

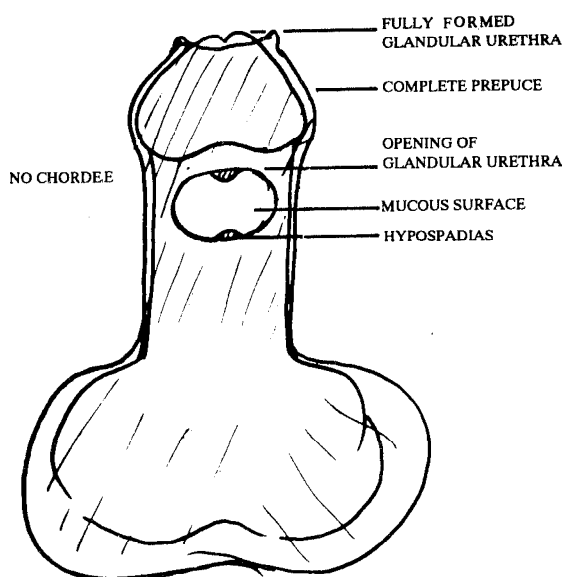


URETHROPLASTY IN HYPOSPADIAS*

Suresh Gupta
 Delhi Plastic Surgery Clinic, New Delhi

Hypospadias is an incomplete development of the anterior urethra which presents itself with a meatal opening at various levels on the under surface of the penis. In the portion distal to the urethral opening the deficient elements are represented by attenuated fibrous tissue, which is also short in length thereby adding to this inadequacy a ventral curvature to the organ, which is commonly referred to as chordee.

The urethra is formed by the progressive fusion of the urogenital folds from the back forwards as an endodermal tube, which is later united at the glanular level with an ectodermal one starting backwards from the glans as a blind pit. Hypospadias occurs due to a developmental arrest of the urethra ascribed to a lack of fetal androgen at the critical stage when fusion of the urogenital folds is occurring. The earlier the disturbance in fetal life the more proximal the arrest of fusion, and the more severe the degree of hypospadias.



(Fig - 1) Unusual case of Hypospadias

In 1962, I¹ published a case of an unusual hypospadias where the subglanular opening of the normally formed glanular urethra was separated from a penile hypospadiac opening by unfolded urethral mucosa on the ventral surface of the penis (Fig - 1).

This case lent support to the prevailing concept of urethral development i.e. the fusion of genital folds. The theory of canalisation of a solid cord of ectodermal cells put forward by Barnstein and Mossman² has few subscribers now. Chordee and ventral curvature of penis in hypospadias occurs due to a growth differential between the normal dorsal cavernous tissues and the deficient mesenchymal tissues distal to the hypospadias opening.³ Rarely is this defect seen in the female and only in exceptional circumstances requires treatment.

CLASSIFICATION OF HYPOSPADIAS

This is made according to the anatomical location of the meatus (Barcat)⁴ after the release of the ventral curvature when present.

Location of Meatus after release of Chordee

- | | |
|--|---|
| 1. Anterior hypospadias (70 per cent) | - Glanular
- Coronal |
| 2. Midpenile hypospadias (10 per cent) | - |
| 3. Posterior hypospadias (20 per cent) | - Posterior 1/3rd shaft
- Penoscrotal
- Scrotal
- Perineal |

You will notice here that almost 70 to 80 per cent cases according to this classification which is used widely in western countries fall into groups for which no surgical treatment was found necessary in the past, as there was no functional disability. The present series does not include cases of Anterior Hypospadias. However, the present mores of society and socio economic pressures have increased the demands for distal hypospadias repairs. The same factors play a part in building up requests for single stage operations even though their complication rates remain higher.

* Based on the Sushruta Oration delivered to the Association of Surgeons of India at Calcutta in December, 1992.

The incidence is one in 300 births⁵. Eight per cent of hypospadias cases have fathers who suffer from this defect. The associated deformities are undescended testicles (13.6 per cent) which is found more in proximal defects and inguinal hernia (9.1 per cent).

