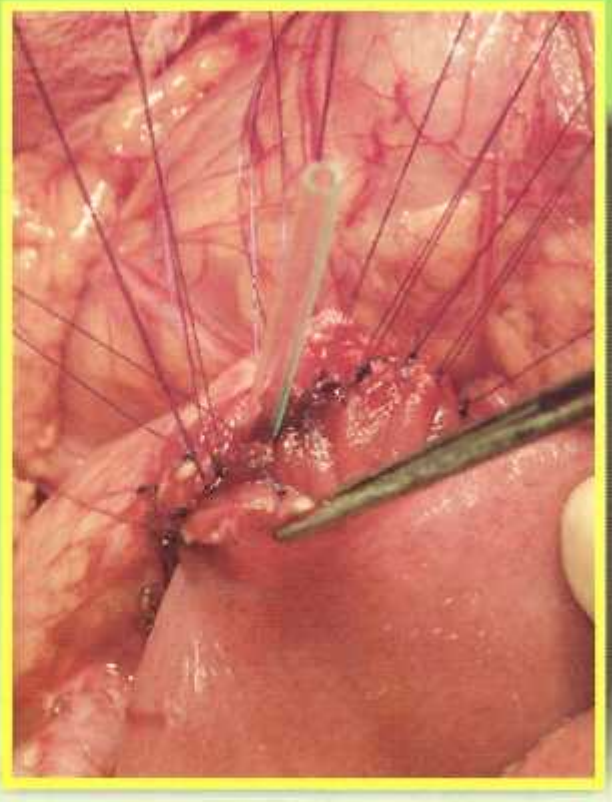
RECENT ADVANCES IN SURGERY–9

Editor

Roshan Lall Gupta



JAYPEE

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Hypospadias

Asopa HS, Singhal GG

Hypospadias, a congenital defect is defined as an abnormal urethral opening situated proximal to its normal site on the ventral aspect of penis anywhere between the tip of the glans and the perineum. This may or may not be associated with other local defects, like chordee (skin and dartos, short fibrosed spongiosa or corporal disproportion) and abnormal distribution of skin. The proximal defects may have other pronounced abnormalities in the urogenital system. The incidence of hypospadias in the reported series is about 1 in 300 male live births and the incidence is increasing probably due to the greater use of hormone analogues in the early antenatal period.

CLASSIFICATION OF HYPOSPADIAS

This is according to the site of the external urinary meatus on the ventral surface (after chordee correction, if chordee present) (Fig. 3.1).

HISTORICAL REVIEW OF HYPOSPADIAS REPAIR

No description of this condition is available in *Sushrata Samhita*. Dieffenbach (1836) is credited with the first attempt to correct hypospadias which was, however, unsuccessful.[1] The first successful repair was described by Anger in 1874. Since then, more than 250 techniques have been described ranging from multistaged procedures to single staged procedure. The following historical description is based on certain basic principles but mainly directed towards one aim and that is a straight penis and the external urinary meatus located near the tip of the penis.

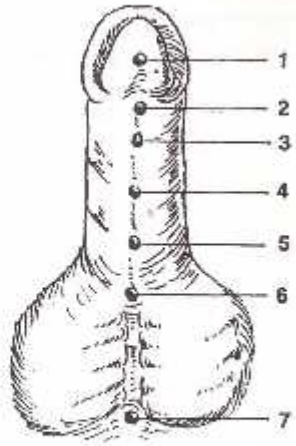


Fig. 3.1: The various types of hypospadias: (1) glanular, (2) subcoronal, (3) distal penile, (4) midpenile (5) proximal penile, (6) penoscrotal, (7) perinea

Historical Description

1. Buried skin tube: Carl Thiersch in 1869 and Duplay in 1880 described the use of buried skin tube as a neourethra. This method was later popularised by Sir Denis Browne in 1950[2] and is still used as a two stage procedure.
2. Perimeatal flaps: Ombredanne (1932) suggested making a circular flap with the hypospadic meatus at its centre. The edges of the circular flap are gathered together with a pursestring and the raw area covered with the freed and button-holed prepuce. Later on Mathieu used vertical perimeatal flaps. Thompson advocated the use of lateral perimeatal flap.
3. Inlay free graft: The method of producing urethra by an inlay free graft of a penile tunnel is associated with the name of Nove-Josserand (1897)[3] and its later exponent was McIndoe (1937)[4]. Devine and Horton[5] further elaborated the technique.
4. Formation of tube from penile and scrotal skin and burying the penis: Bucknall (1907) described the method of temporarily burying the new urethra between penis and scrotum. Cecil later modified the procedure.[6]
5. Mobilisation of urethra and bringing it to the tip of the glans was reported by Von Hacker (1897). Almost 100 years later the technique has now been revived.
6. In a single stage operation, Broadbent *et al*[7] in 1951 used a full thickness oblique strip of skin from the prepuce and penile skin.
7. Byars[8] introduced the first successful two stage repair in which the first stage comprised of chordee correction and redistribution of dorsal penile skin onto the ventrum. In the second stage, neourethra is formed by using the ventral penile skin. This technique is still used for patients of hypospadias with severe chordee.
8. Single stage procedure involving the principle of chordee correction and a type of pedicled flap to form neourethra has revolutionised the concept of hypospadias repair. Based on this principle, Hodgson,[9] described the technique of using vertical inner preputial flap, based on blood vessels supplying the dorsal penile skin. Asopa *et al* (1971)[10] used the first axial pattern flap based on superficial dorsal penile vessels by using inner transverse preputial skin. Duckett (1980)[11] has used island flap of inner preputial skin for hypospadias repair. Asopa *et al* in 1984 introduced the double island flap technique.[12]

Gittes and McLaughlin in 1974,[13] described the technique of artificial penile erection, on table, by injection of saline into the corpora. This has been a milestone development in the treatment of hypospadias. As realised by Asopa *et al*[14] and many other workers in late 80s that every patient of hypospadias does not have spongiosal chordee and the seemingly curved penis can be straightened by degloving and releasing the skin and dartos chordee. This concept later led to the development of onlay pedicle flaps.

