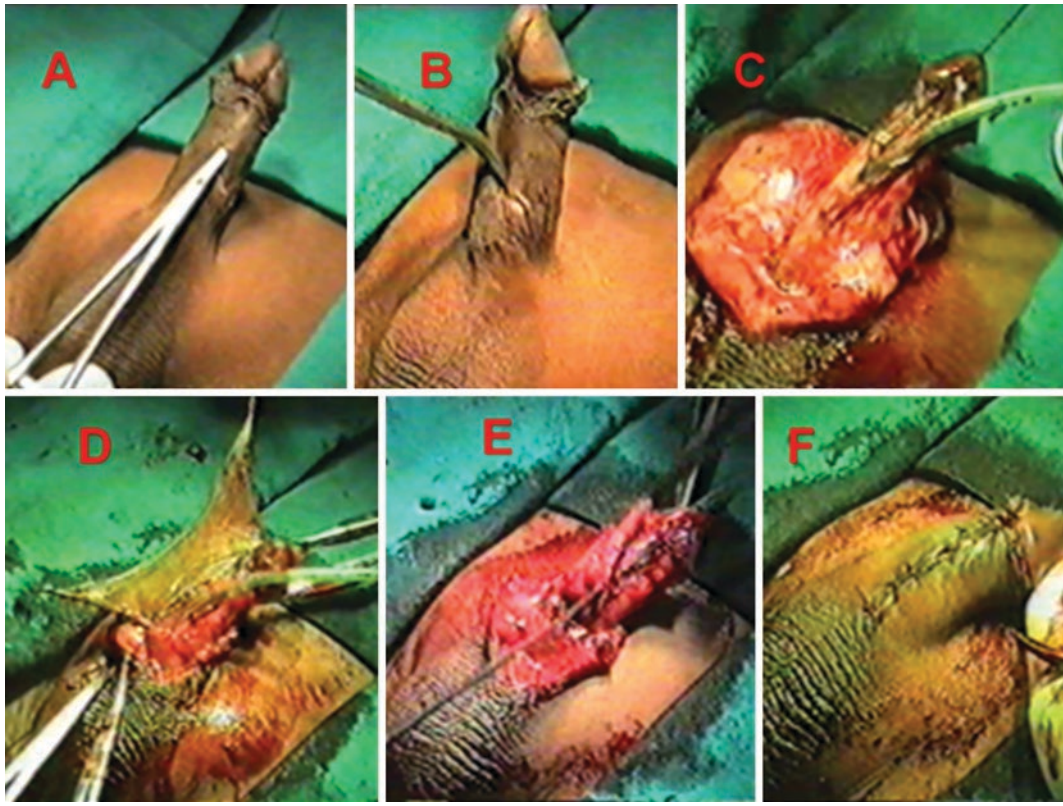

Fig. 22.5 (**a**, **b**) Multiple fistulae and distal laid open urethra. (**c**) Penile degloving and creating urethral plate by combining all fistula. (**d**) Onlay flap urethroplasty. (**e**) Dartos cover over neo-urethra. (**f**) Glansplasty and skin closure

Two-stage repair in hypospadias cripples the standard of care in modern Hypospadiology. Bracka popularized it as a potential solution to high-risk cases [6]. In staged repair, the most important consideration is the complete removal of the scarred and diseased tissue, correction of chordee, and placement of the tissue to be used for urethral substitution. The most commonly used substitution tissues are Buccal mucosa, non-hair-bearing abdominal skin, and Bladder mucosa. The attractive part of the abdominal skin is its availability and ease of harvesting with low morbidity, but the long-term durability of a skin-based urethroplasty is questionable. The Buccal mucosa graft is preferred for urethral replacement in hypospadias salvage surgery, and our choice is also the same. The graft is taken wider than required to compensate for the estimated 15% contracture in graft width and extend distally into the glans (Fig. 22.9a–c). The graft is supported by tunica vaginalis flaps affixed to the corporal bodies where the graft the bed is unsuitable. Other important points are the proper placement of the graft and quilting the graft to the underlying corpora with the tunica dartos or soft tissue to support the graft material's lateral edges. This will help ensure an adequate blood supply during mobilization of the edges of the graft for tubularization. A bolster dressing is sewn to the graft's underside with the Foley catheter running through the dressing. In spite, all measure graft contracture is inevitable in quite a number of patients (19–22%) who require revision or replacement of the graft [7].

Usually, second stage urethroplasty is done 6–12 months later. We prefer to wait up to 12 months before closure. The size of the neo-urethra is decided by proximal urethral calibration with a sound, and the urethral plate is mobilized. Care is taken to mobilize the urethral

