

One-stage Surgical Correction of Proximal Hypospadias

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Abstract

Introduction: Proximal hypospadias poses major problems in surgical correction owing to the complexity and severity of the abnormalities, leading to the use of staged repairs to correct this condition. However, with precise definition of the components of this deformity a single-stage operation can be developed and applied successfully for surgical correction of this condition. **Materials and Methods:** Twenty-six patients with severe proximal hypospadias were subjected to a one-stage repair. Excision of proximal fibrotic dartos tissue and removal of dysplastic urethral plate tissue corrected chordee completely. Urethral reconstruction was then performed by tubularising a flap of dorso-lateral preputial skin which was then anastomosed to the proximal urethra. The glandular part of the urethra was reconstructed using the distal part of the flap as an onlay graft over the meatal groove. The suture lines were covered with a layer of dartos tissue and skin closure was completed by transposing dorsal skin to surface the ventral penile shaft. A urethral catheter was left in for 10 days. **Results:** All patients have been followed up after surgery from 1 to 5 years with a median period of 2 years. There were no fistulas. Two patients had mild stenosis at the meatus which responded to dilatation. One patient developed a stricture at the proximal anastomosis which required secondary correction. All other patients achieved satisfactory correction, both in terms of voiding and in the cosmetic appearance of the genitalia. **Conclusion:** Single-stage repair of hypospadias can be successfully applied in the correction of severe proximal hypospadias. It requires meticulous dissection and careful design of reconstructive techniques. The end results are comparable to staged procedures and morbidity is significantly lower.

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Introduction

Proximal hypospadias represents the most severe end of the spectrum of this abnormality. Although hypospadias itself is a relatively common condition, severe types account for only 20% of all cases. Androgens are known to play a pivotal role in gonadal development but the aetiology of hypospadias remains uncertain.¹ Recent studies have identified some risk factors that appear to have a positive correlation. The familial incidence of this condition is well recognised.^{2,3} In a detailed study using genetic, endocrine and biochemical evaluation, genetic syndromes and chromosomal abnormalities were implicated as significant aetiological factors.² Low birth weight is another risk factor that correlates with hypospadias and cryptorchidism.³

Patients with proximal hypospadias often have associated undescended testes. This finding is significant because up to one-third of such individuals may have intersex disorders.⁴ In such cases, non-palpability of the gonad increases by three-fold the likelihood of an intersex state being present. The severity of the hypospadias also appears to be strongly related to this association.

The surgical correction of severe types of hypospadias

represents a complex surgical challenge. Detailed understanding of the anatomical basis of the condition is essential to developing surgical techniques that can be successfully applied.⁵ In the hypospadias penis, the differences in anatomy lie in the tissues distal to the urethral orifice which in the severe types may be at the perineum or scrotum. These abnormalities relate to the distribution of the nerves, the corporeal bodies, the glans and the presence of large vascular spaces in the distal tissues.⁵ Owing to the complexity of the surgical procedures required for correction in proximal hypospadias, attempts have been made to deal with the anticipated problems using innovative approaches. Pre-treatment with human chorionic gonadotrophin (HCG) appeared to decrease chordee and increase penile shaft length resulting in advancement of the meatus distally.⁶

Numerous surgical techniques have been described for the correction of hypospadias. In recent years, one-stage operations have increasingly been favoured and are now exclusively the method of choice for distal hypospadias. However, severe types of proximal hypospadias present several features that pose difficulties in surgical correction. Chordee is often very severe and may require combined

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procedures for complete correction. The penis is generally short and not well developed. In addition, it is tethered to the perineal tissues, giving it a buried appearance (Fig. 1). Preputial skin may not be adequate enough to reconstruct the urethra and bring the meatal opening to the tip of the glans. The scrotum may be bifid with penoscrotal transposition. Based on previous work done by the author, a new approach to single-stage urethroplasty in proximal hypospadias was developed and has been successfully employed. Details of the technique are presented and illustrated in the following sections.

