Late Postoperative Complications of Hypospadias Repair

21

Amilal Bhat

21.1 Introduction

Though there has been much advancement in Hypospadiology, and the results of hypospadias repair have improved significantly, however still, complications are inevitable regardless of surgical experience and technique used to repair hypospadias. High success rates have been reported in childhood, but the follow-up has been short in most studies. Available information about these patients at adolescence and sexual maturity are less. Some childhood hypospadias repair complications like urethral stricture and chordee may develop after many years and may present late. The complications may be as high as 54% in long-term follow-up even in experienced hands. The first complication may appear even after five years, and the most prolonged interval documented has been 14 years. Patients/parents of these children are asked to follow-up until their transition to adolescence and adulthood. So, the urination problems, cosmetic appearance, sexual dysfunction, infertility, and psychological issues can be addressed [1]. Primary hypospadias repair patients older than six years at the time of surgery are less satisfied than their younger counterparts. These problems become of more of a concern to the patients after puberty due to the changes in physical appearance, more awareness and interest in sexual activity. The patient requires rectification of urethral stricture, fistula and diverticula, meatal stenosis, residual/persistent chordee, urethral hairs and stones and recurrent UTI. The complications are likely to involve a single compartment of the male genitalia (urethra, corpora cavernosa, glans, or penile or scrotal skin) or a combination. Surgical therapy of the patients is challenging, as the available tissue for the construction of neo-urethra has already been utilized. The most crucial issue in complications of hypospadias repair to be addressed is why hypospadias surgery failed. Some of these may be due to the inexperience of the operating surgeon or improper application of the procedure and others from the tissues' failure to heal properly. Complications are more significant in proximal hypospadias than distal one, flap repair than TIPU, urethral plate resection than preservation, severe versus minimal chordee, and healthy tissue cover versus no cover [2].

A. Bhat (✉)
Bhat's Hypospadias and Reconstructive Urology Hospital and Research Centre, Jaipur, Rajasthan, India

Department of Urology, Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan, India

Department of Urology, Dr. S.N. Medical College, Jodhpur, Rajasthan, India

Department of Urology, S.P. Medical College, Bikaner, Rajasthan, India

P.G. Committee Medical Council of India, New Delhi, India

Academic and Research Council of RUHS, Jaipur, Rajasthan, India

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21.2 Common Postoperative Complications

These late complications can be divided as follows:

1. External urinary meatus and glans—Meatal stenosis, retrusive meatus and glans dehiscence, glanular scars
2. Urethra—Fistula, stricture, and diverticulum, laid-open neo-urethra, hairy urethra, urethral stones
3. Penile shaft—Chordee, torsion, and aesthetic deformity, inclusion dermoid, granuloma
4. Psychosocial and psychosexual

21.3 External Urinary Meatus and Glans

21.3.1 Meatal Stenosis

There are no strict criteria defined for meatal stenosis. Snodgrass defined a meatal calibre of less than 8 French is to be considered as meatal stenosis. Incidence varies from 0.7% to 21% [3]. It may be due to technical issues during the surgery, like fashioning a narrow urethral meatus or suturing the glans wings too tight. Glanular wrap and urethral tunnelling are surgical techniques to position the meatus at the tip of the glans. Performing either of the techniques erroneously may result in meatal stenosis. Meatal stenosis can be prevented in the glanular wrap technique by generously incising ventrally up to the corpora and laterally along both sides of the site proposed for neo-urethral placement. An adequate plane between the corpora and glans tissue tips is created to prevent unwanted tension, which risks the collapse of the underlying neo-urethra. Deepening the glanular incision is mandatory if the approximation of the glans cannot be accomplished without tension.

An adequate size sound for the age is interposed between the neo-urethra with its indwelling stent and the glanular wrap when the glans is approximated (Fig. 21.1). Suturing of the glans wings is done up to mid-glans to have conical meatus and avoid the meatal narrowing. The glans tunnelling technique is an acceptable alternative in the well-formed glans with a normal-appearing meatal cleft. The scissors are passed deep through the glans, and an ellipse of the deeper tissue along with epithelium at the meatal cleft is excised to create a tunnel. The completed tunnel must allow the easy passage of an 18 French sound.

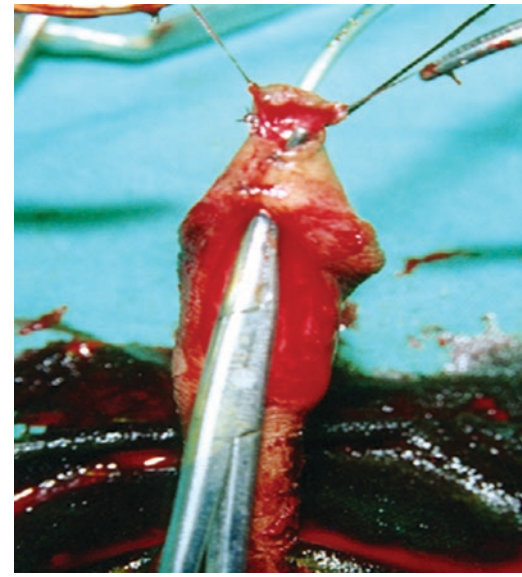

Fig. 21.1 Diagram showing adequacy of glanular wings

21.3.1.1 Treatment of Meatal Stenosis

1. Meatal dilatation
2. Meatotomy
3. Meatoplasty
4. Redo repair

Meatal narrowing at a one-month visit may be due to glanular oedema, and meatal calibration is sufficient, but if it persists at the 3-month visit, then meatal dilation is indicated. A meatotomy may be required for persistent stenosis. The scarred meatus is incised dorsally or ventrally, depending on the position of the meatus, and the skin is re-approximated to urethral mucosa, horizontally opening the urethra in a Y–V fashion. In more severe cases, an extensive glanular meatoplasty may be required. In

these situations, a ventral transverse onlay island flap or a tubularized incised urethroplasty may be used and covered with glans wings, or a ventral flap is developed and folded into the split glans. Severe meatal stenosis with proximal extension or BXO may require a redo repair with a buccal mucosal graft. No studies were found reporting the results of meatal dilatation.

21.3.2 Retrusion of Meatus

Meatal retrusion is occasionally encountered after the meatal advancement with glanuloplasty incorporated (MAGPI) technique and the Mathieu hypospadias repair in which the glansplasty sutures have given way. Incidence varies from 1.2% to 26% [4, 5]. Now incidence has come down because most of these patients are treated with TIP repair. Meatal regression is caused by the selection of the wrong repair for the patient's anatomic features. The urethra, which is immobile or the meatus that is non-compliant, results in retrusion of the neo-urethra to its original position. In the Mathieu repair, an inadequate ventral skin flap may lead to the glansplasty sutures' premature dissolution with the same result. The consequences of this complication are predominantly cosmetic rather than functional. However, if significant splaying or deflection of the stream occurs, revision of the meatus is advisable. Revision of urethroplasty with TIP repair (Fig. 21.2a–f) yields good results in such cases.