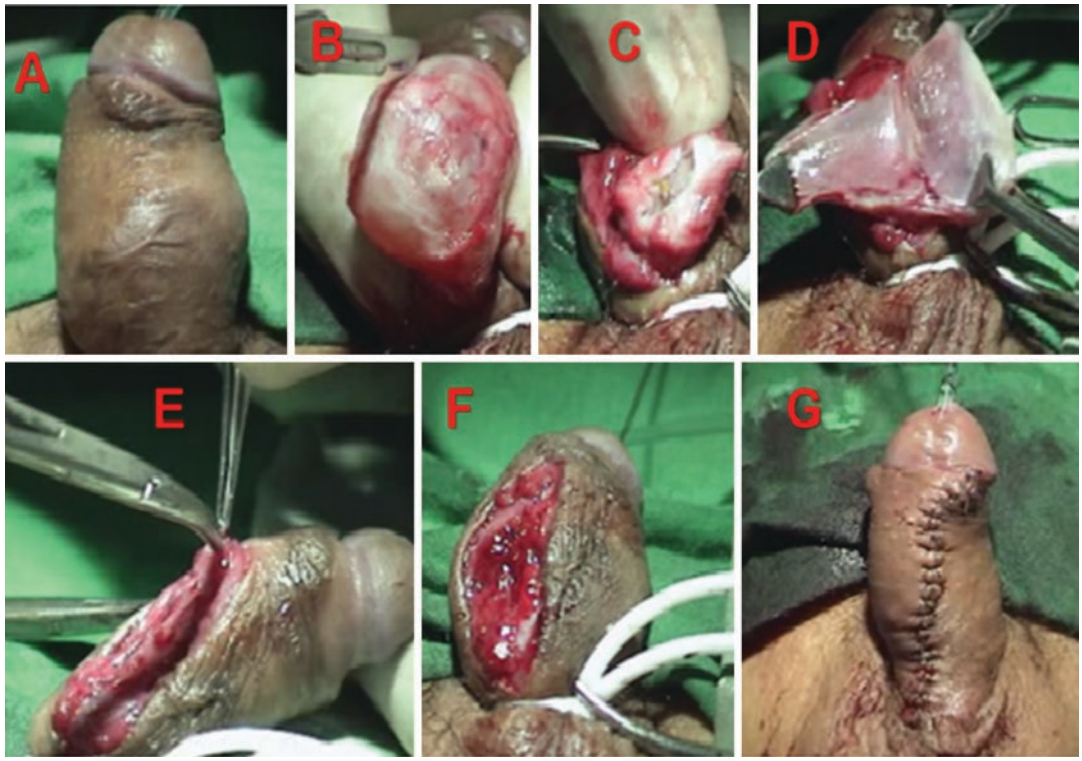

Fig. 22.6 Showing diverticula, torsion, and urethral stones. (**a**) Deformed shaft, torsion, and ballooning of ventral surface of the shaft. (**b**) Mobilized urethral diverticula. (**c**) Urethral stones in opened diverticula. (**d**) Excision of urethral diverticula closure of the neck of diverticula. (**e**, **f**) Supporting the urethra with dartos. (**g**) Skin closure and final picture

edges as little as possible to prevent the devascularization of the graft material. In cases with less than 25% contracture (Fig. 22.10), it may be augmented with a dorsal Buccal mucosal graft to prevent the re-stricture. But where almost the whole graft is lost or there is severe contracture, then the graft procedure has to be done again (Fig. 22.11). Lingual or lip mucosal graft may be used or supplemented in cases contracture after Buccal mucosal graft (Fig. 22.12).

The tubularization is done in two layers and is supported by the available dartos. We prefer to cover it with tunica vaginalis in all cases to prevent fistula, which is a commonest complication. The per-urethral catheter is placed and kept for 2–3 weeks postoperatively. A few prefer a suprapubic catheter for 3–4 weeks to avoid the ventral pressure on the incision from a full urinary drainage bag pulling on the catheter.

Cheritin B et al. 2007 [19] reported the results of 28 patients of hypospadias cripple who had undergone 2–5 surgeries earlier. Twenty-three cases were managed by a single-stage (penile skin flap repair 21+ bladder mucosa graft 2) in whom the meatus was located in the proximal part in 19 patients and mid-penile 4 cases. Fourteen patients had chordee, which was corrected by excision of scar tissue and dorsal plication. Five cases were managed in a staged manner. The complication rates were very high (46.3%), and 14.2% needed revision. They had placed the local penile skin flap with an adequate vascular supply to treat hypospadias cripples. Snodgrass and Elmore repaired 25 cases of failed hypospa-