Methods

The average age of the patients for this type of urethroplasty is 12 to 24 months. Under general anaesthesia supplemented with caudal bupivacaine, a stay suture of 5/0 Prolene is placed through the tip of the glans. Two parallel lines are marked on either side of the meatal groove. A dorso-lateral flap of preputial skin is outlined with the base situated along a line from the base of the glans to the urethral orifice (Fig. 2). The central strip of epithelium over the urethral plate is not included in this flap, as it will need to be excised (Fig. 3). The distal margin is not marked, as the length of flap that will be needed cannot be ascertained until chordee has been completely released. The decision not to use the urethral plate in this method of repair contrasts with other techniques that utilise parametarial skin flaps.^{7,8} Experience with surgical correction in severe types of hypospadias has shown that the urethral plate may need to be excised to ensure complete correction of chordee (Fig. 4). In other cases, it may be dysplastic and appear as thin membrane making it unsuitable for urethral reconstruction although some reports suggest it can still be used with good results.^{9,10}

The operation begins with an incision around the base of the urethral orifice. This is deepened and fibrotic dartos tissue that is causing chordee is excised. At this point it must be noted that in severe types of hypospadias the proximal urethra enveloped by the corpus spongiosum runs very close beneath the skin. This has to be carefully mobilised to avoid cutting into the spongy tissue as otherwise there can be severe bleeding.

The mobilisation and separation of the proximal penile shaft is continued to completely release the base of the penis from the perineal tissues to which it is adherent (Fig. 5). The effect of this separation is to allow the penile shaft to migrate upwards towards the symphysis pubis. This allows the two halves of the scrotum to come together below the penile shaft and hence enable peno-scrotal transposition to be corrected. However, it must be noted that this radical mobilisation of the bulbar part of the urethra with corpus spongiosum cannot completely correct chordee by itself without additional procedures.¹¹

Following release of proximal chordee tissue, attention is now focussed on the urethral plate. In most cases of hypospadias, histological examination of the plate tissues shows epithelium with well-vascularised connective tissue. There is no evidence of fibrous cords that were previously thought to cause ventral curvature.¹² This finding, in fact, forms the basis of the one-stage technique of repair utilising the urethral plate that was published previously by the author.¹³ However, in severe types of hypospadias the plate tissue is usually dysplastic and does not have the supple texture and mobility of the normal plate. It can easily be demonstrated by doing an artificial erection test that this tissue is a significant contributor to the ventral chordee. Even after radical dissection of the proximal urethra and spongiosum with release of all fibrotic dartos, the urethral plate can be seen as a tight band exerting a bowstring-like effect on the penile shaft. Excision of the dysplastic plate tissue is carried out starting at the base of the glans and working proximally towards the urethral orifice.¹⁴ This is done because in the author's experience, the bulk of the dysplastic tissue lies distal to the urethral orifice (Fig. 6). The part of the urethral plate nearer to the urethra is often normal in texture and can be incorporated in the neourethra. The depth of excision must extend to all layers of the corporal bodies to ensure that chordee-causing tissue is effectively removed (Fig. 7). The dysplastic tissue has a fibrous, gritty feel and can easily be recognised. Excision of this tissue results in a visible straightening of the penile shaft. It is quite remarkable that the hypospadias penis which looks small and buried can have a normal-looking appearance at the conclusion of this step.

Excision of the urethral plate precludes the use of this tissue in reconstruction of the urethra. To avoid this problem and also in cases where chordee correction appears to be incomplete, dorsal plication at the 12 o'clock position has been advocated as a safe method of correcting the penile curvature.¹⁵ However, this method causes shortening of the penis, which is undesirable in cases of severe hypospadias. Another technique involves splitting the corpora cavernosa ventrally after incising the ventral plate in the midline, and rotating the corporeal bodies towards the dorsal midline by suturing them together with non-absorbable sutures. The neurovascular bundles have to be dissected and elevated to avoid being caught in the sutures.¹⁶ Although it is claimed that complete correction of chordee can be achieved, the method is unnecessarily complicated and not without risk of complications. The author's technique for creating a neourethra does away with the need to preserve any part of the urethral plate, while at the same time ensuring that chordee can be completely corrected.