David M Davis⁶, Philadelphia said the following : "The combination of qualities necessary for the surgical treatment of hypospadias is found in comparatively few individuals. One can only say that hurried and ill-considered operations are sure to fail and no one should undertake to operate for hypospadias unless he is willing to devote the time and energy necessary for a thorough study of the methods which have proved satisfactory and to a meticulous performance of the operative procedure. After that he may proceed to invent new and improved methods for himself". I quote Dr Davis for I could not have put it better. This then explains why the ability of the surgeons comes before the technique. More than 150 methods described in literature to deal with this problem reflect on the inherent difficulties. It also explains succinctly the results in different hands showing a fistula rate varying from 40 per cent to 3 per cent.

AIM OF TREATMENT

One cannot emphasize too strongly the dual sexual and urinary function of the penis. In a hypospadiac these are in abeyance and only a full restoration of both constitutes a good result. Therefore, the treatment must aim at a full relief from ventral curvature to allow normal sexual activity. The absent urethra should be replaced with a new one through which a single urinary stream can be projected forwards with the patient standing. It should not suffer from new drawbacks of stricture formation, growth of hair, fistulae and should be roomy enough for future instrumentation. The cosmetic appearance of the penis is important.

There are some historical references to earlier Greeks amputating the penis beyond the hypospadias opening as redundant, and since then many ingenious attempts were made to treat this deformity. Of note are the following events: In the 19th century Bouisson suggested a transverse incision at the point of greatest curvature. Thiersch⁷ described the use of local flaps to form the male urethra. Duplay⁸ after releasing the chordee demonstrated that a buried skin strip would epithelialise to form a tubular urethra, a fact which was resurrected and popularised world over by Denis Browne⁹. Nove'-Josserand¹⁰ introduced the idea of urethroplasty with split

skin grafts which was developed further by Sir A H McIndoe¹¹.

I have referred to more than 150 separate techniques described in literature to cure this condition and I also feel sure that at one time or the other excellent results must have been obtained by the various protagonists, so with some diffidence I have put together on a chart techniques in common use today.

POPULAR OPERATIONS IN USE FOR URETHROPLASTY

A. Staged Procedures

Usually two operations with low complication rates

- | | | | |
|-----|--|--|-----------|
| i | Buried skin strip method
(It is applicable to all degrees of hypospadias) | : Marion ¹²
Duplay ⁸
: Browne ⁹ | - 1946 |
| ii | Belt technique | : Fuqua ¹³ | - 1970 |
| iii | Bayars ¹⁴ principle | | - 1955 |
| iv | Cecil Culp ¹⁵ | | - 1955-59 |
| v | Van der Meulen ¹⁶ | | - 1964 |

B. Single Stage Procedures

Single hospitalisation. Applicable to penile defects only.

a. Distal Hypospadias

- | | | | |
|----|---|---|------------------|
| i | Glanular defects
Meatal advancement | : Maggi-Duckett ¹⁷
Gap-Zoantz ¹⁸ | - 1981
- 1989 |
| ii | Subglanular defects
Meatus based flaps | : Mathieu ¹⁹
Horton-Devine ²⁰ | - 1932
- 1972 |

b. Penile defects

- | | | | |
|----|---|---|------------------|
| | | : Prepuccial flaps | |
| i | Single flap - dorsal or inner prepuce either as tube or onlay flap | : Asopa ²¹
Duckett ²² | - 1971
- 1980 |
| ii | Double prepuccial flap of dorsal and inner prepuce - provides inner tube and overlying ventral skin cover | : Hodgson ²³
Standoli ²⁴ | - 1970
- 1982 |