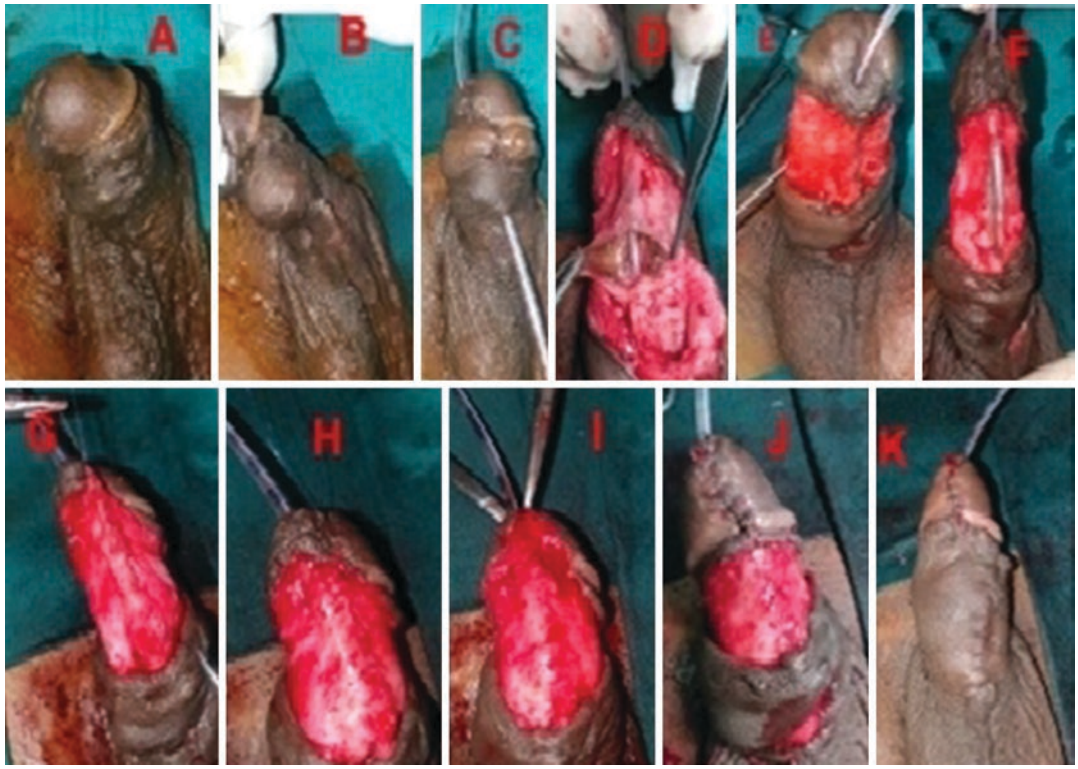

Fig. 22.7 Showing hypospadias cripple after four surgeries. Penile torsion urethral fistula and diverticula. (**a**) Right torsion, mild chordee, urethral fistula, retrusive meatus, and diverticula. (**b**) Inflated diverticula with xylocaine jelly, retrusive meatus, and fistula. (**c**) Infant feeding tube in fistula. (**d**) Penile Degloving & Laid-open diverticula. (**e**) Gittes test torsion corrected and mild glanular chordee. (**f**) Reduction of urethral diverticula and urethral plate prepared. (**g**) Urethral plate tubularization. (**h**) Dartos cover. (**i**) Glanular flaps raised. (**j**) Glansplasty. (**k**) Final picture. Skin closure torsion and chordee corrected

dias using Buccal mucosal grafts in multi-stage repairs having a success rate of 78% [20]. Barbagli et al., in 408 patients, found a correlation of the length of stricture and the presence of lichen sclerosis with a higher risk of treatment failure [21]. Bladder mucosa graft in hypospadias repair is feasible, but it is not popular, and long-term follow-up data are lacking. Li et al. reported their experience using a free bladder mucosa graft in failed hypospadias in adolescents and adults with a complication rate of 12.4% after a follow-up ranging from 3 months to 2 years. Bladder mucosa for urethroplasty after hypospadias repair did not achieve the same results in both studies [22, 23].

22.3.4 Adjuncts to Urethroplasty and Healthy Tissue Cover

Use of biologically based glue All measures should be taken to prevent the surgery failure of hypospadias cripple, who has already undergone two or more surgeries. Fibrin glue has the quality of sealing the suture line, making it waterproof, and also helps in hemostasis [24, 25]. Barbagli in 2006 used fibrin and reported significantly better graft take up, graft adherence, healing, and reduction in hematoma formation [3]. We use the fibrin sealant in selected cases of urethroplasty in these hypospadias cripples. But it is difficult to analyze

Fig. 22.8 Failed multiple hypospadias problem torsion, Glans scars, unsupple shaft skin, urethral stones, and bifid scrotum. (**a**, **b**) Right-sided torsion of the penis, rough skin on the ventral aspect of the penis, scarred glans, bifid scrotum, and penoscrotal transposition. (**c**, **d**) Penile degloving and incised the urethra showing urethral calculi. (**e**) Removal of stone and excision of excess skin to prepare the urethral plate for tubularization. (**f**) Scrotoplasty and skin closure

how useful it is until we exclude all other variables responsible for redo surgeries' failure.

Spongioplasty It is mandatory to cover the neourethra with healthy tissue. Availability of the tissue depends on the type and number of previous surgeries. In cases of previously urethral plate preservation procedures, if spongiosum is available, then the spongioplasty with dartos/tunica gives a better outcome. The residual urethral plate can be tubularized, covered with spongiosum (Fig. 22.13a–g), or created a urethral plate with skin (Fig. 22.14a–g), and supported with dartos or tunica vaginalis flap.

Ventral or Scrotal dartos Reconstructed neourethra with the available urethral plate or by tubularization of neo-urethral plate second stage of two-stage procedures are covered by ventral dartos/scrotal dartos to support the repair. Hayashi et al. (2005) used scrotal dartos wrap after urethral fistula closure with no recurrence of fistula. The scrotal dartos wrapping technique was recommended to cover the neourethra with a well-vascularized flap [26].