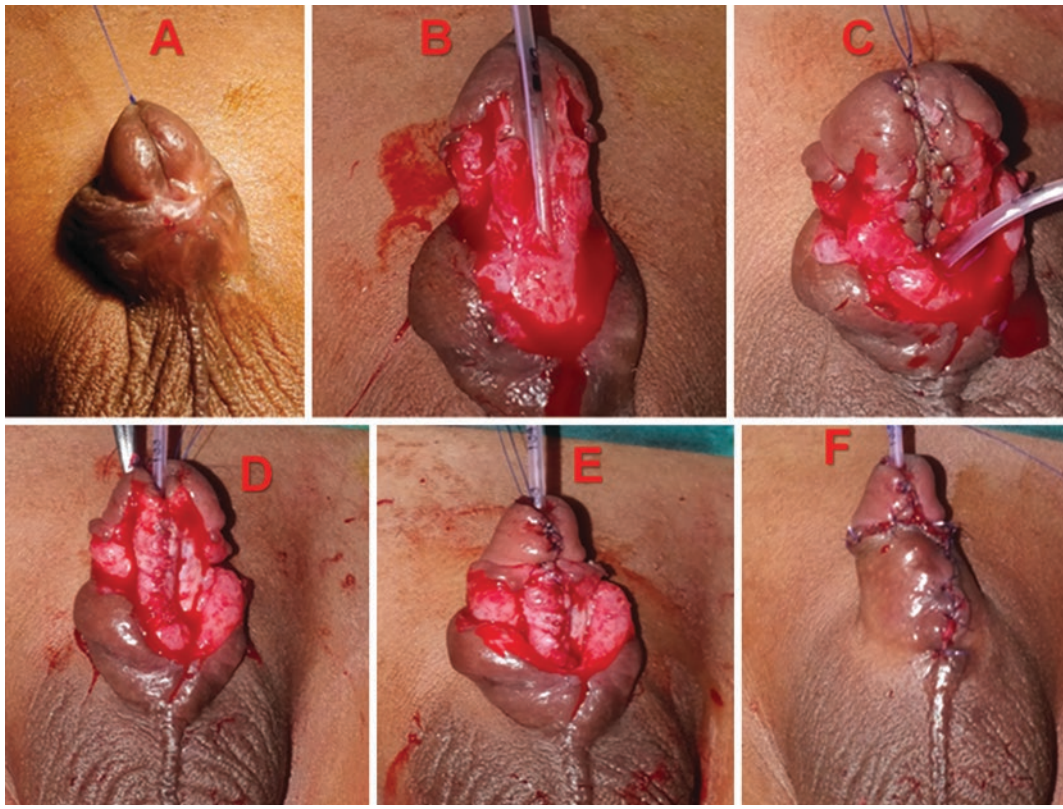

Fig. 21.2 Tubularized urethral plate urethroplasty in a case of fistula and retrusive meatus. (**a**). Two-year-old male with retrusive meatus after TIP. (**b**). Penile skin degloving and spongiosum mobilization. (**c**). Dorsal inlay graft of residual prepucial skin. (**d**). The urethral plate tubularization. (**e**). Spongioplasty and glanuloplasty. (**f**). Final picture after skin closure

21.3.3 Glans Dehiscence

Complete or partial separation of glanular wing is defined as glans dehiscence. The incidence of glanular dehiscence varies from 1.7% to 6.6%. Glans size is a crucial variable in glans dehiscence. Glanular size of less than 14 mm has more chances of dehiscence. Snodgrass reported a 3.5 fold increase in dehiscence in cases with glans size less than 14 mm [6]. Glans dehiscence is more in proximal and re-operative TIPU than the distal one. Incomplete mobilization of granular wings contributes significantly to dehiscence. Extended mobilization of glanular wings deep up to corporal bodies' tip creates wide glanular wings for tension-free closure of glans wing to reduce the glans dehiscence. Few studies have reported increased glans dehiscence when the interposing dartos high up under the glans wings [7], but others have not found it. According to the urethral plate's size and glans wings, glans dehiscence requires second surgery as re-operative TIPU with or without dorsal inlay graft (Figs. 21.3a–f, 21.5a–h). The results of redo surgery are usually good.

21.3.4 Glans Scars

Scars on the glans are rarely discussed as a hypospadias repair complication, but this is of cosmetic concern to the parents and patients. The scars are usually seen at the stay suture site dorsally (Fig. 21.4a–f), ventrally when the glanular sutures are taken through and through and/or mattress sutures are applied, and partial dehiscence of the distal-most sutures. The causes of scar formation are the needle's calibre, the type and size of the suture material, duration of suturing, infection, or an abnormality in tissue healing. If anchoring is required, it can be done using tapes or thinner materials other than silk or

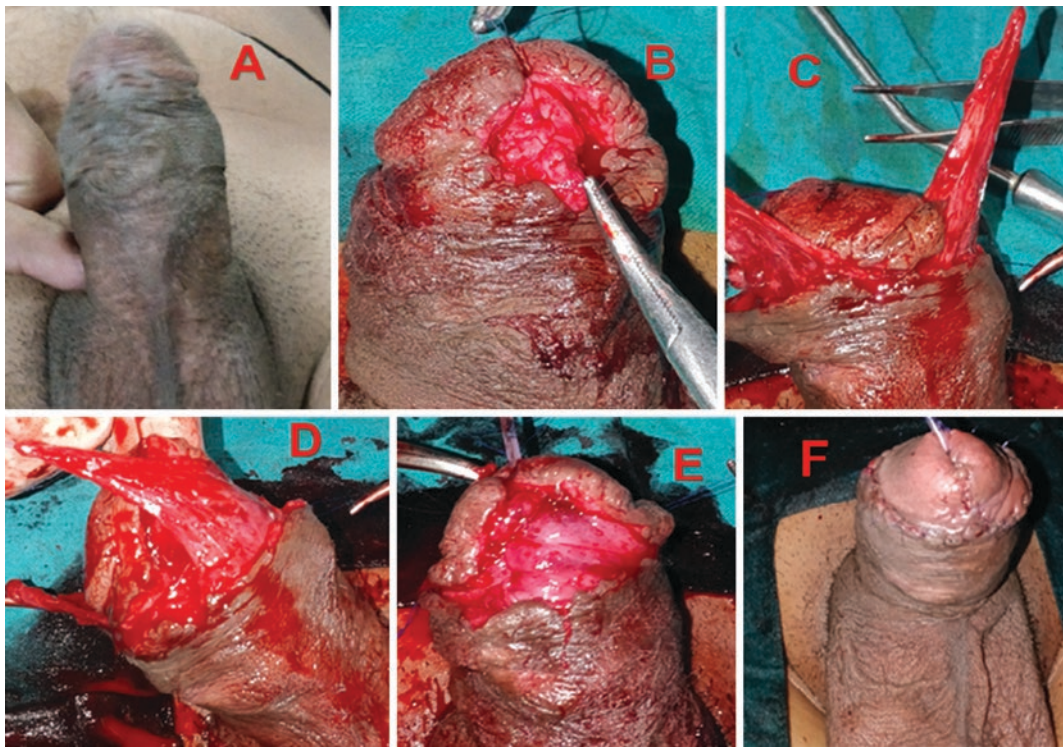

Fig. 21.3 TIPU and spongioplasty in glans dehiscence. (**a**). Glans dehiscence. (**b**). Tubularization of urethral plate and spongioplasty. (**c, d**). Double dartos flaps raised for covering of neo-urethra. (**e**). Covering the neo-urethra with double dartos. (**f**). Final picture after skin closure