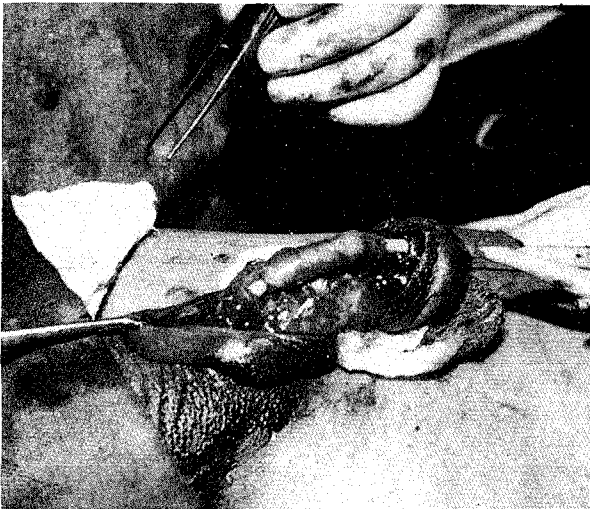
C. Free Grafts

- | | | | |
|----|----------------|--|--------|
| i | Skin: | Nove'-Josserand ¹⁰
McIndoe ¹¹ | - 1937 |
| | Prepuccial | : Horton-Devine ²⁵ | - 1971 |
| ii | Bladder mucosa | : Mammelaar ²⁶ | - 1947 |

The vascularised prepuce flaps are being used increasingly for urethroplasty but suffer from added difficulties of a tube tunnelling through the glans and consequent terminal narrowing and problems of stricture and/or fistulae at the site of urethral anastomosis. Nevertheless, these flaps are popular today as they provide material for one stage repairs.

Skin and mucosa are used as flaps or grafts to restore urethral continuity, but these fail to produce the muscular self-emptying effect of the natural passage. Techniques which tend to produce patulous urethrae allow retention of residual urine and produce weak propulsion of semen. Repeated ascending urinary infections and lowered fertility rates should form subjects for closer study in our patients. Perhaps, we should no longer measure success in terms of fistulae alone.

With this in view we were tempted to utilise a patient's own normal appendix to bridge the urethral defect in a case of pure congenital short urethra by microsurgical technique (Fig - 2). The result was not satisfactory. Much work still needs to be done in the future before tangible results will emerge to this enquiry.



(Fig - 2) Autogenous appendicular free graft ready for Micro Anastomosis

I would now like to place before you a method I have followed from 1957, the year I performed my first urethroplasty and to the present day when I may well have crossed the 1000 mark with only

slight improvements and modifications over the years. This provides me with a fistula rate of around three per cent. I can recommend it to you for its simplicity, dependability and consistency.

The buried skin strip method of Duplay⁸ and Marion¹² as popularised by Browne⁹, meets our requirements admirably. The buried edges of the skin tube themselves by epithelialisation. It is, however, not possible for this tubing process to be completed within the first post operative week, when normal urinary flow is allowed through the new urethra. The success of the repair, therefore, must depend on the firm union of the subcutaneous tissues and skin of these flaps, so that their granulating surfaces could bear the brunt of the urinary flow till they get covered by epithelium. My personal investigation²⁷ indicates that this epithelialization is not completed till the fourth post-operative week.

In Browne's technique reliance was placed on beads and stoppers' to obtain subcutaneous tissue approximation. Absorbable sutures were utilised for skin approximation which were later expected to be shed as part of a sterile scab. This technique does not take into account the vagaries of post-operative oedema of penile tissues. It provided only a fixed distance for the traverse of the swollen flaps. This type of tension suture also precludes the use of oedema controlling dressings. Where the oedema exceeds the expectations of the surgeon the beads cut through, with subsequent epithelialization of the stitch holes and fistulae formation. The frequency of these complaints led Gillies to observe that this method was to be looked upon with 'fistulous suspicion'. Moore²⁸ in reviewing the work of five experienced colleagues reported 46 failures in 74 cases.