Tunica vaginalis flap The local penile tissue vascularity is being compromised because of the multiple surgeries and scaring. So revasculariza-

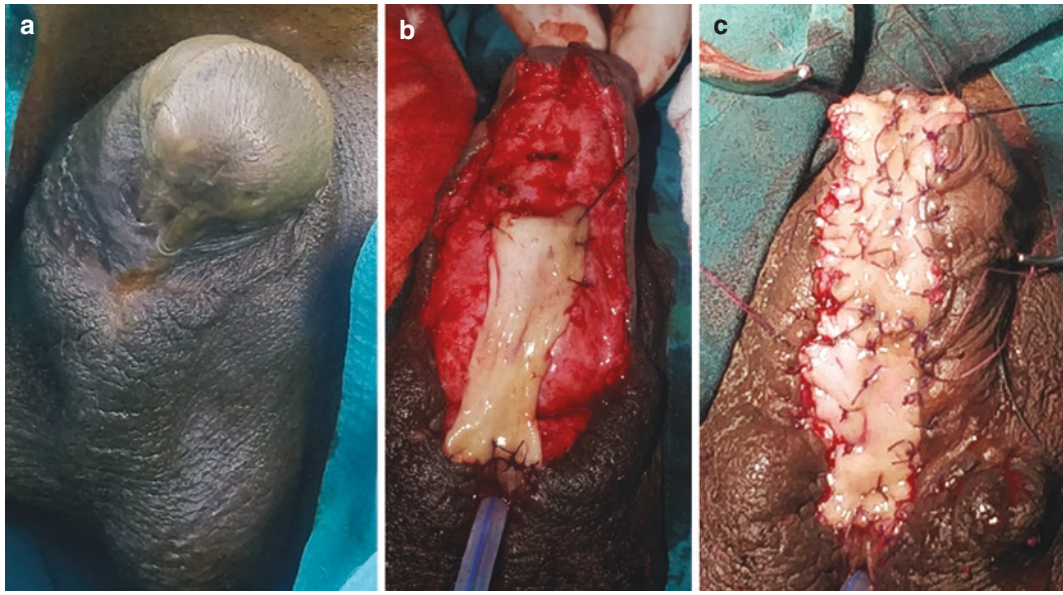

Fig. 22.9 Failed hypospadias in first stage chordee correction and Buccal Mucosal graft. (**a**) Failed hypospadias repair with scrotal meatus, chordee, and unhealthy ventral skin. (**b**) Buccal mucosa graft placement after penile degloving and chordee correction. (**c**) Graft Quilting on the ventral aspect of the penis up to the glans' tip

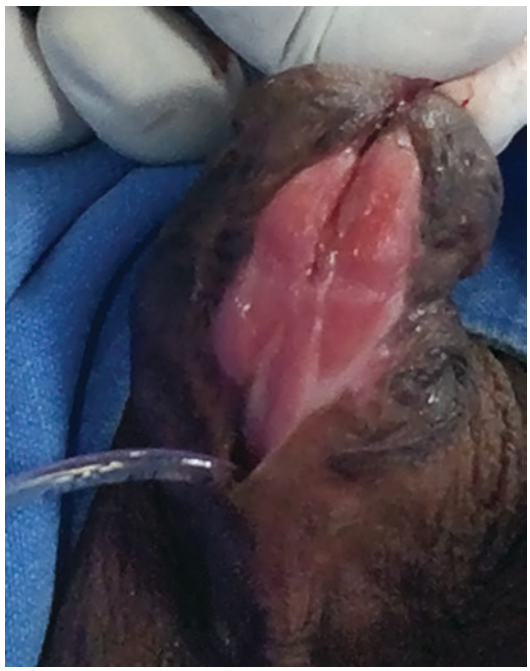

Fig. 22.10 Showing contracture of the graft near the meatus and corona

tion of the newly reconstructed neo-urethra is of paramount importance. The blood supply of the tunica is separate from the local tissue and remains preserved even after repeated surgeries. Thus, tunica vaginalis is the most commonly used interposing healthy tissue cover, and its results are better than the dartos wrap [27, 28]. We use the tunica vaginalis flaps to cover a lengthy or marginal ventral suture line in all cases of redo surgeries.

22.3.5 Resurfacing the Skin

Primary skin closure is difficult if the penile skin has been used to reconstruct the urethra. The dorsal releasing incision may help cover the skin; if not, then a free skin graft. Dorsal transposition flap of preputial the prepucial skin after penile degloving may be designed to cover the ventral skin defect, avoiding the suture line's superimposition. Dorsal dartos-based prepucial skin flap

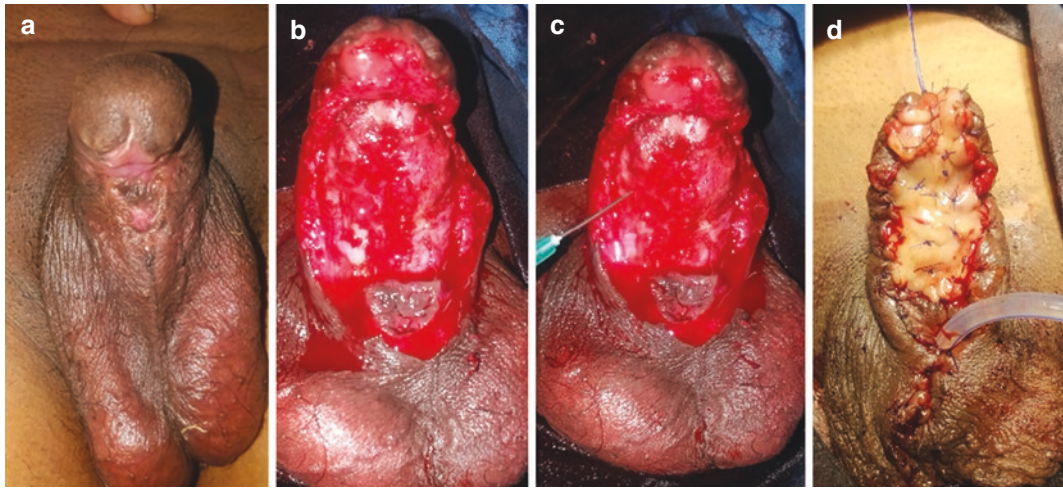

Fig. 22.11 Hypospadias cripple operated five times failed Buccal Mucosal graft. (**a**) Failed hypospadias repair with proximal meatus, chordee, contracture and loos Buccal graft and unhealthy ventral skin. (**b**) Chordee correction done with excising the fibrous tissue after. (**c**) Gittes test to confirm chordee correction. (**d**) Buccal mucosal graft and Quilting on the ventral aspect of the penis up to the glans' tip