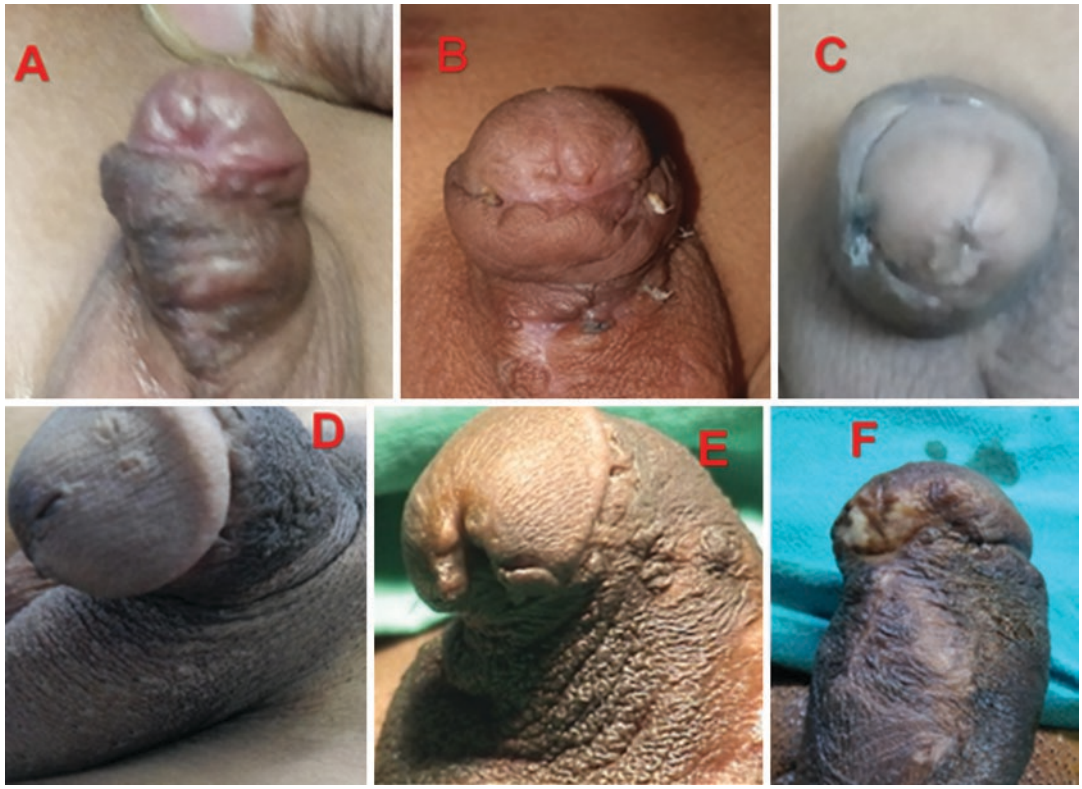

Fig. 21.4 Glans scarring after hypospadias repair. (**a, b, c**). Isolated glans scarring. (**d, e**). Glans scarring associated with chordee. (**f**). Glans scarring with penile scarring

anchoring through preputium. Sub-epithelial sutures for glans closure prevent these scars. Ugly scars can be repaired by excision of the epithelium and suturing it again by sub-cuticular sutures. A scar associated with partial dehiscence of glans requires the revision of TIPU and glansplasty (Fig. 21.5a–h).

21.4 Urethra

21.4.1 Urethrocutaneous Fistula

Urethrocutaneous fistula is the most common and major hypospadias repair complication. The more extensive the urethroplasty, the higher is the frequency of this complication. Though fistula incidence has been steadily decreasing with microsurgical equipment and improved operative technique, it is still the most troublesome complication. The urethral fistula incidence varies from 4% to 28% [8]. The development of the fistula is multifactorial. Oedema-attenuated vascular supply, infection, and haematoma may impair healing of the newly reconstructed urethra. In addition, urethral obstruction distal to repair from meatal crusting or stenosis may lead to high-pressure voiding and disrupt a proximal suture line. Finally, technical factors such as overlapping suture lines, inadequate inversion of the epithelium, or poorly absorbable suture material have been implicated. Detailed pathophysiology is discussed in Chap. 20 on acute complications of hypospadias repair.

The site of the fistula may be according to the type of hypospadias and previous surgical technique (Fig. 21.6a–i). Sub-coronal fistulae are most common in distal hypospadias repair. Urethral fistula management depends on location, size, and time interval from the surgical procedure. A urine leak usually becomes apparent in the first few days after initiation of voiding, and most are noticed in the first six months, but some cases may appear after many years. Small fistulae

Fig. 21.5 TIPU in glans scar and dehiscence. (**a**). Deformed glans with scarring and dehiscence. (**b**). Skin incision marking the urethral plate. (**c, d**). The urethral plate tubularization. (**e**). Spongioplasty. (**f**). Dartos cover over spongioplasty. (**g**). Glanuloplasty. (**h**). Final appearance after skin closure

noted perioperatively, without concomitant inflammation or meatal stenosis, occasionally may close. Larger fistulae and those persisting beyond several weeks invariably require operative intervention. This intervention must be delayed until tissues have thoroughly healed from the previous operation. Six months is generally adequate time to allow ingrowth of blood vessels and resolution of inflammation and oedema. So, fistula repair should be done 6–12 months after the surgery.

21.4.1.1 Prevention

Fistula can be prevented by using inverting sutures with fine suture material. The interposition of a healthy tissue layer plays a vital role in the prevention of fistula. Various interposing healthy tissues to cover the neo-urethra described in the literature are transverse island dorsal subcutaneous flap, dorsal, lateral, ventral, or scrotal dartos flap, single or double dartos flaps, de-epithelized local penile skin, preputial flap, para-urethral tissue, tunica vaginalis flaps, and spongioplasty.

21.4.1.2 Dorsal Dartos

The dorsal dartos flap is the most commonly used as healthy interposing tissue. However, nil fistula was reported by Djordjevic et al. with single dartos flaps [10], while others have reported fistula rates of 13% and 26% [11]. Few studies reported having a better outcome in reduction of fistula formation with the double dartos flaps. But the statistically significant difference was reported only by Appignani et al. [12]. Maarouf A M. et al. (2012) found a higher fistula rate (8%) in the urethroplasties covered with a single layer than with a double layer (none) [7]. However, the difference was not statistically significant (P = 0.1). Elsayed et al. had no significant difference in ure-

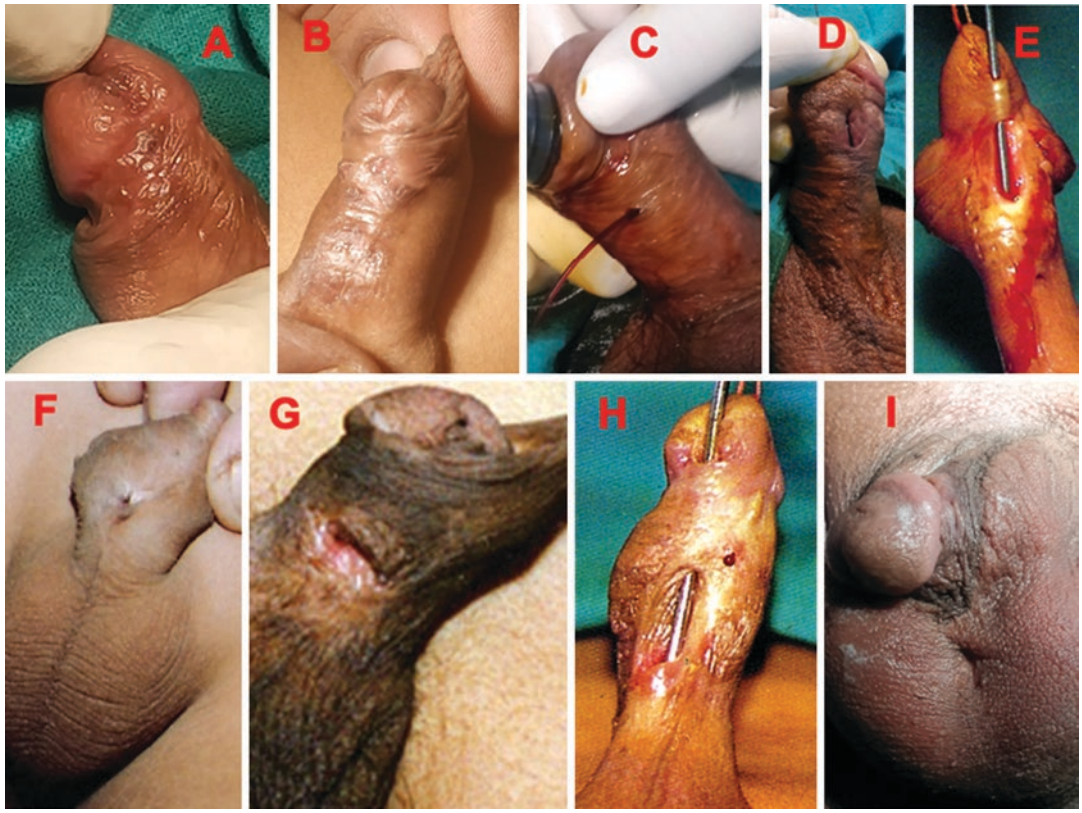

Fig. 21.6 The site and size of fistula. (**a**). Small sub–coronal, (**b** & **c**). Small mid-penile, (**d** & **e**). Large mid-penile, (**f**). Small proximal penile, (**g** & **h**). Large proximal penile, (**i**). Scrotal

throcutaneous fistula between a double-layered dorsal dartos flap and a single layer covering the urethra as a part of TIP urethroplasty [13]. These dartos flaps can be used as a second heathy tissue cover after spongioplasty to reduce the fistula rate.