To overcome this problem I, therefore, introduced instead, a single layer pull through 000 monofilament nylon stitch in the subcutaneous tissues of the lateral flaps to bring about a water-tight approximation and a similar stitch of finer material to approximate the skin edges over the preceding layer. Post-operative oedema now could only marry the tissue edges further together. The watertightness was maintained in the face of oedema without compromising the blood supply. The stitch runs before overtightening occurs. Relief of oedema only renders the stitches loose and assists their removal.

OPERATIVE PROCEDURE

Operative treatment is divided into two stages. A general anaesthetic with endotracheal intubation is

administered to all cases. A local infiltration of 1:200,000 adrenaline in saline, allowed 15 minutes to take effect, causes effective vaso-constriction for precision of dissection and minimisation of bleeding.

One should remember that separation of the thick vascular subcutaneous tissues from the overlying penile skin renders the skin prone to necrosis, and, therefore flaps should be dissected at the deep fascial level next to the corpora cavernosa. Prepuce flaps should be separated to the minimum extent required. Hooks and retractors should be applied to the deeper layers and not to the skin edges.

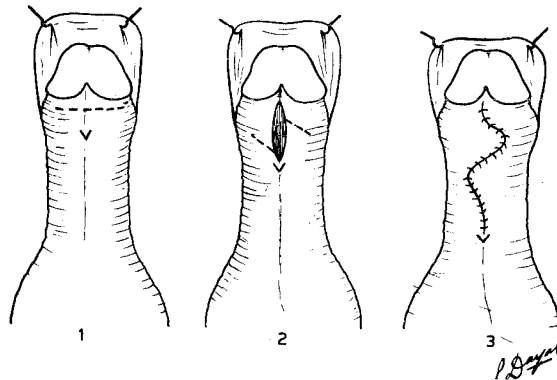
I Stage - Correction of Associated Ventral Curvature (Chordee)

With the exception of infants who present

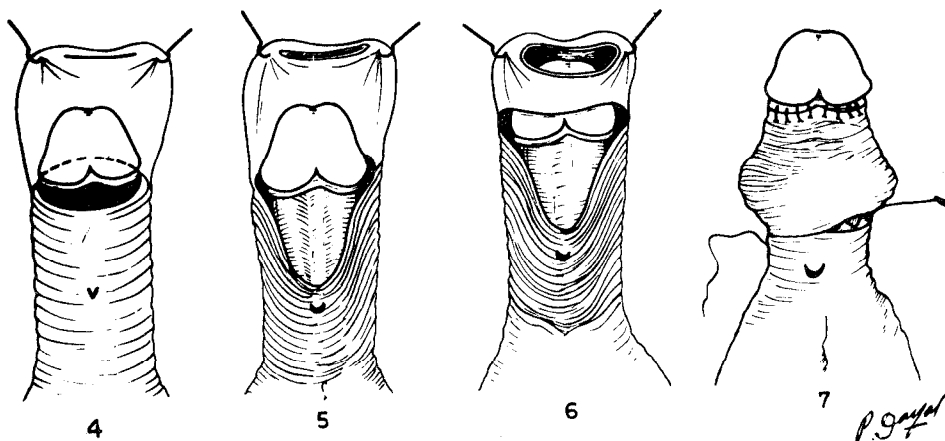
themselves with an associated pin hole meatus and need a meatotomy, no further treatment is required till the child reaches the age of two to three years. This stage should be delayed if the organ is too small to operate upon with ease.

Emphasis must be laid on complete excision of the vestigeal fibrous tissue and freeing of all normal structures from its tethering effect. This fibrous tissue extends from the glans down into the cleft between the corpora cavernosa. Straightening of the organ must be confirmed by the artificial erection test of Gittes and McLaughlin²⁹ which forms a useful addition to the armamentarium of the hypospadias surgeon.