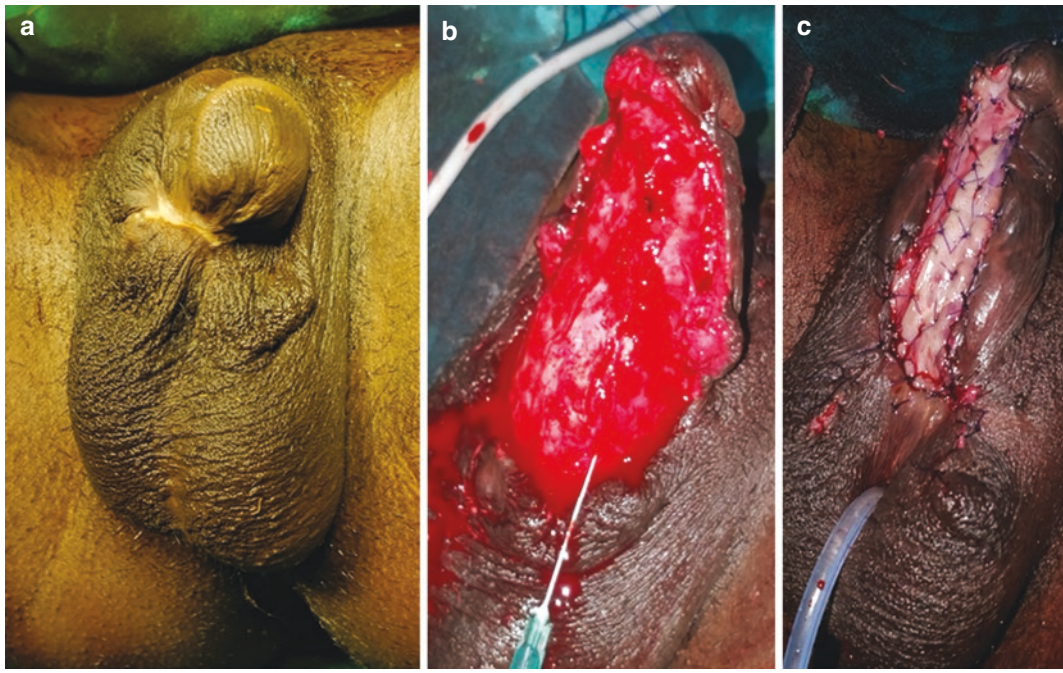

Fig. 22.12 (**a**) Hypospadias cripple had surgery five times with severe chordee and penile torsion correction and graft contracture. (**b**) Chordee correction done with excising the fibrous tissue and Gittes test to confirm chordee correction. (**c**) Buccal and lower lip Graft fixed to the ventral aspect of the penis up to the glans tip

may be brought ventrally to cover the skin if the partial dorsal hood is available. Single or double Z plasties at the penoscrotal junction to cover the skin on the ventral surface are good options (Fig. 22.15a–f). This will not only cover the ventral surface but also will prevent the recurrence of