In 1994 Snodgrass[15] described the incised urethral plate tubularisation technique and it has made the repair of hypospadias without spongiosal chordee an easier task.

For the last five years Asopa and his team are using a modification of Snodgrass method in which the raw area, after incising the urethral plate is covered by a dorsal free graft and this does help to reduce complications of stenosis.

PRESENT DAY CONCEPT OF HYPOSPADIAS REPAIR

The goal of hypospadias surgery is to produce a straight penis and the external urinary meatus located at the tip of the conical glans. A symmetrical skin cover is provided with minimal, short and long-term complications. The procedure is preferably performed in one stage as a day case and at the young age. Till the 60s it was generally argued that cosmetic considerations are secondary and are more the concern of the parents of the child and that chordee should be corrected by staged procedures. Today, however, the concept has radically changed.

The following describes as to how to achieve the above objective and is mentioned under various heads:

1. The operating surgeon
2. Selection of an optimal operative technique
3. General considerations for achieving a good outcome.

Operating Surgeon

In many developed countries, hypospadias surgery is performed in most institutions by paediatric urologists with training and interest in hypospadias repair. However, in several centres, hypospadias is dealt with by paediatric urologists as well as by paediatric surgeons, plastic surgeons, urologists and general surgeons interested in hypospadias work. A surgeon dealing with hypospadias should be familiar with several techniques to be able to manage all types and grades of hypospadias. One should have real interest, commitment and be properly trained in various techniques, as well as possessing an attitude of proper tissue handling. The dictum "see one, do one and teach one" definitely does not hold good for this type of delicate surgery.

Selection of a Proper Technique

This is perhaps the most important decision one has to make to achieve a good result. A wrong selection of technique may result in unsatisfactory outcome even if the procedure has been technically well performed and by an experienced surgeon. Decision making can usually be initiated in the outpatient visit, but the final decision should be made after degloving the penis. Most modern procedures involve degloving of the penis, as a large number of patients have skin and dartos chordee. Selection of proper technique depends on location of meatus, configuration of glans, presence of spongiosal and corporal chordee, quality of urethral plate, calibre of the meatus and quality of skin and ventral urethra proximal to the meatus and availability and quality of preputial hood.

Common Operative Techniques

It stands to reason that simpler techniques should be considered before more difficult and complicated techniques are decided upon. Various techniques popular all over and used by the authors are:

1. MAGPI (Meatal Advancement and Glanuloplasty)[16]
2. Tubularised incised urethral plate (Snodgrass)[17]
3. Dorsal free graft inlay
4. Onlay transverse preputial skin patch
5. Transverse preputial skin tube
6. Two stage repair.

MEATAL ADVANCEMENT AND GLANULOPLASTY (MAGPI)

An ideal patient for this procedure is the one who has glanular hypospadias with a flat or convex glans and thick and healthy skin proximal to meatus without chordee.[16] MAGPI can be contemplated in patients with coronal hypospadias without or with very mild chordee which can be corrected by dorsal plication or in patients who have retrusive meatus after previous surgery. MAGPI should be avoided in patients with subcoronal or more proximal hypospadias with wide meatus or concave or grooved glans with considerable chordee.

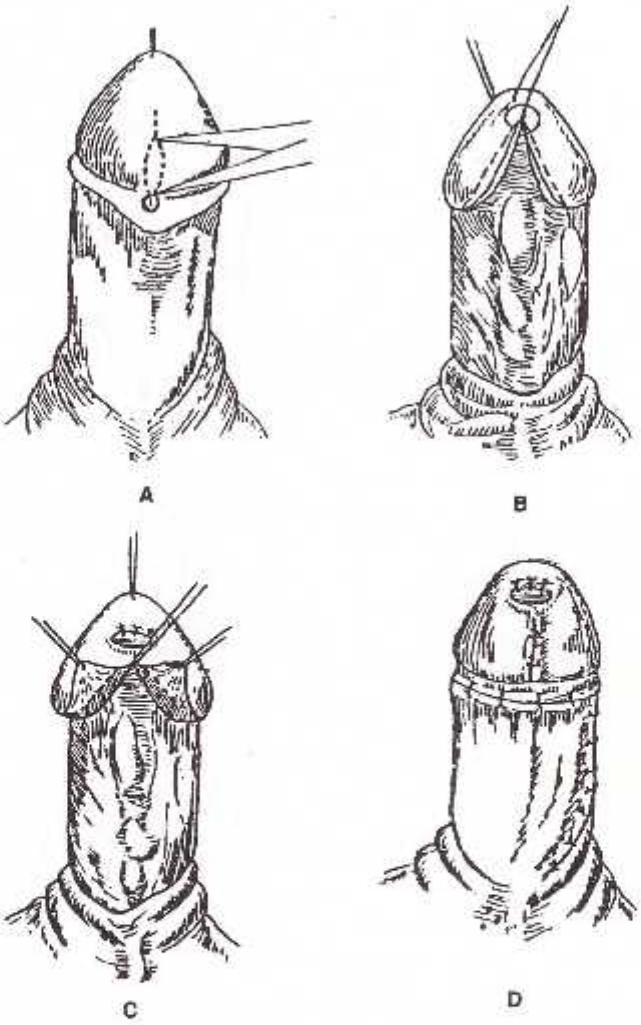
Procedure (Figs 3.2A to D)

A circumcoronal incision is given and chordee is excluded by artificial erection. A vertical incision is given in the dorsal plate of glans distal to meatus and the glanular plate is mobilised starting from the meatus to the proposed site at the tip. The vertical incision is closed by two to three transverse sutures of 6/0 absorbable.