I usually use one of the two following methods to cover the ventral skin defect. The Heinz-Miculicz transverse cut and longitudinal suture with "z"



(Fig - 3) Heinz-Miculicz Procedure and "Z" Plasty



(Fig - 4) Ombradanne-Nesbit Procedure

plasty ensures a soft and supple ventral surface and it also breaks the line of any fibrous tissues which may have got picked up inadvertently in the edges of the horizontal incision (Fig - 3). In more severe cases an Ombradanne³⁰-Nesbit³¹ type of transfer of dorsal prepuceal flap to the ventrum is preferred (Fig - 4).

Excessive skin transfer from the dorsum should be avoided as it is not necessary and only crowds up the tissues on the ventrum. This may even become a source of a troublesome complication later where the redundant skin inside the urethroplasty acts as a valve to hinder the flow of urine. In severe curvatures in adults even after a thorough release there may remain a residual curvature of the corpora cavernosa which becomes manifest in erection.

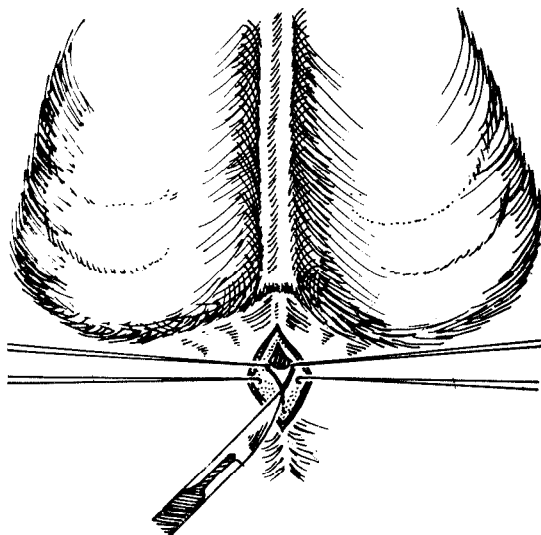
II. Stage - Urethroplasty

Suitable age for this operation in children is between four to six years, provided the organ is not too under-developed. In grown ups three to six months must elapse after the correction of the ventral curvature.

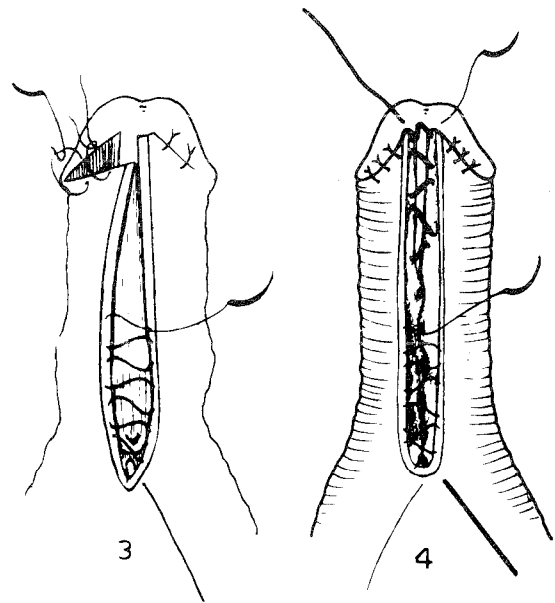
Urinary Diversion

Urinary diversion from the urethroplasty area by a perineal urethrostomy is required in all cases. The method of urethrostomy followed is quite simple. It consists of introducing a suitable sized bougie

through the meatus and making it point up into the perineum. The skin and perineal tissues are divided over the tip of the instrument in line with a three fourth inch longitudinal incision on the linea nigra till the urethral mucosa presents itself (Fig - 5). This is picked up on a pair of fine hooks, the bougie, is slightly withdrawn and the urethra incised open. A lubricated silastic catheter (size 8 to 10) with a three to five cc. bag, is introduced directly through this opening into the bladder. With a little practice this method does not take more than a few minutes and has the advantage on the other prevalent methods of avoiding instrumental damage to the penile urethra. What look like minor tears in mucosa can form the basis of a stricture.