The first step in urethral reconstruction is to measure the length of flap needed to reach the tip of the glans. This flap

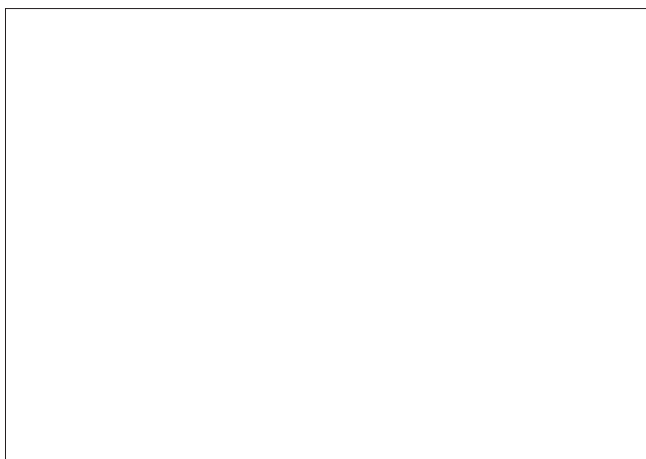


Fig. 1. Proximal (scrotal) hypospadias showing severe chordee and tethering of penile shaft.

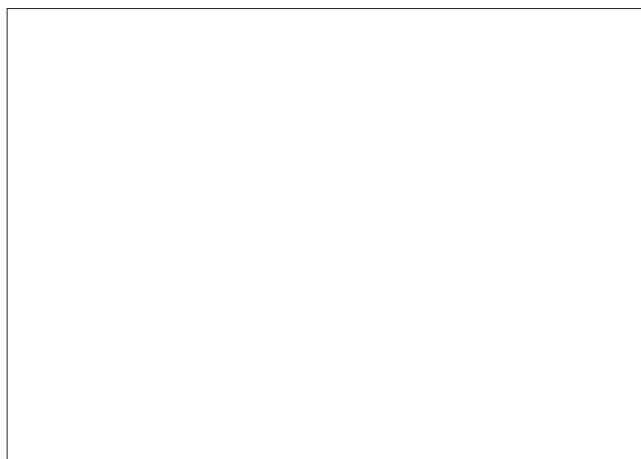


Fig. 2. Outline of flap using dorso-lateral preputial skin.

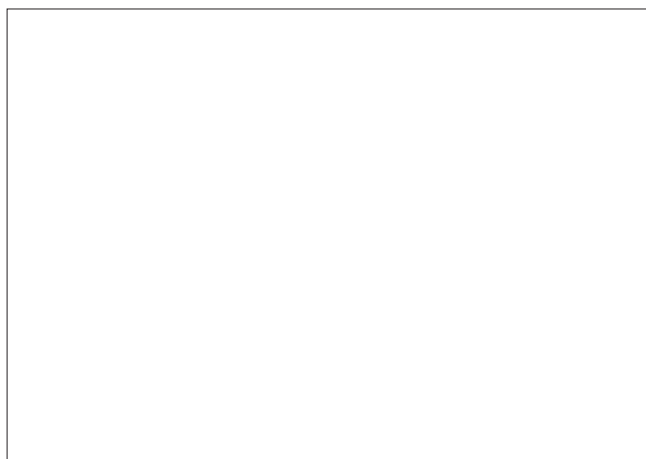


Fig. 3. Dysplastic urethral plate contributing to ventral chordee.

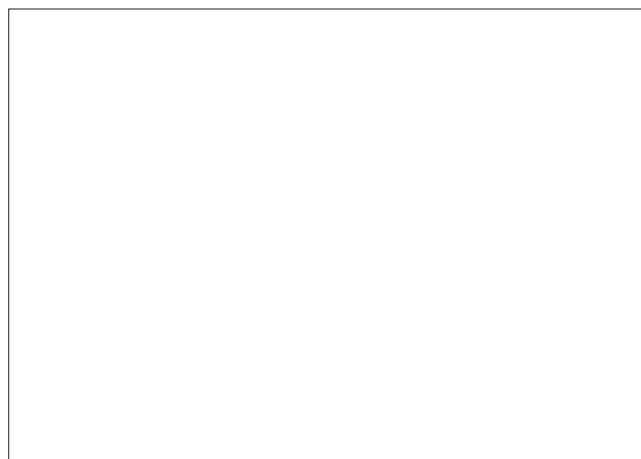


Fig. 4. Proximal dissection with excision of fibrotic dartos tissue. Urethral plate is dysplastic and cannot be used for neourethral reconstruction.