Glans is carefully undermined on both sides of distal urethra between tunica and glans tissue after dividing fanned out spongiosa to expose the tunica underneath. The dissection in the midline must be careful and fairly superficial so as to avoid any injury to the underlying urethra. The glans wings are approximated by two or three vicryl 6/0 sutures after excising the redundant free margin without compromising the lumen of the urethra. Skin cover is provided after excising the redundant skin and giving an oblique cut dorsally if required. Skin sutures by 6/0 chromic catgut are preferably subcuticular. A size 6 French catheter is introduced and light pressure dressing applied.

TUBULARISATION OF THE INCISED URETHRAL PLATE (SNODGRASS)[17]

This technique is best suited for patients of distal penile hypospadias with a wide concave glans (wide groove), wide meatus, healthy thick urethral plate, healthy skin/mucosa ventrally proximal to meatus and without chordee. This can also be done in patients having minimal chordee, that can be corrected by dorsal plication.

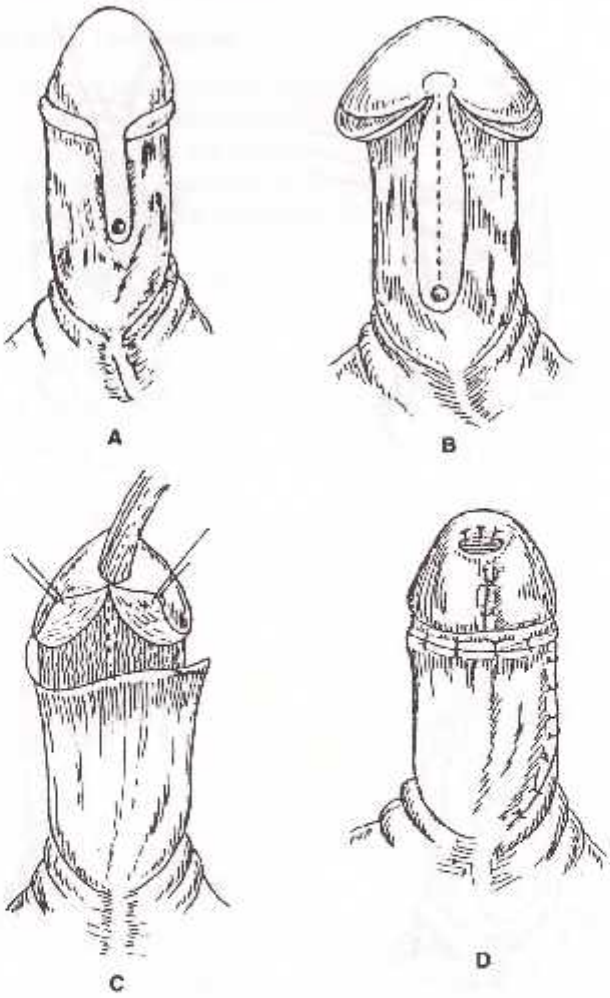


Figs 3.2A to D: MAGPI (Meatal advancement and glanuloplasty) technique: (A) Glanular hypospadias. Vertical incision in the dorsal plate of the glans distal to meatus and a circumcoronal incision in the penile skin. The glanular plate is mobilised from the meatus to the proposed site at the tip, (B) Glans is undermined on both sides carefully between the tunica and the glans tissue, (C) Vertical meatotomy incision is closed transversly. 6/0 absorbable sutures, (D) Skin cover

This technique is avoided in those with more proximal hypospadias with a flat glans, narrow urethral plate, narrow meatus, moderate chordee and when skin proximal to meatus is thin and attenuated.

Procedure (Figs 3.3A to D)

Penis is degloved by a circumcoronal incision incorporating the meatus. The absence of chordee is assessed by artificial erection. The urethral plate is



Figs 3.3A to D: Anterior hypospadias without chordee, with a grooved urethral plate and glans. Ideal for tubularisation of the urethral plate (Snodgrass):(A) A circumcoronal incision incorporating the meatus is given leaving the urethral plate intact, (B) The urethral plate is incised in midline dorsally from the meatus to the tip of the glans and is tubularised, (C) A curtain of dartos is anchored over the vertical suture line, (D) Skin cover is provided

incised dorsally in midline from meatus to tip of the glans. The glans wings are raised on either side of the urethral plate up to midglans level only. Tubularisation on a catheter is performed by a continuous suture of 6/0 chromic catgut. Redundant and thinned out margins of penile skin are excised and a dorsal oblique cut is given in the outer preputial skin. Dartos fascia is overlapped over the ventral suture line and anchored underneath the glans wings and to the tunica of the penile shaft on either side. The skin cover is provided by an eccentric suture line. Catheter is secured and a circular dressing with gentle pressure is applied.