(Fig - 5) Direct Perineal Urethrostomy



(Fig - 6) Urethroplasty Two Layers of Pull Through Water Tight Sutures

Urethroplasty

Dissection of flaps should take place at the deep fascial level close to the Buck's Fascia, and mobilised well round the shaft of the penis. Care has to be taken to avoid all forms of traction on the skin strip to be buried lest its blood supply gets undermined.

Glanular stitches anchoring the anterior ends of the lateral flaps should spare enough skin and subcutaneous tissue towards the midline so that a tension free union can be effected. The two layers stitching must be carried out meticulously and the 'bites' placed adjacent to each other to render the repair watertight (Fig - 6).

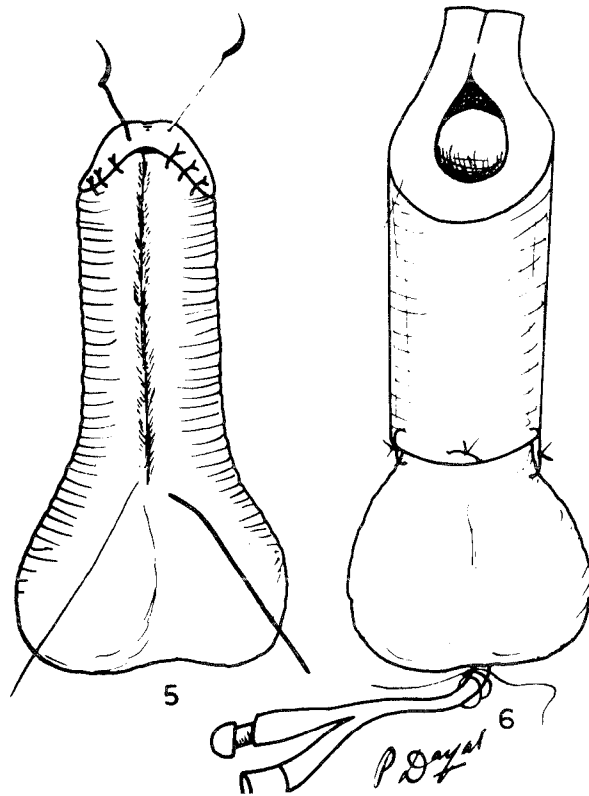
The subcutaneous pull through stitch of monofilament 000 nylon should be applied at the level of the thickest edge of the lateral flap. Further borrowing of tissues from the sides is unnecessary and leads to an undue shortage of skin on the dorsum. The skin edges deserve special attention as they are united with an accurate subcuticular stitch (Fig - 7).

Where too much dorsal skin has been transferred to the ventrum in the first stage which happens more in the bucket handle type of procedure, the distal urethral repair is modified as shown in (Fig - 8 & 9).

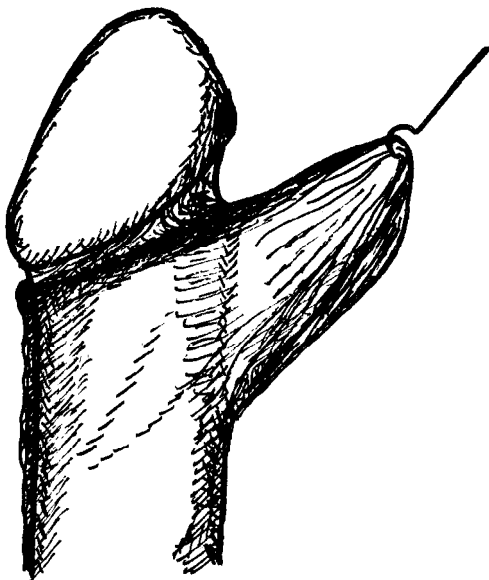
Dissection must be directed away from the proposed urethral plate to preserve its blood supply. Distal meatal stenosis is less likely if the buried strip is cut a little longer than the required length and is broad enough to tube itself easily. The glanular tunnel must be made roomy for the flap to fit in loosely.