21.4.1.3 Spongiosum

The results of spongioplasty and spongioplasty with dartos cover are almost similar in both groups of our study. But Bilici et al. (2011) compared the neo-urethra cover with the dartos alone (75 patients) and spongioplasty with the dartos flap (86 patients). They reported 8% fistula formation with dartos alone while no fistula in spongioplasty with dartos cover [14]. They recommended using the corpus spongiosum with the dartos flap as healthy interposing tissue, as it can be applied easily and effectively to prevent fistulae formation. We also found a reduced fistula formation rate, even in proximal hypospadias repair, when combined with spongioplasty [15]. We compared the complication rate of spongioplasty alone vs spongioplasty and a dorsal dartos flap and did not find a significant difference between the two groups [16]. Thus, spongioplasty, when feasible, is adequate as an interposing layer and may be combined with a dorsal dartos flap or other healthy interposing tissue.

21.4.1.4 De-epithelialized Skin Flap

Durham Smith (1973) first described the de-epithelialized overlap flap in second-stage hypospadias and fistula reported only in 2% of cases [17]. Belman (1988) used the de-epithelialized preputial skin flap as a vascular cover for hypospadias repairs [18]. The same was reported later by many surgeons and Snodgrass himself in TIP procedure. Belman reported a fistula rate of 3.5% after covering the neo-urethra with a de-epithelialized preputial skin flap wrap [18].

21.4.1.5 Tunica Vaginalis

Tunica vaginalis is an excellent interposing tissue and is the first choice in cases of fistula repair, re-operative surgery, and proximal hypospadias repair. Snow et al. (1995) first described the use of tunica vaginalis as an interposition graft and reported a 9% fistula rate in their series [19]. Shankar et al. and Handoo reported similar results in their study [20, 21]. Snodgrass et al. could reduce the fistula rate to 0% using tunica vaginalis flap in their recent study [22].

21.4.1.6 Evaluation and Investigation

Effective management demands a careful assessment of associated urethral disorders such as chordee, stricture, and diverticula. The penile shaft must be evaluated for the presence of other unrecognized fistulas. Distension of urethra with saline mixed Betadine will delineate the hidden fistulae. The fistula tract can be cannulated with a lacrimal probe to determine the site of entrance into the urethra. This manoeuvre is useful in planning the orientation of skin flaps for coverage of the fistula. The lacrimal probe can also be a valuable aid for the dissection of the fistula tract. A micturating cystourethrogram is advisable to delineate the number of fistulas, stricture urethra, proximal dilatation of the urethra, and diverticula. Cystoscopy may help see the size of the urethra and healing after previous surgery, especially to see any hair growth in the cases of prior skin flap surgeries, location and status of urethral diverticula.

21.4.1.7 Treatment

Once the fistula's origin is appreciated, it can be closed with a delicate 7–0 or finer absorbable suture. Small-calibre fistulas can be closed primarily without compromising the diameter of the urethral lumen. An ideal fistula repair should have:

1. Delicate tissue handling
2. Fistulous tract excision
3. Inversion of urethral mucosa
4. Needlepoint cautery
5. Use of magnification
6. Late-absorbable proper suture material
7. Avoiding overlapping of suture line
8. Multilayer closure with well-vascularized tissue

The fistula's closure involves three critical steps: excision of the fistulous tract and closure of the fistula with fine sutures, covering the repair with a healthy interposing tissue layer and skin closure, avoiding superimposition suture line.

A small coronal fistula is excised, and penile shaft skin is advanced to cover the defect. If retrusive meatus with fistula, the ledge between meatus and fistula is excised, and TIPU with spongioplasty (Fig. 21.7a–i) is done. If the urethral plate is not wide, then dorsal inlay skin graft/buccal mucosal graft (Fig. 21.8a–g) or onlay flap urethroplasty is done to avoid the stricture and tension-free closure. Larger fistulas may require coverage with a trap-door or island flap of penile shaft skin. Multiple fistulae can be combined, and closure is done with or without the dorsal inlay. If the defect is larger after connecting all fistulae, then onlay flap urethroplasty is done. In general, better results can be achieved when a second layer or flap coverage is possible, especially in recurrent urethral fistula cases. Skin coverage can be obtained by several methods to avoid overlap of urethral and skin suture lines. Despite a well-performed repair, 4–30% or more of fistulas will recur. Sunay M et al. (2007) reported fistulas at the distal penile in 43.2%, mid in 37.5%, and 31 19.2% in the proximal penile region [9]. There was no statistically significant relationship between the fistula site, size and number of the fistula with success rate.

Snodgrass (2015) et al. had only 5% recurrence after simple fistula and interposing dartos flap [22]. This recurrence rate can be decreased by interposing a non-epithelialized layer between the urethral closure and the skin. Various investigators advocate the use of a scrotal based tunica vaginalis flap, scrotal dartos tissue and de-epithelialized flap. There is no need to divert the urine for simple repairs, but it is advisable to divert the urine for 7 to 10 days with a silicone urethral stent for more extensive repairs. Finally, in cases of severe fistula problems, buccal mucosa grafts have been used with some success.