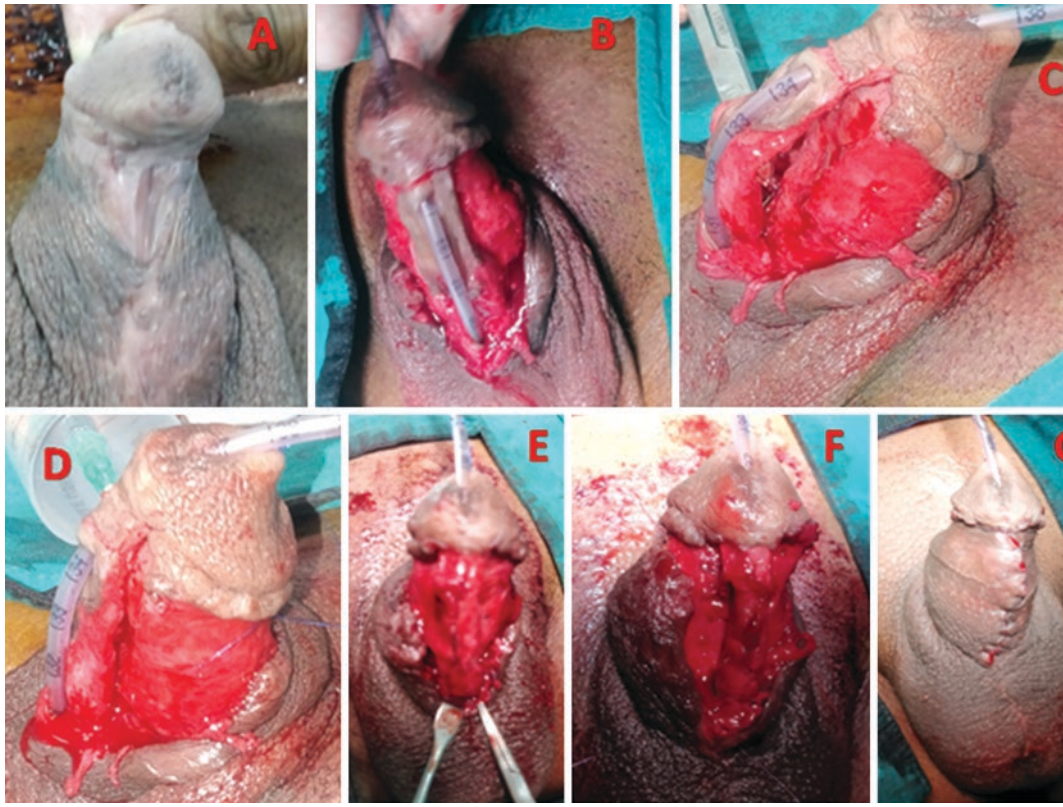

Fig. 22.13 Hypospadias cripple after multiple surgeries. (**a**) Chordee, fistula, Scared ventral skin. (**b**) Penile degloving. (**c**) Residual urethral plate and spongiosum mobilization. (**d**) Gittes test to confirm the Chordee Correction. (**e**) Urethral plate tubularization for fistula closure. (**f**) Spongioplasty. (**g**) Skin closure and final picture

chordee. Scrotal flaps may be a useful alternative in such extreme cases (Fig. 22.16a, b) but hairs on the skin restrict its use. If these measures fail, then a tissue expander is a viable option to cover the skin deficit. The tissue expander is also utilized for penile reconstruction in hypospadias cripples [29]. Full-Thickness Skin Graft is used in the staged procedure to cover the ventral side of the penis and the bed of the neo-urethral plate after resection of all scar tissue and correcting the chordee. Hana et al. (2017) published the results of 85 out of the 215 patients who failed hypospadias who did not have local penile skin to resurface the penis after urethroplasty. Fifty-four patients were resurfaced with scrotal skin, 23 with full-thickness skin grafting, and 4 received a split-thickness skin graft. And six who had 5–8 failed surgeries required the tissue expansion of the dorsal penile skin during 12–16 weeks before the penile resurfacing. Tissue expansion was possible in all six, and they underwent penile skin flap reconstruction of their penises. One patient each had urethrocutaneous fistula and meatal stenosis, which were successfully corrected [13].

In large skin defects with exhausted resources, the old gold Cecil Culp principle is used to stage the urethroplasty and cover the deficiency in the second stage [30]. Weiss (2018) reported their good results, including 23 patients with hypospadias cripple, increasing the detachment of penis from scrotum 9–12 months. The modification of Ceil Culp repair by delaying 9–12 months before take-down enhanced the benefits of a robust vascular bed for wound healing and helped avoid the transfer of hair-bearing scrotal skin penile shaft [31]. Therefore, the procedures mentioned above should be seen as in the armamentarium or strategy to solve the problems seen with hypospadias