Dorsal Slit

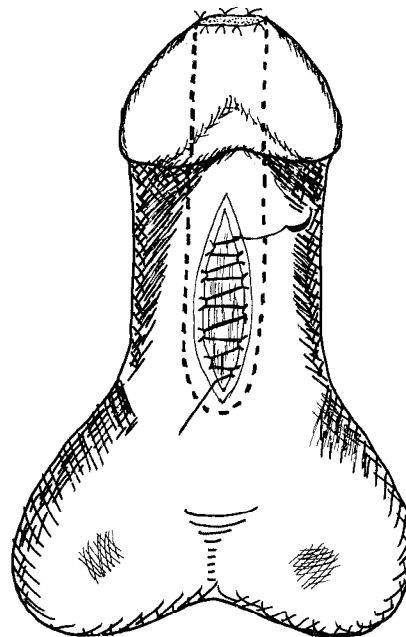
A dorsal relaxation incision as described by Browne is not a must in all cases. Where there is an element of snugness after the suture of the lateral flaps this form of relaxation is desirable. For peno-scrotal defects the incision on the dorsum must be carried proximally beyond the firm pubo-penile ring and it should be covered with a split skin graft from the adjoining thigh. Post operative cicatrization and



(Fig - 7) Completion of Urethroplasty and use of U Foam



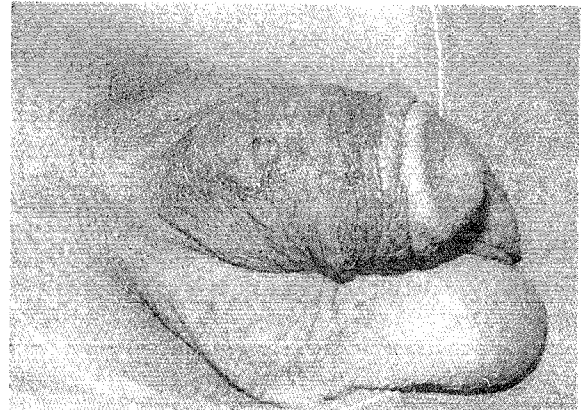
(Fig - 8) Excess Skin on the Ventrum & Modification of Urethroplasty for Excess Ventral Skin



(Fig - 9) Modification of Urethroplasty for excess ventral skin



(Fig - 10) Dorsal Cicatrisation Following Healing of Ungrafted Wound



(Fig - 11) Dorsal skin graft in place

dorsal skin shortage is not as rare as is often thought. (Fig 10 & 11).

In the original Browne technique instances of dorsal skin shortage were fewer, probably because of a very austere use of prepuccial skin in the correction of ventral flexion. Reports of recurrences of 'chordee' were perhaps more.

Polyurethane foam dressing³² is ideal for this operation. The material is stitched round the shaft of the penis. It retains its elasticity and absorbency right up to the time it is removed and by keeping the organ gently pressed and in erect position minimises oedema. It does not stick to the wound edges and stitch ends.

Post Operative Care

On the sixth post operative day the urinary diversion is dismantled and the dressings are removed. The patient is allowed to pass urine with the stitches in place for three to four days when the remaining sutures are eased out. This routine is seldom varied. The closure of the urethrostomy has posed no problem. It takes place on its own in three to four days.

RESULTS

The chart reveals a simple breakdown of cases in terms of fistulae in the repair over a period of 24 years (1962-1986). In the last few years incidence of fistulae has become infrequent.

From 1962 to 1974					
Patients	Age	Three layer technique	Two layer technique	Total	Fistula
Children	4-12	89	63	152	7
Adolescents & adults	12-23	7	15	22	2
Total		96	78	174	9
5.17%					
From 1974 to 1986					
Patients	Age	Three layer technique	Two layer technique	Total	Fistula
Children	4-12	—	348	348	11
Adolescents & adults	12-28	—	44	44	4
Total		—	392	392	15
3.82%					
Grand total				566	24
(1962-1986) 24 years					(4.24%)

COMPLICATIONS

Early Complications

- I Haematomas
- II Infection
- III Meatal Encrustation
- IV Devascularised Flaps
- V Erections
- VI Bladder spasms
- VII Pain

Bladder spasms and post-operative penile erections can be reduced a great deal by using catheters much thinner than the size of the urethra and having small balloons of 3 to 5 cc to avoid urethral and trigonal irritation.