A DORSAL FREE GRAFT ON AN INCISED URETHRAL PLATE

This procedure is offered to patients who have distal penile hypospadias with a flat glans and a narrow but healthy urethral plate. The meatus may be narrow or wide and there is no chordee.

The procedure is also performed for those with more proximal hypospadias and with the above criteria but with minimal chordee that is correctable by dorsal plication. It is also performed for patients with previous hypospadias surgery who have healthy distal penile skin but with no chordee.

Procedure (Figs 3.4A to E)

The procedure is the same as that of Snodgrass except that after incising the urethral plate, the two halves of the plate are mobilised partially from underneath the tunica and anchored to tunica. The raw area between the two halves of the urethral plate is covered with an inlay dorsal free graft.

THE ONLAY TRANSVERSE PREPUTIAL SKIN PATCH

The onlay patch can be applied to patients who have narrow urethral plate from the distal penile meatus to the proximal penile meatus and with attenuated ventral skin. Glans may be flat or convex and there is no chordee.

It is possible to perform the procedure in patients with the above criteria and with minimal chordee corrected by dorsal plication.

The technique is not suitable in those who have marked chordee, scarred or attenuated prepuce or in patients with previous surgery and with no prepuce.

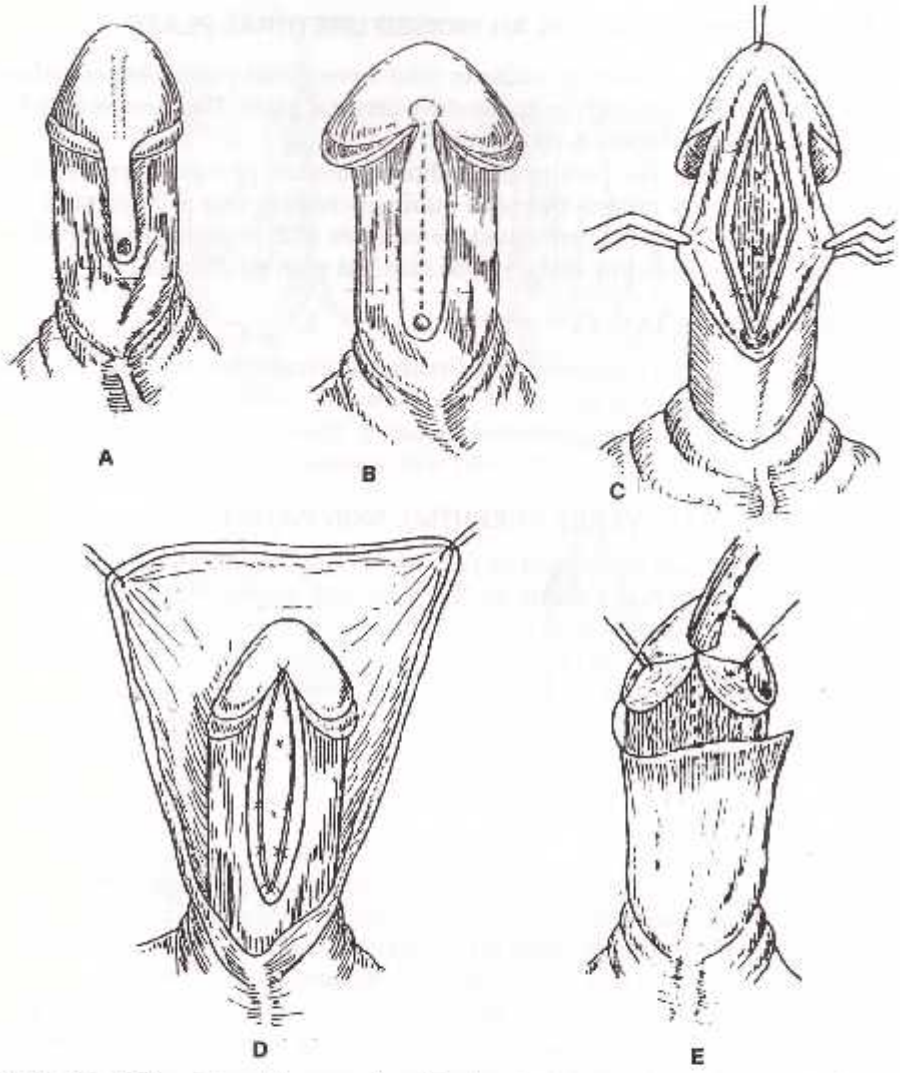
Procedure (Figs 3.5A to H)

A racket-shaped incision incorporates the meatus. Degloving is performed upto an appropriate level (not too proximally). Urethra is laid open upto the healthy urethra. The glans wings are raised on either side of the urethral plate upto the proposed tip and without injuring the corpora cavernosa.

The inner preputial flap is marked with 4/0 nylon stay sutures in a triangular fashion with the apex at the right corner at the junction of prepuce with outer skin and base at the left side at the junction of prepuce with outer skin. The inner preputial flap is raised from the outer prepuce. Between the two layers of prepuce, based on superficial dorsal penile vessels, care is observed not to injure the superficial dorsal vessels. A dorsal oblique cut is created in the outer preputial skin upto midline observing utmost care not to damage the superficial dorsal vessels. The left one-third of prepuce is separated from the outer skin in an avascular plane and thus the whole flap is based on superficial dorsal penile vessels. The preparation of the inner preputial flap and the oblique dorsal cut is further illustrated in Figures 3.6A to E.