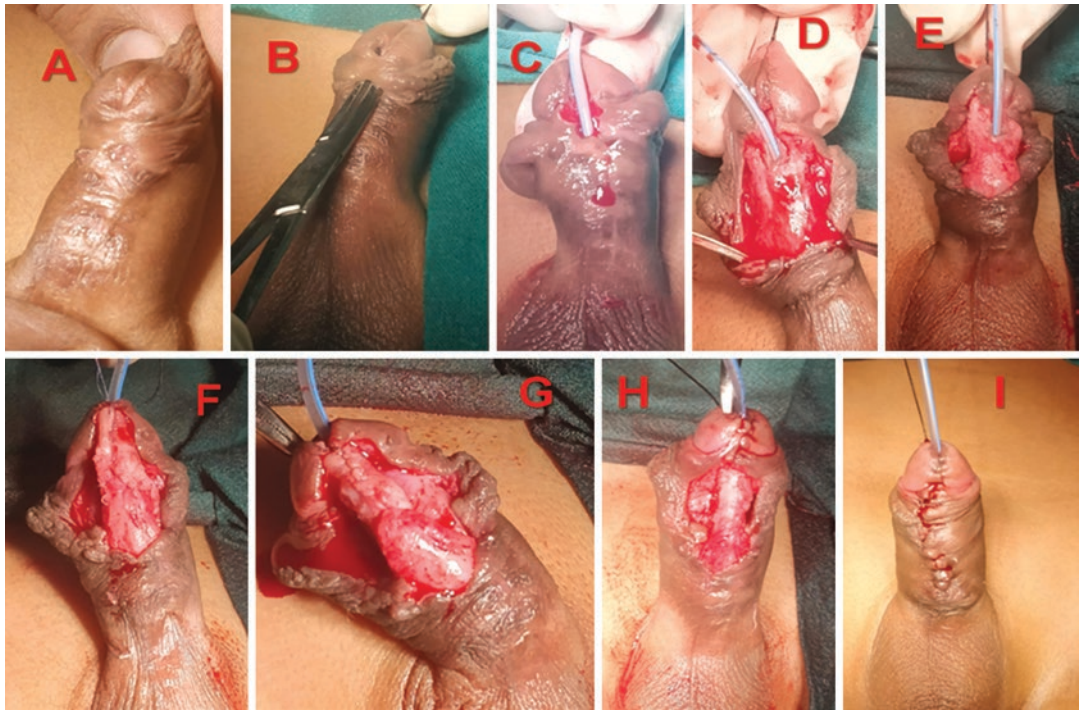

Fig. 21.7 TIPU with spongioplasty in retrusive meatus with fistula. (**a**). Retrusive meatus with urethrocutaneous fistula and glanular chordee. (**b**). Haemostat in the fistula showing skin ledge. (**c**). Laid-open distal urethra after incising the skin ledge. (**d**). Urethral plate and spongiosum mobilization. (**e**). Urethral plate mobilization into the glans. (**f**). Urethral plate tubularization. (**g**). Spongioplasty. (**h**). Glansplasty. (**i**). Skin closure

21.4.2 Stricture Urethra

Stricture of the urethra is the second most frequently reported complication after fistula in hypospadias surgery. Strictures are likely to form at anastomotic suture lines of the urethra and neo-urethra, sub-meatal sutures of the glans closure, or incision site of the urethral plate. Three months after the surgery, the strictures become apparent with the decreased urinary stream force, straining during voiding, or urinary tract infection. Sometimes the patient may present with splaying of the urinary stream, urethrocutaneous fistula, or rarely urinary retention. There are several factors implicated in the formation of neo-urethral stricture. Poor design of the neo-urethra, insufficient calibre, tension on suture lines, and inadequate spatulation of the urethra at the anastomosis are important factors. Trauma, infection, and tissue ischaemia can result in inflammation and concentric scarring of the lumen. In tubularized pedicle flaps, a stricture may be functional, secondary to a redundant neo-urethra kinking at the proximal anastomosis. Although there were initial concerns that TIP's relaxing incision would create strictures, it is rarely encountered. Diagnosis of the stricture with accurate length and location is done by urethrogram and is confirmed by cystoscopic examination with a 0-degree lens under anaesthesia. Proximal dilation of the urethra (Fig. 21.9a, b) may be delineated in the urethrogram and help plan the treatment.

Others favour diagnosis with symptomatology only, and preoperative cystoscopy without urethrogram [23]. We prefer a urethrogram for better planning of the treatment. As long as stricture with the narrow urethra, it may not be possible to see the stricture's proximal extent**.**

Management of Stricture Methods applied for the management of stricture are

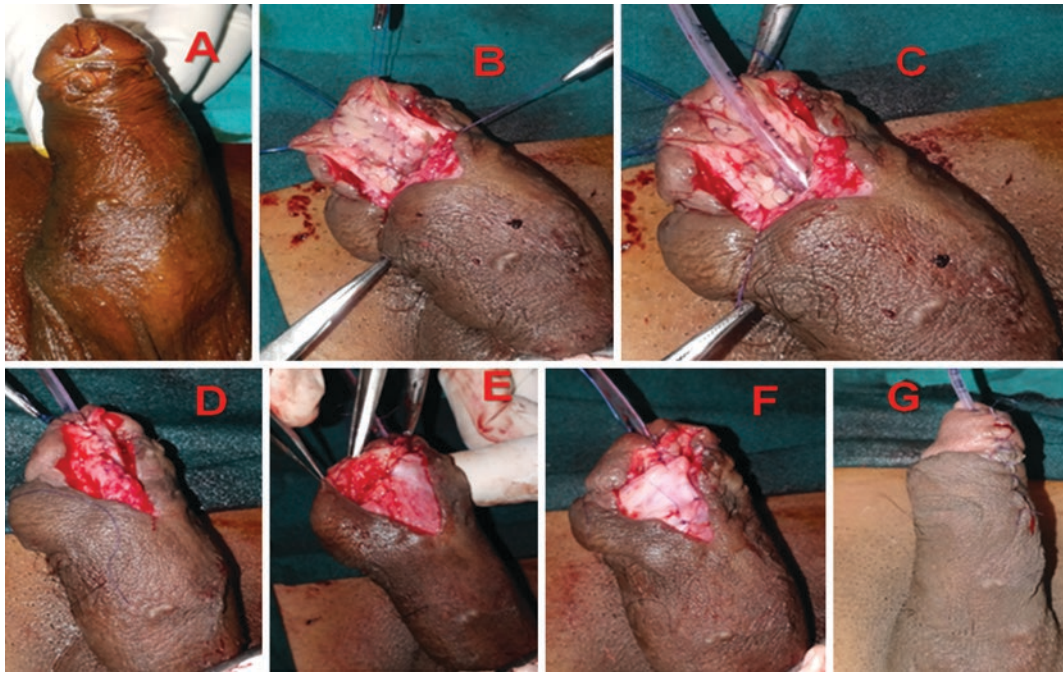

Fig. 21.8 TIPU with dorsal buccal mucosal inlay double dartos flap cover in fistula repair. (**a**). An adult patient with glans dehiscence and sub-coronal fistula. (**b**, **c**). Urethral plate mobilization and placing the buccal mucosa inlay graft. (**d**). Urethral plate tubularization. (**e**). Spongioplasty and raising the double dartos flap. (**f**). Sutured double dartos flaps covering the neo-urethra. (**g**). Final appearance after glansplasty and skin closure

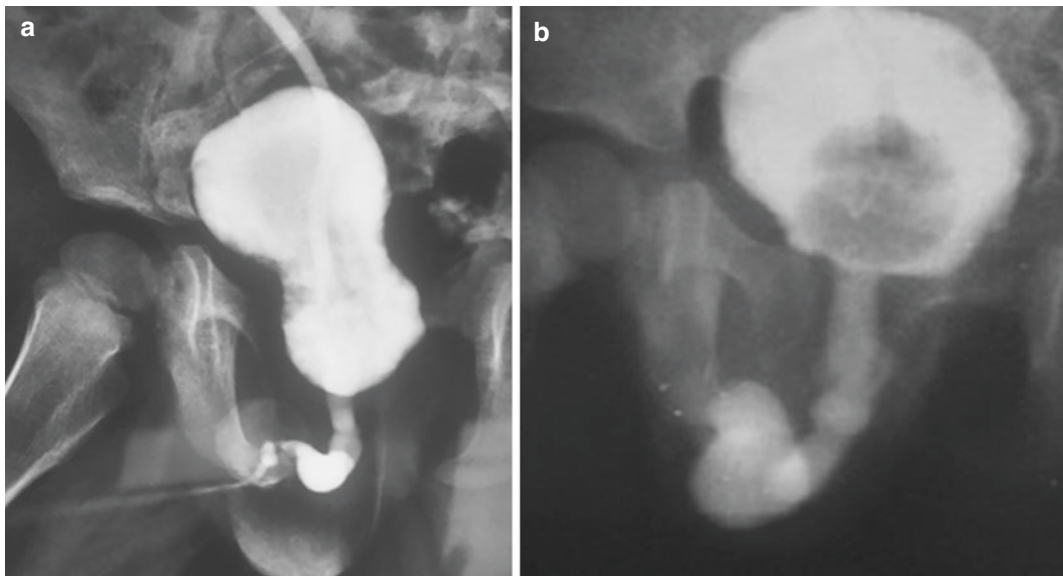

Fig. 21.9 RGU and MCU in post hypospadias stricture. (**a**). Retrograde urethrogram showing short segment urethral stricture with proximal dilatation. (**b**). Micturating cystourethrogram showing blind-ending urethra with proximal dilatation