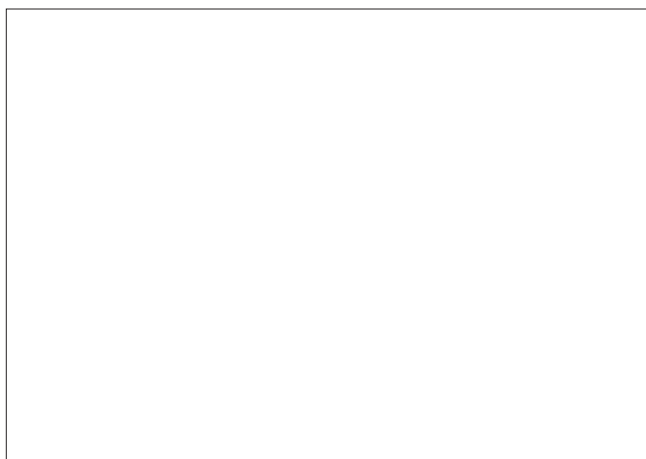


Fig. 5. Release of tethering of penile shaft resulting in elongation of penis.

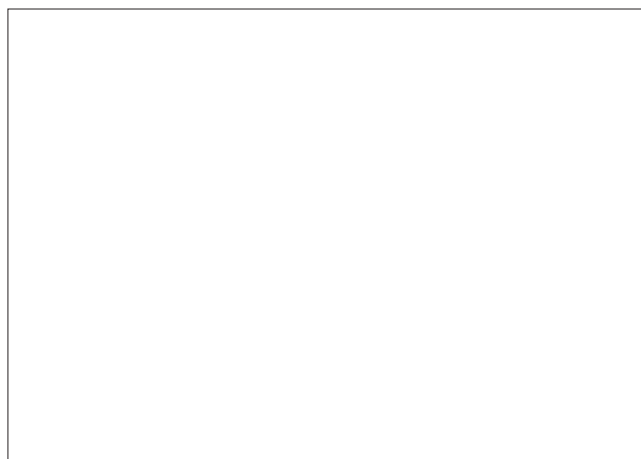


Fig. 6. Excision of dysplastic urethral plate to complete chordee correction.

is carefully elevated, preserving its blood supply from the dartos layer on which it rests. In severe types of hypospadias, raising a long, vascularised preputial flap can be technically demanding. The author, however, prefers

this method rather than using preputial skin as a free graft as has been described.¹⁷ The use of tubularised free grafts results in a significantly higher rate of proximal strictures. However, it appears that this problem is not apparent when

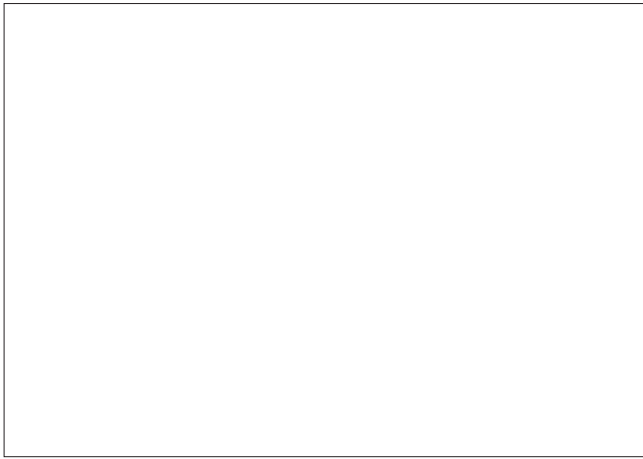


Fig. 7. Completed excision of urethral plate down to level of tunica.

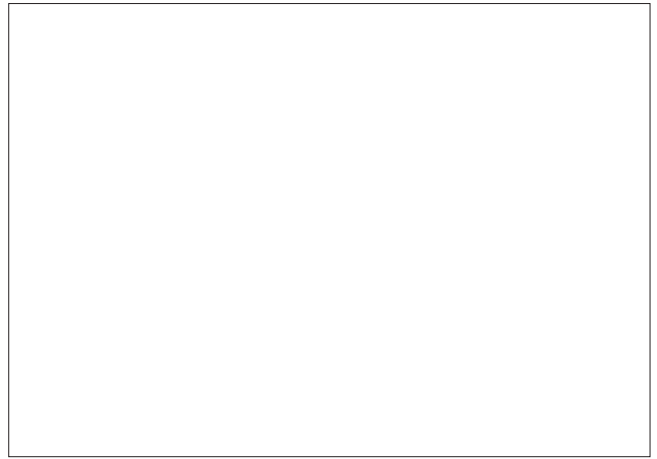


Fig. 8. Tubularisation of flap to create neourethra.