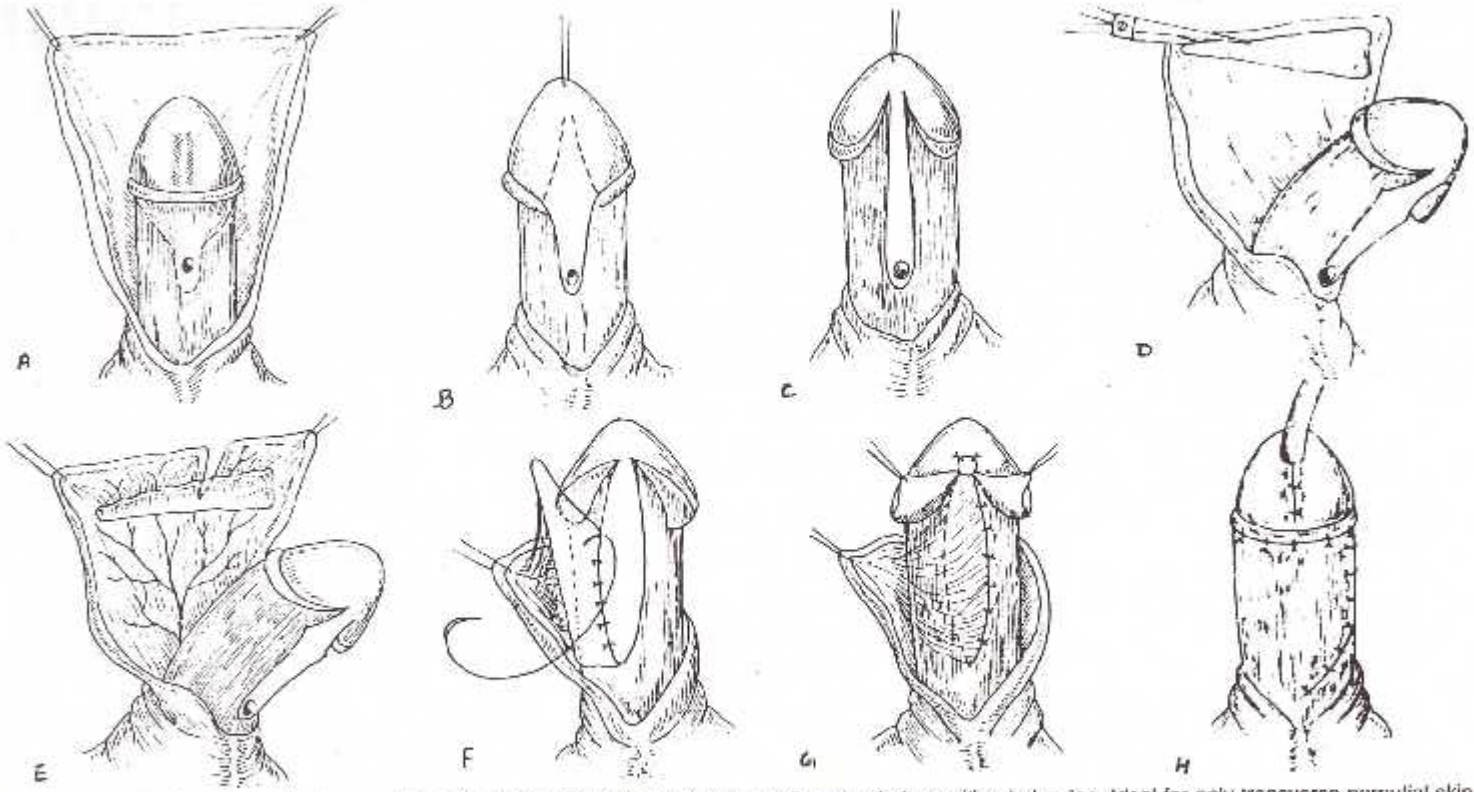
Formation of Neourethra

The inner preputial flap is applied over the urethral plate in an onlay manner. The first stitch should be placed from the middle of the flap to the middle of the