1. Urethral dilatation
2. VIU
3. Excision & primary anastomosis
4. Replacement urethroplasty—Adjacent skin flaps, pedicle flaps, and tube grafts, buccal mucosa grafts—single/two stage

These strictures are amenable to dilatation or visual internal urethrotomy. Husmann and Rathbun showed success rates of 22%–24% with urethrotomy for stricture disease after hypospadias repair, whether clean intermittent catheterization was employed or not. Success rates of 72% and 63% have been reported for onlay flap urethroplasty strictures and post TIPU strictures, respectively [24]. Visual internal urethrotomy is more effective in TIPU strictures and short anastomotic than tubed grafts or tubed flaps repairs strictures. Repeated dilation or urethrotomy in such patients may worsen the existing fibrosis, better be avoided. Failed dilatation or VIU and a long, complicated stricture is an indication of revision urethroplasty. Choice of urethroplasty is end to end in a small segment stricture but has more recurrence chances. Most of the cases are suitable for dorsal inlay. Recently Saavedra and Rourke (2019) coined the term HAUS (Hypospadias Associated Urethral Strictures), grouped the patients in four, and advised the treatment modalities as single-stage, two-stage urethroplasty, and perineal urethrostomy according to the group [25]. In our opinion, most hypospadias strictures can be managed in one- or two-stage using buccal or labial graft. An algorithm is proposed for the management of post hypospadias strictures (Fig. 21.10).

21.4.3 Urethral Diverticulum

Diverticula are diffuse dilation of either the neo-urethra or the native urethra. Proximal dilation of the native urethra occurs secondary to a stricture in the neo-urethra or otherwise in flap repairs after six months. They present with recurrent urinary tract infections, dribbling of urine, weak stream, and ballooning of the undersurface of the penis with lateral displacement of the penile shaft during micturition. The patient or parents have to milk the urethra to empty the collected urine in the urethra. The diverticula are more frequently observed in patients with onlay flaps and two-stage repairs because of the lack of spongiosum and a longer urethroplasty. The reported incidence of urethral diverticula in tube and flap urethroplasties is 7–12% [26, 27]. The urethral diverticula rarely occur in TIPU; Snodgrass reported in only three patients (0.33%) of 885 cases of TIPU and 1.43% in two-stage graft repairs [28]. Various factors for diverticula are lack of supporting tissue, turbulence due to poor fixity of urethra, distal resistance at the glans with or without metal stenosis or stricture urethra, and a sudden step-off in diameter at the level of the neo-urethral anastomosis. Surprisingly, distal obstruction is not so commonly associated with post hypospadias surgery diverticula. Snyder et al. found stricture only in one out of thirteen cases [29]. Snodgrass reported diverticula in 5 patients out of nine who underwent Byars flap repair in proximal hypospadias, but none had distal obstruction [22].

Retrograde and micturating urethrogram helps delineate the urethra for distal obstruction, size of the diverticula, and any associated fistula. Cystoscopy before a repair will make the surgeon wiser about the status of the urethra, diverticula, stones in diverticula, prostatic utricle, and any secondary changes in the bladder. The urethra and diverticula's distension with saline on the operating table will show the diverticula's size and leakage to locate the fistula. A localized diverticulum is usually excised and sutured longitudinally to prevent narrowing of the urethra. In large diverticula cases, the tissue is typically elastic and well-vascularized, making it suitable for repair. Repair is done by excising the excessive part of the diverticular skin wall. A portion of it is denuded to cover the suture line and neo-urethra, creating a pseudo spongiosum (Fig. 21.11a–f). The technique is called pseudospongioplasty. A tunica vaginalis flap cover over the repair

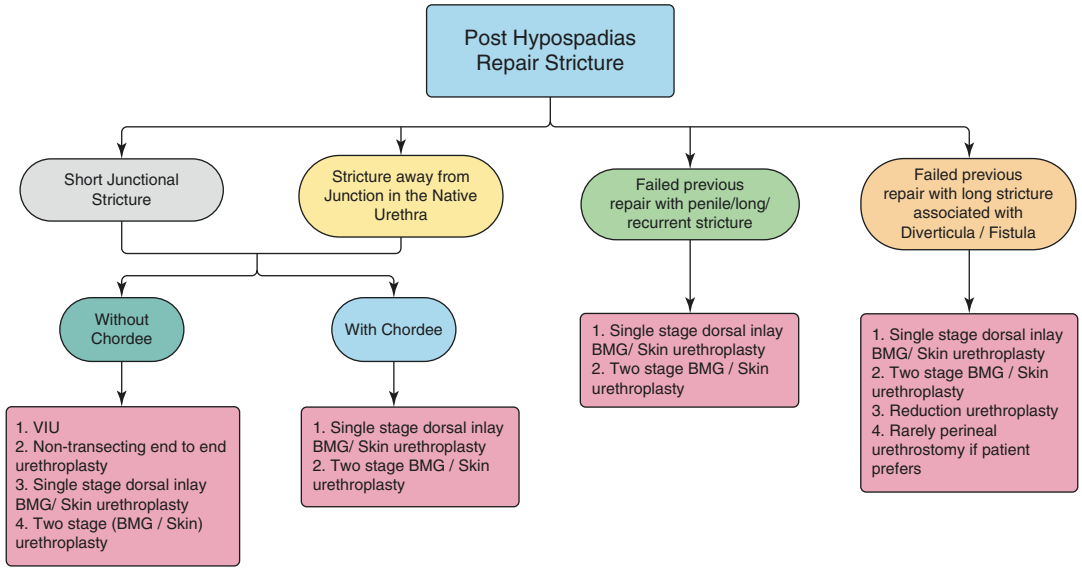

Fig. 21.10 Algorithm for post hypospadias repair strictures

Fig. 21.11 Reduction urethroplasty in urethral diverticula. (**a**). An adult patient with a urethral diverticulum. (**b**). Skin incision showing saline-filled diverticulum. (**c**). Laid-open diverticula. (**d**). Urethral skin trimmed to create the urethral plate of adequate size. (**e**). Urethral plate tubularization and covering it with dartos. (**f**). Skin closure

effectively decreases the urethrocutaneous fistula rate. Alternatively, a dartos flap or a de-epithelialized flap may be employed. Results of diverticula repair are good, but there are chances of fistula and recurrence of the diverticula. Snyder et al. repaired the diverticula in 13 cases with a success rate of 76.23% [30].

21.4.4 Hairy Urethra

This complication is seen in flap procedures where hair-bearing skin is used and incidence rate as high as 5–15% [8]. The hirsute graft may cause dysuria, infection, urethral calculi, urethral moustache, and hair bezoars. Hairy urethras are most commonly seen in older patients with multiple staged procedures. In modern hypospadiology, a hairy urethra is rare, as hair-bearing skin is used less frequently, but the Koyanagi procedure may have this [31]. The best solution to the problem is to avoid using the hairy urethra. The best replacement hairy skin is the inner prepuce, which most closely resembles the urethra and other substitutes include non-hair-bearing skin of the inner arm or upper thigh, bladder mucosa, and buccal mucosa when prepuce is not available.

Treatment

1. **Chemical Epilation**: Singh and Hemal instilled a Thioglycolate dilute solution into the neo-urethra three monthly to ensure complete tricholysis and prevention recurrence of hair growth in future [32]. But this modality fails, and recurrence has been documented.
2. **Electro-epilation**: Local measures are to remove the hair and calculi endoscopically and fulguration of the follicles at the same time. Usually, the stone associated with hair can be removed, but it is challenging to fulgurate all hair follicles.
3. **LASER (CO_2 YAG)**: Cohen S et al. used CO_2 laser desiccation with reasonably good results. They recommended it as the choice of modality for a hairy urethra, especially in cases of the failure of electrolysis, but long-term results are not available [33]. Beiko D. et al. reported the urethroscopic Holmium YAG laser epilation in urethral diverticular hair follicles following hypospadias repair in one case [34]. Unfortunately, data on long-term success is not available.
4. **Replacement urethroplasty**: Replacement urethroplasty is the option after the failure of chemical and electro-epilation and CO_2/YAG laser ablation. The replacement of urethroplasty with buccal or bladder mucosa in one stage or two stage is the choice in these cases.