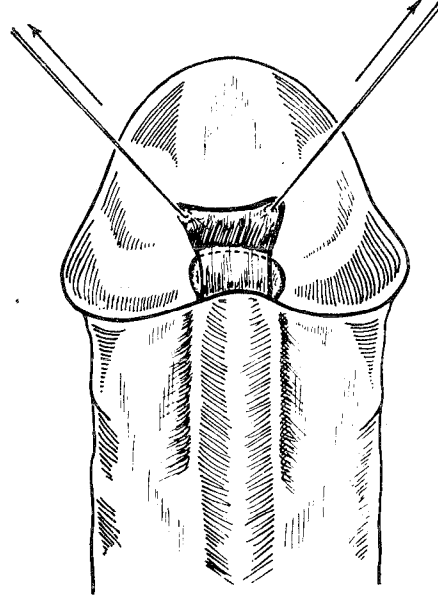
Late Complications

1. **Fistulae:** Greater attention to details and improvement in techniques have benefited the results worldwide. Haematoma with or without infection and attempts at removal of the stitches prematurely contributed to most of our breakdowns.

Presence of distal urinary obstruction due to stricture and/or diverticulum should be excluded in all these patients as a preliminary to treatment. In case of an established fistula, excision of all scar tissue including the tract, followed by a tension free cover, form the essentials of the treatment. No attempt is made to stitch the inner lining which is left free to epithelialise. Stitching often causes local necrosis of skin edges and only adds to the problem. Where even a suggestion of tension in tissue cover exists a local flap should be resorted to. A short urinary diversion for 48 hours or so may be required in large fistulae.

2. **Receded Meatus:** This is treated as a minor hypospadias. The ventral skin cover is advanced locally over the under-surface of the glans by mobilising the loose surrounding skin and subcutaneous tissue usually present on the ventrum. Where the skin falls short it can be helped forwards by Byars' Procedure or other suitable method.

3. **Stricture and diverticulum:** In the neo-urethra, these are usually a result of instrumental damage or poor technique, bad design of the flaps, avascular loss of tissue and at times post-operative infection. Internal Urethrostomy which may require to be repeated, helps in most cases, where, urethral dilatation has failed. It may be necessary at times to re-do the urethroplasty.



(Fig - 12) "Hitching Up" and Excision of Excess Ventral Skin Causing Valvular Obstruction

4. **Valvular obstruction in the new urethra³³:** It manifests as urinary obstruction following removal of urinary diversion. It is relieved by the passage of the catheter. The cause lies in loose skin of the urethral plate folding forwards and obstructing the flow of urine. This condition may be likened to a loose pair of trousers which require 'hitching up'. It is approached through an incision along the posterior edge of the neo-meatus (Fig.12). With the help of two snips of the scissors in the two lateral recesses, redundant skin of the back wall is pulled out of the meatus and is adequately trimmed. A few stitches complete the operation.

Reconstruction of urethra will remain a demanding surgical procedure calling for special talents in the treating surgeon. Greater understanding of local anatomy and requirements of repair, atraumatic technique and good planning of operations has brought down the complication rate to between three and five per cent. Gone are the days of repeated unsuccessful hospitalisations full of disappointment to both the patient and the surgeon.

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Author

Dr. Suresh Gupta MS, Delhi Plastic Surgery Clinic, 12 Jaipur Estate, Nizamuddin East, New Delhi

Requests for reprints to **Dr. Suresh Gupta M.S., Delhi Plastic Surgery Clinic, 12 Jaipur Estate, Nizamuddin East, New Delhi - 110 013**