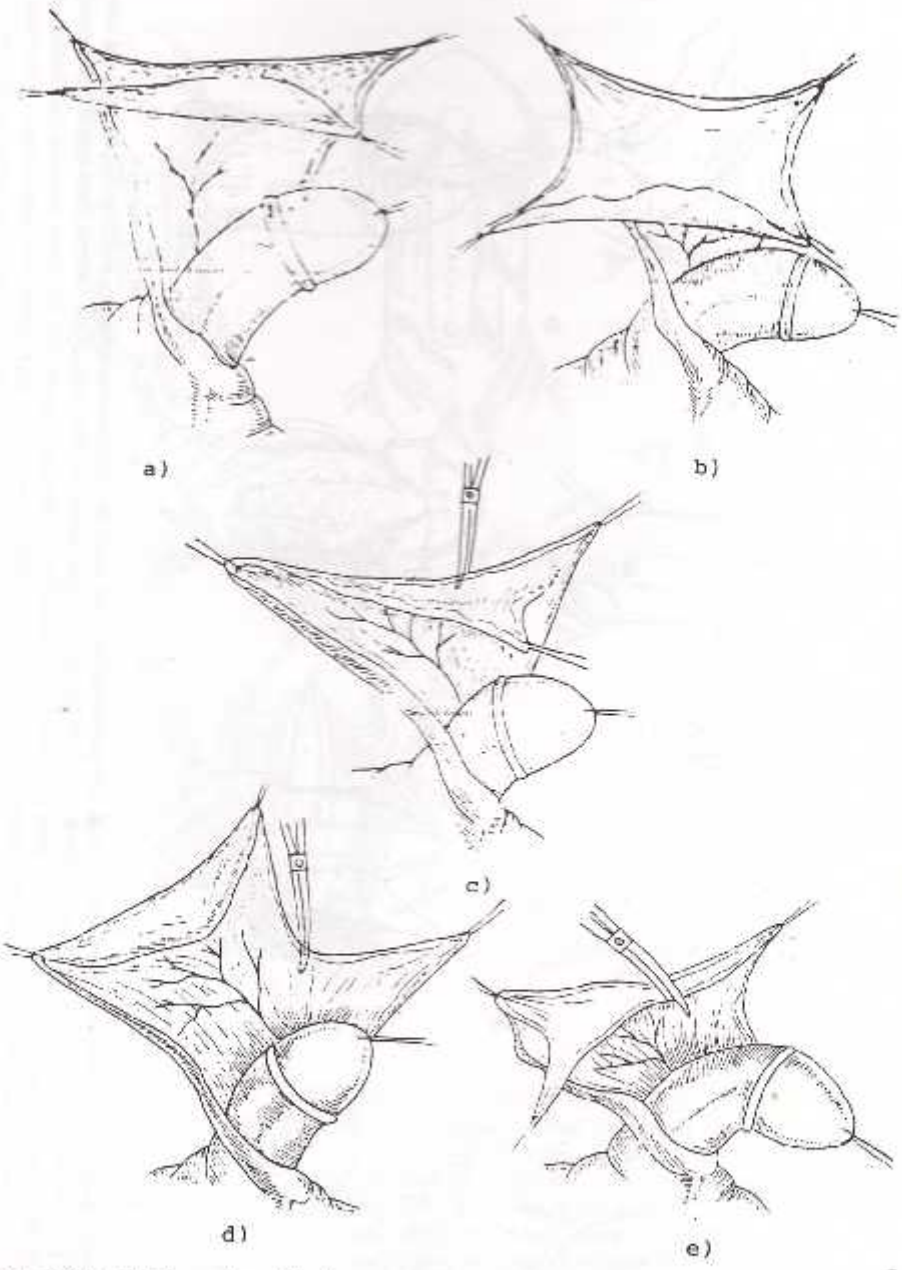


Figs 3.4A to E: The midpenile hypospadias with a flat glans and a healthy urethral plate without chordee. Ideal for a dorsal free graft on the incised urethral plate (A) A circumcoronal incision incorporating the meatus, leaving the urethral plate intact, is given. (B) The urethral plate is incised dorsally in the midline from the meatus to the tip of the glans. The glans wings are mobilised upto the midglans level only. (C) The halves of the urethral plate are mobilised on either side for about 2 to 3 mm and anchored to the underlying tunica. (D) The raw area between the halves of the urethral plate is covered by a free graft (from inner preputial skin or penile skin or buccal mucosa) and anchored by absorbable sutures to the urethral plate and tunica. (E) The dartos fascia anchored with skin is overlapped over the ventral suture line and the skin is covered by an eccentric suture line

laid open urethra by 6/0 chromic catgut, with knots inside and the skin surface facing towards the urethral lumen. The right urethral margin is sutured to the flap by 6/0 chromic interrupted sutures upto the proposed tip and proximally upto the apex of the spatulated urethra.



Figs 3.5A to H: Anterior penile hypospadias with attenuated ventral skin with small grooved glans without chordee. Ideal for only transverse preputial skin patch: (A) Degloving by a racket-shaped incision incorporating the meatus, (B) Glans wings are raised on either side of the urethral plate upto the proposed tip, (C) The urethra is laid open upto healthy urethra, (D) The inner preputial flap is marked in a triangular fashion, (E) The inner preputial flap based on superficial dorsal penile vessels is raised. An oblique cut at the junction of right 2/3rd and left 1/3rd is given upto an appropriate level (without injuring the blood supply), (F, G) The inner preputial flap is applied in an onlay manner and neourethra is formed, (H) Skin cover is provided with an eccentric suture line



Figs 3.6A to E: Preparation of the inner preputial flap and details of oblique cut at the margin of the outer preputial skin after developing inner preputial flap: (A) The inner preputial flap is marked in a triangular fashion with its apex at the right corner and the base at the left corner, (B) The inner preputial flap is separated from the outer preputial skin by sharp dissection between the two layers (based on superficial dorsal penile vessels), (C, D) An oblique cut in the outer preputial skin at the junction of the right 2/3rd and the left 1/3rd is given upto midline without damaging the blood supply, (E) The inner preputial flap which is still attached by avascular fibres to the left 1/3rd of outer prepuce is separated from avascular attachments

The flap is appropriately sized as to provide a uniform and adequate lumen of the neourethra. The left margin of the urethral plate is now sutured by 6/0 chromic interrupted sutures. A 6 or 8F plain Portex catheter is secured.

Glanuloplasty is performed by approximating the wings of the glans after anastomosing the rest of the neourethra by 2 to 3 subcuticular sutures of 6/0 vicryl. The skin covering is done by an eccentric suture line preferably by 6/0 chromic subcuticular stitches. A light pressure dressing is applied.