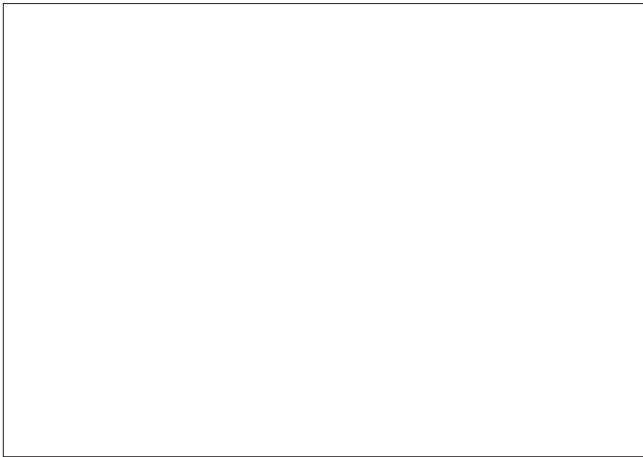


Fig. 9. Dartos layer mobilised from dorsum and used to cover suture lines.

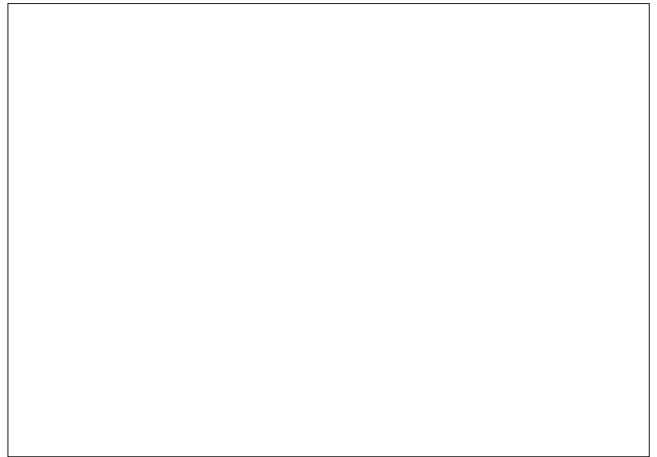


Fig. 10. Completed repair with apposition of ventral skin flaps.

the grafts are used in an onlay manner. Although there is no difference in terms of results between the two methods of using tissues, free grafts are inherently more liable to long-term complications and for this reason, the use of flaps is preferred.

The base of the flap is sutured to the urethral orifice in a complete circle. The flap is now tubularised over a #6F catheter using a continuous 6/0 polydioxanone (PDS) suture (Fig. 8). At the base of the glans, a tourniquet is applied and parallel incisions are made on each side of the meatal groove. The incisions are deepened to develop two glans wings of sufficient calibre to accommodate the neourethra. The flap is now sutured to the meatal groove on either side to form the glanular portion of the urethra.

The use of this combined tubularised onlay technique to create the neourethra has distinct advantages over other methods using onlay or inlay flaps.^{18,19} It results in a single suture line over the penile part of the urethra and has a uniform caliber throughout its whole length. Tubularised incised plate (TIP) urethroplasty has been advocated as an

addition to reduce the need for extensive preputial tissue for the neourethra in cases of severe hypospadias.²⁰ While the results have been favourable in distal hypospadias, the technique is not always suitable for proximal types of lesions as the urethral plate may need to be excised. Furthermore, when the urethral groove is shallow, the neourethra tends to be narrower in caliber and this predisposes to complications such as stenosis and fistula.²¹ It may, however, have some application in redo situations.²⁰

The penile shaft is degloved by mobilising the rest of the prepuce and skin. This allows further release of chordee-causing dartos tissue. A layer of dartos tissue from the distal prepuce is now elevated and transposed vertically to cover the entire urethral suture lines extending into the glans (Fig. 9). The meatus is now fashioned by suturing the glans wings to the edge of the neourethra. The two halves of the glans are united in the midline with two layers of sutures to provide a snug fit around the urethral tube. In all cases of primary repair of hypospadias, it has been possible to obtain adequate dartos tissue to reinforce the urethral suture lines and provide a backing for the neourethra. This

step is essential in preventing fistula formation. Other methods of providing a wrap around the urethral tube using such tissues as the distal corpus spongiosum have not been necessary.²² The penile shaft is then resurfaced by transposing the dorsal skin ventrally. This is an important step, as there is a deficiency of ventral skin in hypospadias which must be corrected to avoid the problem of secondary chordee. In addition, it is frequently necessary to carry out Z-plasty lengthening of the ventral skin edges by making transverse cuts at the junction of the penile and scrotal flaps. This step has the important effect of releasing chordee due to a tight ventral skin suture line. The edges of the flaps are then sutured to give a cosmetically acceptable appearance (Fig. 10).