21.4.5 Urethral Stones

Urethral calculi are a rare but troublesome complication and are seen in the hair-bearing scrotal skin urethroplasties. It may also form in the urethral diverticula or secondary to stricture urethra in hypospadiacs. The exact incidence is not known, but there are case reports. Somerville et al. reported urethral calculi in two patients (8%) among 24 patients of second-stage urethroplasty [35]. Barbagli et al. reported 1 in 60 patients with failed hypospadias surgery [36]. The largest series of 5 cases was reported by Hayashi et al. [37]. Four of the patients had previously undergone Thiersch-Duplay repair, and the type of repair was not known in the fifth case. Diagnosis is easy as stones may be visible on the skin surface because of minimal tissue support without spongiosum after hypospadias repair (Fig. 21.12a, b) and can be palpated in the urethra on clinical examination. A plain radiograph may delineate the number of stones, size, and location (Fig. 21.12c). If needed, ultrasonography clinches the diagnosis. Small stones can be removed endoscopically, and energy used for breaking the larger stone is lithoclast and laser. Holmium: YAG laser is an excellent option for removing stones and hair in the urethra. Recurrence is common unless complete epilation of hairs is done. A large stone, multiple stones, and stones in diverticula require urethrotomy and/or redo urethroplasty. We had six such patients with urethral stones, two of them were with impacted urethral stones and required the urethrotomy, and four were managed endoscopically.

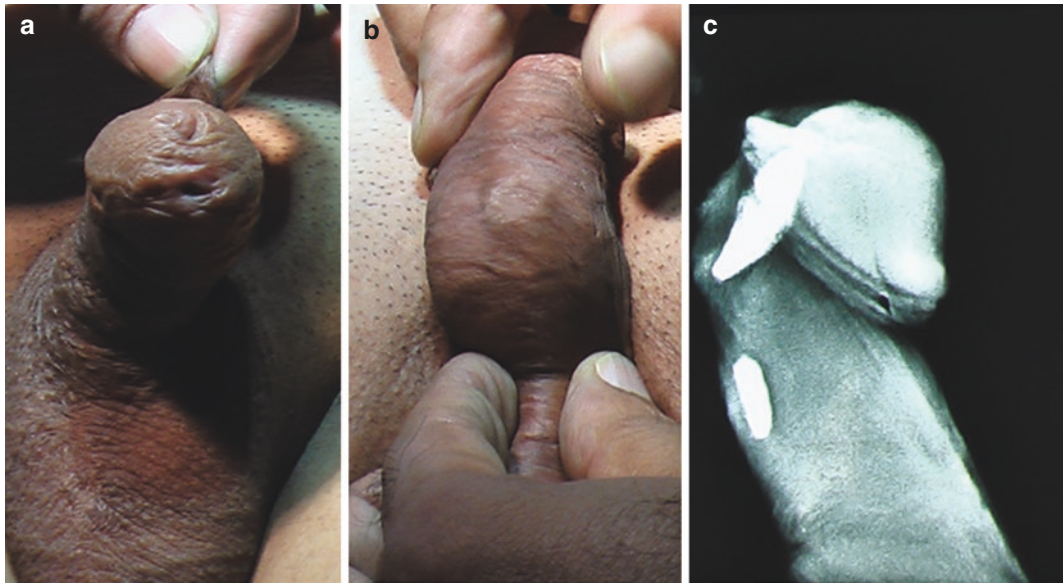

Fig. 21.12 Showing impacted urethral stones and fistula. (**a**). Sub-meatal stenosis and glans fistula. (**b**). Stone is visible on the ventral aspect of the penis on stretching. (**c**). Penile soft tissue X-ray showing impacted stones in the urethra

21.4.6 Recurrent/Chronic Urinary Tract Infections

Recurrent UTI may be seen in a few cases after hypospadias surgery. The causes are diverticula, stricture, an enlarged prostatic utricle, and a hairy urethra. Urethrogram and cystoscopy are done to confirm the diagnosis and delineate the urethral anatomy. Prostatic utricle should be suspected in patients of severe hypospadias repair with chronic or recurrent UTI, and very rarely, they might require excision to control the infection.

21.5 Penile Shaft

21.5.1 Chordee

Residual/persistent chordee is the third most common complication of hypospadias repair after fistula and stricture. With the use of intra-operative erection, it can be prevented in most cases. The occurrence of persistent chordee is primarily because of the misinterpretation of intra-operative chordee correction. Although rare, this complication may result from corporeal disproportion or extensive urethral fibrosis. The residual or persistent chordee may cause sexual dysfunction and requires correction. Significant chordee of more than 30 degrees needs surgical correction. The definitive evaluation is performed in the operating room under general anaesthesia at the time of repair. The penile skin is de-gloved in a circumferential fashion. The urethra/urethral plate with spongiosum is mobilized from corpora cavernosa, any remaining chordee or fibrous tissue is resected from the ventral aspect of corpora (Fig. 21.13a–f).

Even after these steps, the persistence of chordee is confirmed by the Gittes test, and if the urethra is bowstringing; it is divided. Fibrous and scar tissue present on the penile shaft requires excision. Mild chordee of less than 30 degrees can be managed with dorsal plication in patients with an adequate length of the penis. And severe chordee or patients with a smaller penis, the correction is done by superficial corporotomy or corporoplasty by a dermal or tunica vaginalis graft. First, dermal or tunica vaginalis grafts are performed by making a ventral transverse incision in the tunica albuginea at the point of maximal penile curvature. This incision may allow the