TRANSVERSE PREPUTIAL SKIN TUBE

It is ideally performed in those who are having considerable chordee with a conical glans or with a flat or shallow glans but with good adequate prepuce.

Patients with severe chordee, a proximal meatus and an inadequate prepuce, moreover, patients with history of previous surgery and no prepuce or markedly scarred prepuce are possibly not the candidates for this technique.

Procedure (Figs 3.7A to F)

A circumcoronal racket-shaped incision incorporating the meatus is given. Degloving is done underneath the dartos and Buck's fascia all around so as to correct the skin and dartos chordee.

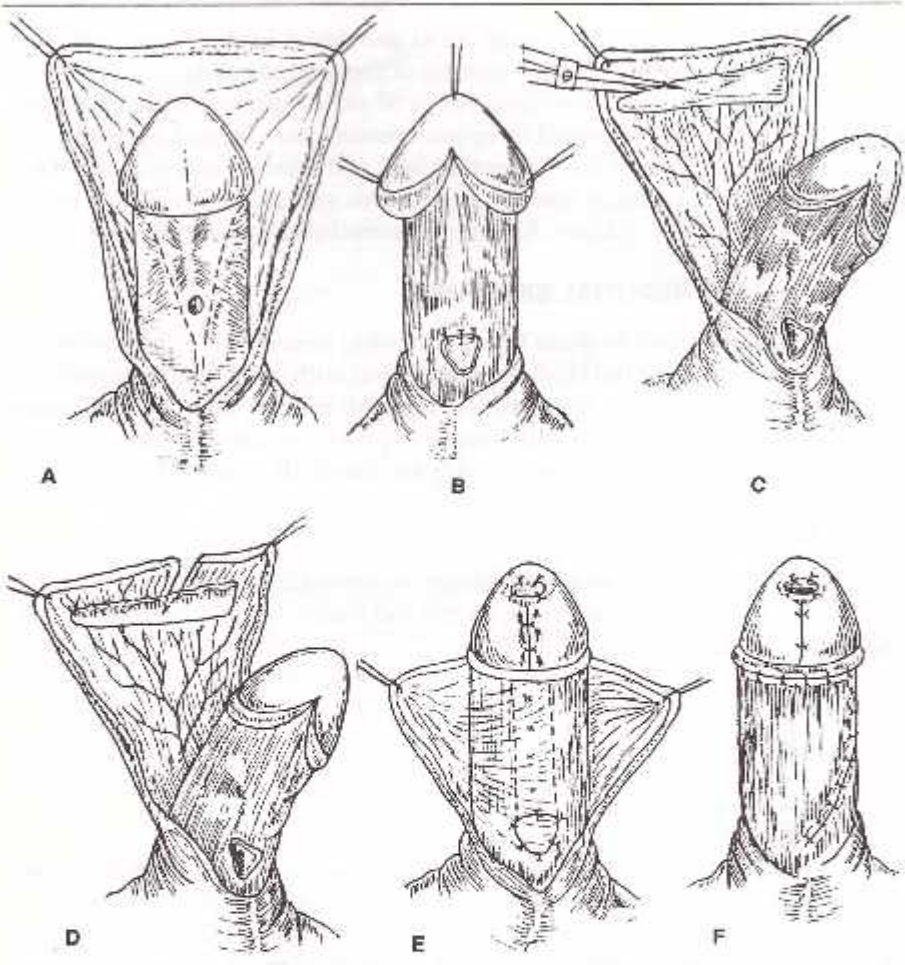
The extent of the true chordee is assessed by Gittes method of artificial erection. Urethra is laid open proximally. Urethra is transected at the point of maximum chordee. The chordee correction is performed slowly and bit by bit by sharp dissection, by incising all fibrous tissue above the tunica, till the healthy urethra commences. Similarly the distal part of chordee is corrected by excising all fanned out fibrous spongiosal tissue.

In a patient with flat or shallow glans, the glans is slit open in midline and the glans wings mobilised adequately over the tunica. Alternatively, if the glans is conical, glans tunneling is done by dissecting the glans from the shaft above the tunica and making a cut at the tip of the glans of the same size as of the proposed neourethra.

The inner preputial flap is prepared in the same manner as that of onlay preputial patch technique (Figs 3.6A to E). After developing the inner preputial flap, an oblique cut in the outer preputial skin on left side at junction of right two-third and left one-third upto the midpoint, with care to protect the blood supply (superficial dorsal vessels). The proximal urethra is anchored to the tunica by 2 to 3 fine 6/0 vicryl sutures. The proximal urethra is spatulated for about 0.75 cm so as to make a wide anastomosis. Proximal anastomosis is performed by bringing the apex of the preputial flap to the spatulated urethra with 6/0 chromic interrupted sutures. A neourethra is formed by tubularisation of the edges of the flap by interrupted sutures of 6/0 chromic catgut.

The distal urethral anastomosis is performed either by bringing the neourethral tube through the tunnel of the glans or by stitching the glans wings as the case may be.