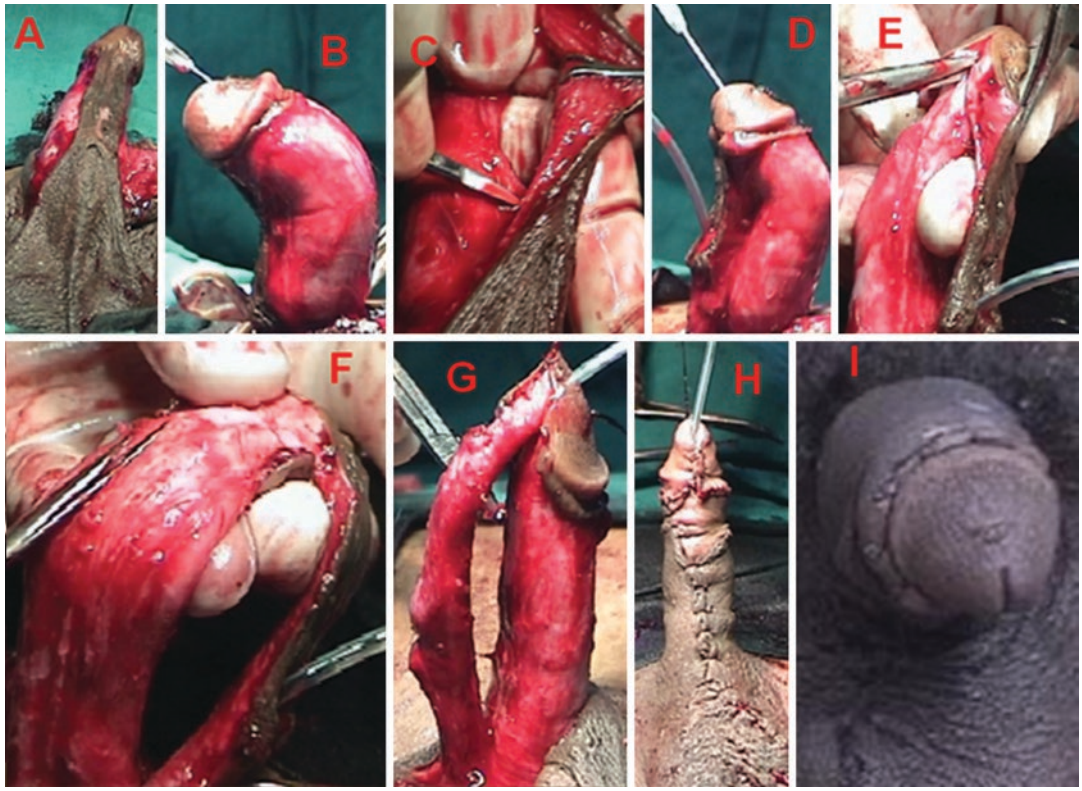

Fig. 22.14 Hypospadias cripple after multiple surgeries having laid-open urethra with significant chordee. (**a**) Penile degloving. (**b**) Gittes test showing severe chordee. (**c**) Midline skin urethral plate and spongiosum mobilization. (**d**) Gittes test showing chordee. (**e**, **f**) Resection of the tethering tissue from the ventral surface of corpora. (**g**) Midline skin Urethral plate and spongioplasty tubularization. (**h**) Skin closure and final picture. (**i**) Postoperative picture Meatus at the tip

crippled. When necessary, a combination of techniques is used in a single or staged repair.

22.3.6 Reconstruction Penile Part Loss

Ischaemic injury to the penis and glans by injection of epinephrine, tourniquet, and infection after corporotomy/corporoplasty is likely to occur and may cause partial or complete loss of penis and glans. Hana (2020) presented his results of hypospadias surgery's grievous complications in a web conference on controversies in hypospadias surgery. He had partial penile/glans loss in five, total glans loss in six, total penile loss in four and fibrotic corpora in one case [32].The penile enhancement surgery may increase 1–2-cm penile length and a 2.5-cm augmentation of penile girth. Penile length can be added by cutting the suspensory ligament. A tissue expander has also been used for increasing the penile length. But the frequent complications, like penile deformity, paradoxical penile shortening, disagreeable scarring, granuloma formation, migration of injected material, and sexual dys-

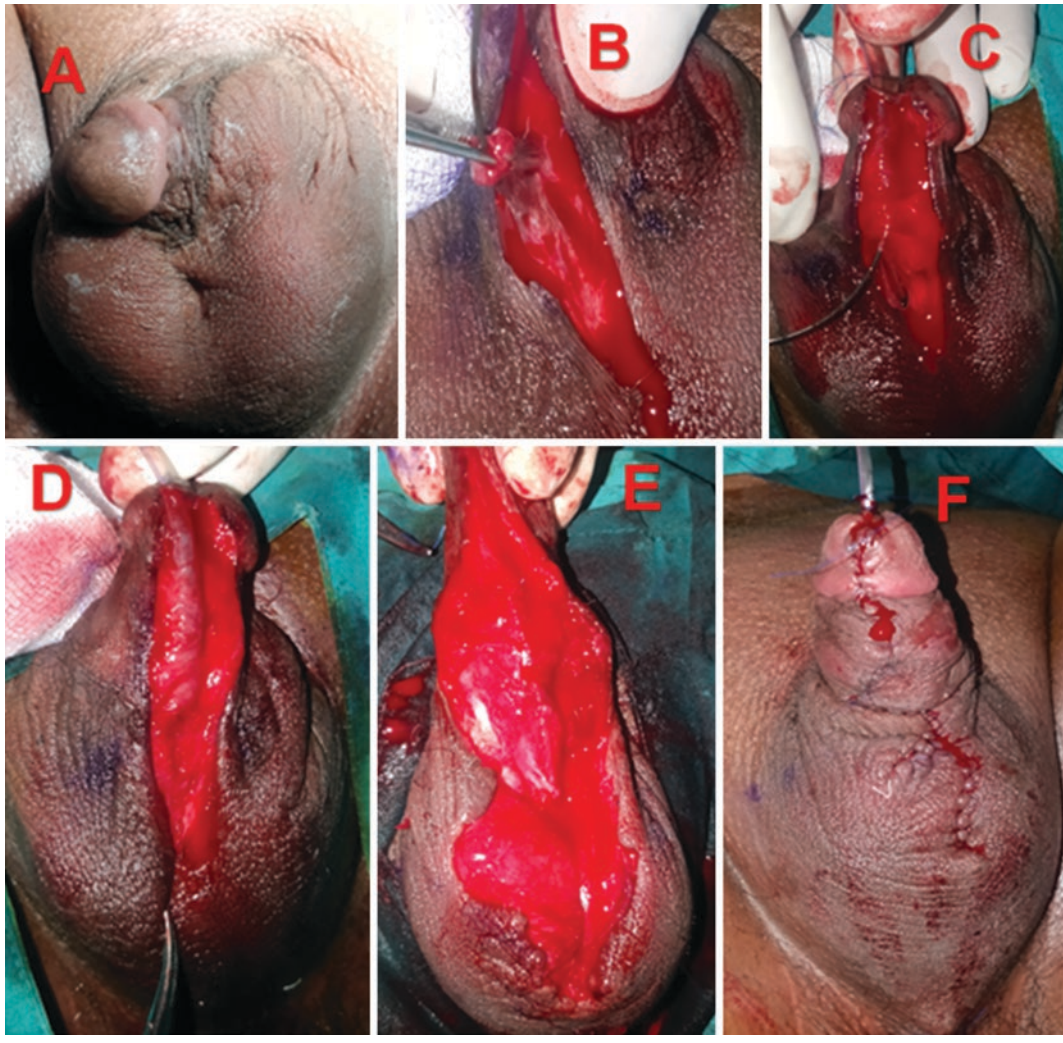

Fig. 22.15 Hypospadias cripple after five surgeries fistula, chordee, torsion, retrusive meatus, and skin scarring. (**a**) Fistula, chordee, torsion, and skin scarring. (**b**) Mobilization of the fistulous tract. (**c**) Excision of the fistulous tract. (**d**) Closure of fistula. (**e**) Dartos cover over the urethra and prepared skin flap for closure. (**f**) Final picture skin closure correction of chord and torsion