At the conclusion of the operation, a simple, transparent dressing is usually all that is necessary. The use of complex types of dressings that were previously recommended has not been shown to confer any significant advantages.^{23,24} However, if there is extensive oozing, a compression dressing using elastic bandage may be applied for a few days. To keep the dressing in place and prevent it from sliding out, its distal edge must be sutured with 3 or 4 interrupted sutures to the preputial margin at the coronal sulcus. A silastic urethral catheter or soft feeding tube is left in place for approximately 10 days. In some difficult cases, it may be necessary to carry out suprapubic cystostomy as well as keeping the urethral catheter in place as a stent.

At the end of 10 days, the patient is returned to the operating room for examination under anaesthesia. The urethral catheter is removed and the neourethra tested by gently passing a metal sound. A feeding tube is also inserted and saline is injected to test for leaks. If a fistula is detected, it is closed immediately by suturing a flap of dartos tissue over the site of the leak in the urethra. In such cases, the catheter will be left in place for another week.

Results

Complications after urethroplasty for proximal hypospadias are more common than in repairs for distal types of lesions. They include fistula, stricture and meatal stenosis. To date, the combined tubularised onlay technique of hypospadias repair has been applied in a total of 26 patients. One patient developed a stricture at the proximal anastomosis and this had to be repaired at a subsequent operation after a period of diversion. Two patients had slight stenosis at the meatus which responded easily to dilatation. All other patients were successfully corrected with good long-term results. The follow-up period ranged from 1 to 5 years, with a median of 2 years.

Discussion

Fistula after hypospadias surgery is the most frequent complication and it occurs more often in the proximal types

of lesions. Several factors such as vascularity of the tissue, suture technique, provision of a supporting layer over suture lines, and prevention of stenosis of the neourethra are important in the development of this complication. A small leak can usually be easily closed as described previously since there is sufficient healthy tissue available at the local site to repair the defect. However, a major disruption of the urethral tube is best treated by proximal diversion. This can be done by simply exteriorising the urethra at the most proximal point of the disruption, in effect creating a hypospadiac orifice. The subsequent repair should be left for a much later time when all the tissues have completely healed and returned to normal. At this time, a careful assessment is made to determine which method of reconstruction is feasible. The problem with such cases is that there is very little penile skin left to form a new urethra. This leaves the surgeon with very few options for the redo operation. Substitutes such as tunica vaginalis have been tried but the results are poor.²⁵ In such situations, it may be advisable to refer the patient to a centre with experience in doing complex cases rather than attempting a difficult repair.

Strictures occur most frequently at the proximal site and this is probably related to the circular nature of the anastomosis. An adequate size of neourethra and accurate suture technique can prevent this complication. When strictures develop, they are not likely to respond to simple dilatation. Instrumentation such as passage of a sound or cystourethroscope carries a significant risk of disruption of the urethra with creation of a false passage. Most of these cases will require open urethroplasty.²⁶ Our approach in such cases has been to open the urethra just proximal to the site of the stricture as a urethrotomy and wait for a period of 6 months to 1 year before carrying out the definitive repair.

Late onset chordee has been described, although we did not see any cases in our series.²⁷ This complication occurs after a long interval, usually more than 10 years and the patients in our series have not reached that length of follow-up yet. However, we have encountered this problem in our other cases of hypospadias who have reached 14 years follow-up or more after surgical correction. The condition is due to a combination of urethral fibrosis and corporeal disproportion. It presents at or after puberty and can cause significant disability in adult life. Correction of the problem will need to be tailored to the specific problem in each individual case. The occurrence of such late complications is a strong reason to advise long-term follow-up of all cases of hypospadias. The evaluation of any technique for the surgical correction of this condition must include the results when patients reach adult life.

Proximal severe types of hypospadias can be successfully

corrected with one-stage procedures. The technique developed by the author allows for total correction of chordee and urethroplasty without compromising the objectives of repair and gives a satisfactory result.

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