Glanuloplasty is performed by one or two subcuticular vicryl sutures. Catheter 6 to 8 Fr Portex is secured and anchored. The avascular and rough



Figs 3.7A to F: The proximal penile hypospadias with considerable chordee and with adequate prepuce. Ideal for transverse preputial skin tube procedure: (A) Degloving is performed by a racket-shaped incision incorporating the meatus, (B) Chordee is assessed. Urethra is laid open upto proximal to chordee. Urethra is transected at point of maximum chordee and chordee correction is performed, (C) The inner preputial flap is marked in a triangular fashion, (D) The inner preputial flap based on superficial dorsal penile vessels is raised. An oblique cut at the junction of the right 2/3rd and the left 1/3rd is given upto an appropriate level (without damaging the blood supply), (E) A tube is formed from the inner preputial flap, (F) The skin cover is provided by an eccentric suture line

margins of penile skin are excised and the skin cover is performed by interrupted 5/0 or 6/0 subcuticular interrupted stitches with an eccentric suture line. At times, if the covering skin is short, then an oblique cut at the penoscrotal skin may be given to form z plasty with two layer cover. Alternatively, if the skin gap is more, a rotation flap from the scrotum is raised after incising the medial raphe of scrotum. The rotation flap may be obtained from either side of scrotum and it must be of an adequate size to bridge the gap and help provide the skin cover. This procedure ensures a

double layer protection of the proximal anastomosis. A circular dressing with light pressure is applied.

THE TWO STAGE REPAIR OF HYPOSPADIAS

The two stage repair is suitable for patients with marked chordee and meatus situated far proximally. It is also suitable if there is no or inadequate prepuce or if there is preference of the surgeon.

First Stage

A circumcoronal incision, circumscribing the external urethral opening, is applied leaving 5 to 6 mm corona. Degloving is done and chordee correction (if necessary) is performed. Glans is laid open and glans wings are raised. The dorsal penile skin is incised in the midline upto an appropriate level so as to cover the degloved penis with care while not injuring the superficial dorsal vessels. The suturing is started from the tip of the laid open glans to the meatus proximally by 6/0 chromic catgut and the two edges of the covering skin lying in midline. A light pressure dressing is applied.

Second Stage

It is usually done after 6 months.

Procedure

An assessment is made for the width of the laid open glans, the quality of the ventral penile skin, the meatal area for stenosis or for any hair bearing area. After assessment, a 14 F catheter is passed. Two parallel incisions are given on the ventral penile skin, circumscribing the meatus upto the midglans. The width of the ventral penile skin should ideally be equal to the calibre of 14F catheter. After leaving the ventral penile skin strip intact, the rest of the covering penile skin is mobilised after leaving a cuff of 4 to 5 mm corona and degloving is done. Byars cut is now given on dorsal penile skin in such a way that the covering skin suture line will fall eccentrically.

A tube is made of the ventral penile strip by 6/0 subcuticular chromic catgut sutures. Skin covering is provided in two layers, inner subcuticular by 5/0 chromic and outer skin to skin by 5/0 chromic. 6 to 8 F catheter is secured and light pressure dressing applied.

GENERAL CONSIDERATIONS

Vascularity

Axial pattern based flaps have excellent healing property. The penile skin and the inner prepuce is supplied by superficial dorsal penile vessels. Preservation of vascularity of flaps and islands of skin is achieved by careful dissection and protecting superficial dorsal penile vessels.

Free Grafts

Free grafts may be used as a dorsal inlay after incising the urethral plate and as lateral or ventral onlay grafts. The dorsal inlay graft, however, is always the better choice in comparison to ventral or lateral onlay grafts as the later are unreliable due to short-term or long-term postoperative complications in form of fistulae, stenosis or diverticulum.

Minimal Tissue Damage and Correct Tissue Planes

To get into correct tissue plane is generally easy even in redo surgery. The correct plane is underneath the dartos and Buck's fascia. The plane is easily reached by starting the dissection proximally as there are less chances of tethered tissue at the normal site. The dissection in correct plane helps in preserving the vascular supply of the flaps.

Good results also depend upon gentle tissue handling. This is better achieved by the use of operator's thumb and forefingers as far as possible. Skin hook and nontoothed forceps are preferable to toothed forceps.

Suture Material and Suture Technique

Fine suture material is used. 6/0 to 7/0 chromic catgut is used for making neo-urethra and for the skin cover. 6/0 vicryl is used for anchoring and fixing the tissues.

The inversion of the skin of urethral mucosa is a necessary step in neo-urethra formation. Subcuticular stitches are ideal. At times, skin sutures may lead to growth of epithelium which may communicate with the urethral lumen and lead to fistula formation. Growth of epithelium in the suture tracts may at times lead to unsightly tracts. Tension over skin cover is avoided by the use of scrotal flaps and or Z plasty.

Suture Line

The added cover by dartos or the skin and dartos flap is provided over the ventral suture line. An eccentric suture line of skin cover is always ideal to decrease the possibility of fistula formation.

Antibiotics

During the operation procedure, the topical use of antibiotics in dilute saline solution helps to control infection. Use of systemic antibiotics postoperatively is advised. Ideally, broad spectrum antibiotics are started two days prior to surgery and continued for 5 to 6 days postoperatively.

Haemorrhage

Haemostasis is achieved by minimal and precise use of cautery and by infiltrating the incision line by 0.5 per cent xylocaine mixed with 1/8 lac dilution of adrenaline. Alternatively, tourniquet may be used for a judiciously

appropriate period. If there is continuous bleeding during surgery, a light pressure circular dressing always helps to control postoperative bleeding.

Catheter

6 or 8 F Portex is suitable for urine drainage. Polythene catheter being thin walled has an advantage as it provides better lumen than Portex catheter of the same size. Silicone catheter is very soft and liable to kink easily and is therefore not recommended except in cases where diapers are used along with instead of bag drainage.

Magnification

Hypospadias repair is usually contemplated in infants and hence magnification is essential for precise dissection and suturing.

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