function, limits their routine use. Glans can be re-shaped by coronal sculpting with tubed graft/dermal graft placed subcutaneously in patients with a partial or total loss of the glans. Phalloplasty is recommended in complete loss of penis or fibrosis of corpora. The technique used for phalloplasty is Bevan and Decosto abdominal flap or forearm flap phalloplasty [33]. These viable options help reconstruct a functional penis. With good results, Hana used the abdominal flap phalloplasty in four cases and forearm flap phalloplasty in one patient.

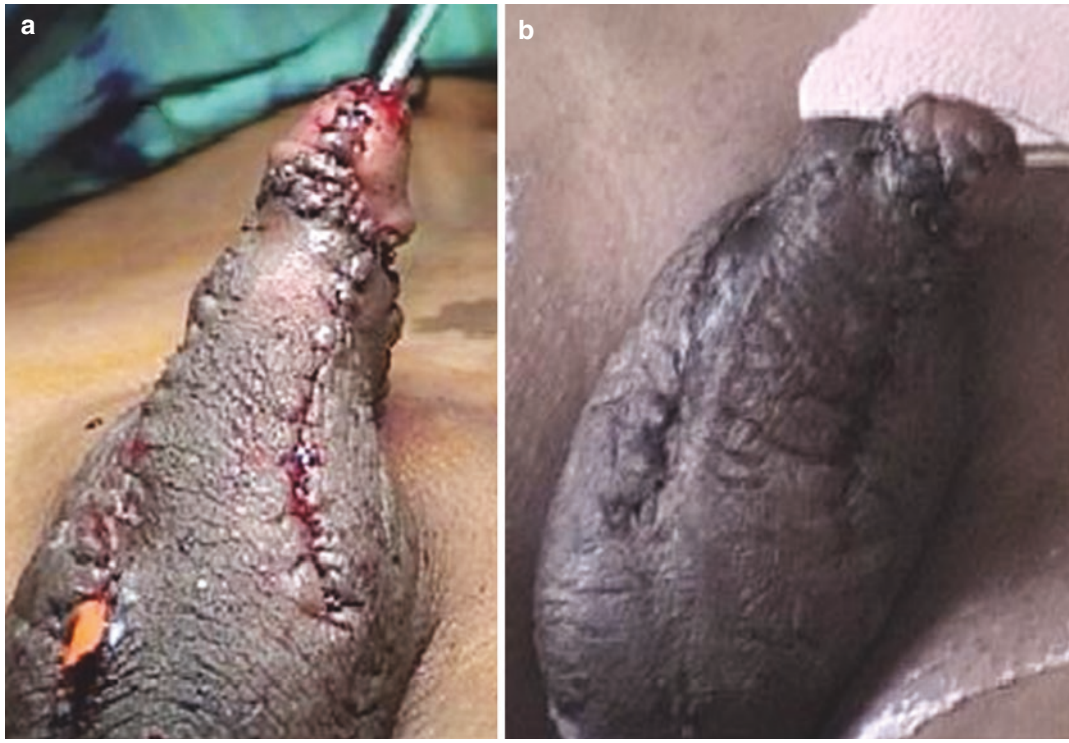

Fig. 22.16 Showing scrotal skin flap (**a**, **b**) for skin closure after failed hypospadias repair

22.4 Conclusions

No single technique is considered standard of care for crippled hypospadias repair; they have multiple problems of variable deformities and the consequent functional abnormality. Evaluation and treatment of each patient should be individualized. The surgeon's experience with all surgical techniques of hypospadias repair is an important factor in a successful outcome. Problems can be grouped in as and treated accordingly:

1. Residual Chordee/Penile Torsion—Penile degloving, urethra/urethral plate/Vascular pedicle mobilization, Plication procedures. Corporotomy/Corporoplasty.
2. Reconstruction of the urethra: In single or preferably two-stage urethroplasty; Previous urethra, Residual urethral plate, Peri fistula skin flap, penile skin flap, onlay flap, Bladder/Buccal mucosal graft
3. Healthy tissue cover: Dorsal, ventral, and scrotal Dartos/spongioplasty, Tunica vaginalis flap.
4. Resurfacing of the skin: Primary skin closure, dorsal releasing incision, dorsal skin flap, Scrotal flap, and free skin graft, tissue expanders, and Cecil Culp staged repair
5. Reconstruction of penile part loss: Glans supplementation. Penile implants and penile reconstruction.

Tissue expanders are safe and effective for acquiring genital skin for resurfacing in selected cases of hypospadias cripples and should have a place in the surgical armamentarium of complicated, redo-hypospadias and hypospadias cripple repair. Alternatively, penile skin graft, non-hair bearing skin grafts,

Buccal mucosal, or bladder mucosal grafts are used to reconstruct the neo-urethra. In severe cases, Cecil Culp urethroplasty may be used where either skin is unavailable to cover the penile shaft, and urethroplasty needs support.

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