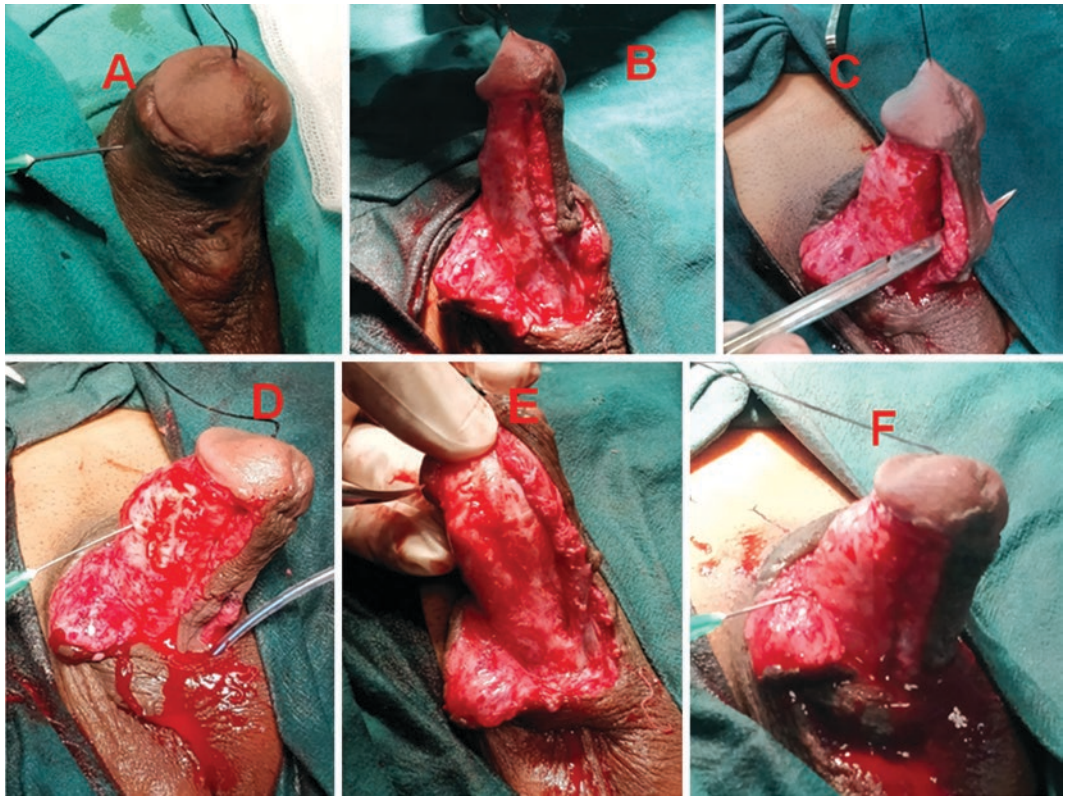

Fig. 21.13 Showing correction of residual chordee by mobilization of spongiosum. (**a**). Gittes test showing mild to moderate chordee. (**b, c**). Penile skin degloving and urethral plate mobilization. (**d**). Gitte's test showing mild curvature. (**e**). Midline dissection and excision of fibrous tissue for chordee correction. (**f**). Gitte's test showing correction of curvature

edges of the tunica to spring apart and to straighten the corporal bodies. Next, a dermal or tunica vaginalis graft is interposed and secured with a running, interlocking, fine suture. The correction of the curvature is finally confirmed on the table. Then urethroplasty is done with the available tissue in a one- or two-stage buccal mucosal urethroplasty.

21.5.2 Penile Torsion

The second common complication seen in patients of inner prepucial flap urethroplasty (Fig. 21.14). The traction on dorsal dartos as interposing tissue or uncorrected torsion associated with hypospadias may be the cause in plate preserving procedures. In cases with dorsal dar-

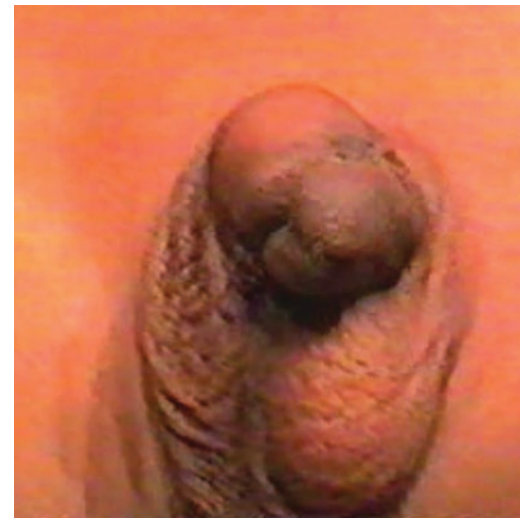

Fig. 21.14 Showing right torsion of 90-degree with diverticula, and retrusive meatus

tos cover, single dartos flap has higher chances (mild glanular torsion 90.7% and moderate glanular torsion 9.3%) than the double dartos flap (0%) [38]. The causative factor is an inadequate mobilization of the vascular pedicle and traction on the pedicle.

The torsion can be prevented by adequate vascular pedicle/dartos flap to the root of the penis and proper adjustment of skin flaps during skin closure. A mild torsion of <30° does not require treatment, but moderate to severe torsion requires corrective repair after six months. The treatment modalities are releasing the dorsal dartos pedicle, de torque by penile degloving and realignment, tunica albuginea plication sutures the tunica albuginea to pubic periosteum and sutures dorsal dartos opposite to torque in primary cases. The techniques for the management of torsion are described in Chap. 18 on torsion.

21.5.3 Inclusion Dermoid and Granuloma

Penile dermoid cyst may be congenital and acquired. Congenital occurs in the midline and may also be associated with hypospadias (Fig. 21.15a). Acquired inclusion dermoid cyst is an infrequent complication. We came across such three cases presented with swelling on the penis and mild torsion of the penis. Clinical examination showed a firm, well-defined swelling free from the skin. We did excision of the cyst in a daycare surgery (Fig. 21.15d–f) and

Fig. 21.15 Showing dermoid cyst and granuloma. (**a**). Dermoid cyst with hypospadias. (**b**). Post hypospadias male child showing swelling on the right side of the inner prepucial skin after hypospadias repair. (**c**). Excision of the granuloma and skin sutures. (**d**). Post hypospadias repair left-sided penile shaft swelling. (**e, f, g**). Excision of dermoid cyst

biopsy confirmed the dermoid cyst. Another rare complication is granuloma; because of the impregnated smegma or any other foreign material like late absorbing sutures. Excision of granuloma and re-suturing of the skin resolves the issue (Fig. 21.15b, c).

21.5.4 Balanitis Xerotica Obliterans

BXO is a chronic inflammatory process of unknown aetiology, and it affects the glans, prepuce, or urethral meatus and may extend into the urethra. The cause of BXO in hypospadiacs is not iatrogenic, and many cases are reported even before surgery. BXO is sometimes seen in patients after hypospadias repair and may affect the meatus, prepuce, glans, and the fossa navicularis. The clinical appearance is that of a sharply marginated white patch on the glans. Occasionally a rough, lichen-type scab is present. Patients are treated according to the stage of the disease. Early cases can be treated with topical steroids and Tacrolimus, a highly selective immune modulator.

Surgical repair is required for most of these patients. This involves relieving the meatal stenosis, initially by meatotomy, followed by more extensive resection and finally two-stage buccal mucosal urethroplasty. There are rare reports of malignant degeneration. Therefore, BXO lesions require periodic follow-up, and biopsy is indicated whenever a change in clinical appearance is observed.

21.5.5 Cosmesis

The shape of glans, glans dehiscence, chordee, penile torsion, and skin may contribute to an ugly appearance of the penis post-operatively. Mureau and colleagues reported that many children and adolescents of hypospadias (39%) desired functional and/or cosmetic penile improvement but were reluctant to seek advice. Similarly, adult hypospadias patients reported a more negative genital appraisal than comparison subjects and 37% desired functional or cosmetic penile improvement [39].

21.6 Psychosocial and Psychosexual

Psychosexual issues are more in hypospadias patients (32.8%) than in comparison subjects (12.8%) and are inhibited from seeking sexual contact. The variables affecting sexual function are the severity of hypospadias, patient age at final operation, and sociosexual development. The majority of patients experienced a normal adult sex life but were reluctant to seek advice for sexual problems. Bubanj and coworkers (2004) concluded that the sexual function of patients who underwent surgery for hypospadias, in general, is not affected [40]. However, a difference in certain aspects of sexual behaviour was noted. Patients with hypospadias were less sexually active and had a smaller total number of sexual partners than control subjects, and control subjects were significantly more delighted with their sexual life. A detailed description is available in Chap. 27.

21.7 Conclusions

Patients of hypospadias surgery should be followed for long-term to adolescence and adulthood as late complications may present years after surgery. Fistula, stricture, meatal stenosis, and diverticula are common complications. Non-responder to meatal dilatation cases require meatoplasty. Visual internal urethrotomy is indicated in short, simple anastomotic stricture, but complex strictures must be dealt with buccal mucosal urethroplasty in a single or two stage. Reduction urethroplasty with pseudospongioplasty and or tunica vaginalis cover is the choice of treatment. Single fistula is closed after freshening of margins with healthy tissue cover dartos or tunica vaginalis,

and multiple fistulae are combined together, and onlay/inlay flap urethroplasty is done. Residual curvature or persistent curvature of more than 30 degrees requires treatment with ventral lengthening in small penises. The psychosexual problems are dealt with by the teamwork of psychiatrists, urologists, and andrologists. The multiple chronic complications can be managed by correcting chordee/penile torsion, reconstructing the urethra, healthy tissue cover, and skin resurfacing of the skin in one or two stages.

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