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Dear Jacques:

I would like to ask that you do a chapter in our new book, *Reconstructive Surgery of the External Genitalia*. I'm doing the book with my son, Chuck, (Pediatric Urologist) and Jack Elder, the head of Pediatric Urology at Case Western Reserve University in Cleveland. We're having approximately 100 authors who are known all over the world for their expertise in this field and your contribution would be welcomed.

We and your peers consider you to be an authority on Hypospadias. We are inviting you to write a chapter entitled "Multi-Staged Hypospadias Repairs: Is There Still a Need?" We think your contribution should be approximately five pages long and suggest it contain four illustrations and four color photographs. If you will have your artist do rough sketches of what you would like to present for illustrations we will have our artist do the final illustrations here so we can have a standardized book with illustrations throughout by the same person.

I'm firmly convinced there is a place for the multi-staged hypospadias repair and hope you will present a good argument for the book. I'm also particularly proud that we can have you and your country represented in the book. It should be a good product for we have most of the leading urologists and pediatric surgeons included as authors also.

I do hope that you will be able to do this, and will look forward to hearing from you soon.

Kindest personal regards.

Sincerely,

Charles E. Horton, M.D.
MULTI-STAGED HYPOSPADIAS REPAIR, IS THERE STILL A NEED?

Prof. Dr. J.C. van der Meulen
Dr. P.M. Gilbert

After 200 years of hypospadias surgery starting with Dieffenbach and the successive promotion of several hundred techniques there is still no consensus on the best treatment for this anomaly. Also even using the best accepted techniques reported complications can be very high while treatment of these can be even more difficult than the primary operation. A sad situation considering the time and the energy put in by many surgeons and the loss of quality of life suffered by the patients.

Indications for hypospadias surgery

Objective determination of efficacy of one surgical procedure over another requires first of all a common language. For instance chordee should only be called chordee if it disturbs function and if function can only be restored by dissection of the corpora and retropositioning of the meatus. In other words an "orthoplasty". Not very long ago all hypospadias patients were considered to have chordee and therefore in need of an orthoplasty before the reconstruction of an urethra (urethroplasty) could be considered. Smith and Blackfield (1952) were the first to challenge this concept in the following statement: "First of all, we find it necessary to explode the myth about the presence of a "bowstringing" of the rudimentary corpus spongiosum extending distal to the abnormally placed orifice, as the cause of chorda". Smith (1955) later reported having found this strand (dutifully depicted by medical illustrators) in only 3 of his 73 patients with curvature of the penis. Then why the curvature? Van der Meulen attributed this phenomenon to the ever present shortage of skin on the ventral side of the penis and explained this shortage by a discrepancy in growth of the urethral plate and the skin of the penis. This discrepancy will occur, when the development of the urethral plate is disturbed, while the skin continues to grow. As it cannot grow in a longitudinal direction, it folds upon itself and becomes plicated. By this plication most of the skin is shifted toward the dorsal aspect, where the dog-ears are formed. The oblique raphes mark the fusion of the edges of the plication. This explanation had important consequences for many patients with hypospadias. Not only because it allowed for immediate urethral reconstruction and correction of curvature, due to skin shortage, in more than 80% of hypospadias patients, but also because results of treatment for this type of hypospadias dramatically improved. (R.)
Today the pendulum has swung even wider to the other extreme. Peled et al recently wrote that in their series of patients none had chordee, that any curvature was due to shortage of skin, that this shortage could be corrected by rearrangement of skin and that consequently a one-stage urethroplasty was always possible. Whether this view is correct is doubtful, but if we ever want to reach a consensus on the best treatment for hypospadias, the usefulness of an orthoplasty and its indications, if they remain, will have to be decided upon.

Objective determination of efficacy of one surgical procedure over another also requires a common strategy. If the need for an orthoplasty should no longer exist and all patients with hypospadias can be treated by one stage urethroplasty, the question is there a need for two-stage hypospadias repair becomes futile. If however an orthoplasty remains imperative in selected cases the question must be answered.

Not long ago a two-stage ortho-urethroplasty was the rule rather than exception. Today the pendulum has here also swung to the other extreme. A one-stage ortho-urethroplasty is now commonly advocated. (R.) Unfortunately, because in contrast with the excellent results of a one stage "urethroplasty", complications of a one stage ortho-urethroplasty are still very high. (R.) Justifying the question raised in the title of this chapter.

Objective determination of efficacy of one procedure over another finally requires a common definition of the short term complications that may result, of the long term implications these complications may have and even more important an explanation of the causative mechanisms involved. (R.)

**Complication of hypospadias repair**

In a discussion of complications following hypospadias surgery distinction should first be made between problems concerning function and problems concerning appearance.

A. Problems concerning function

Functional disturbances following hypospadias repair may be due to complications causing:
1. deficient erection of the penile body
2. deficient dimensions of the neo-urethra
3. deficient protection of the neo-urethra
4. deficient position and dimensions of the neo-meatus
1. Deficient erection of the penile body

Persistant curvature is occasionally seen following an ortho­plasty and is caused by inadequate dissection of the corpora cavernosa or by inadequate distribution of tissues following the dissection.

Release of the corpora is not so much obtained by the resection of tissue i.e. chordae as by full dissection of the corpora. This step involves retropositioning of the urethra. The quality of correction can be checked using the artificial erection test. Once adequate release of the corpora is obtained the defect must be closed, but shortage of skin, a mid-line ventral scar or a short urethra may all result in persist­ance of curvature.

A full thickness graft as advocated by Devine and Horton and more recently by Bracka would seem to be the solution, however in untrained hands rates of graft failure may be unacceptably high and the question of subsequent growth in such grafts has not been answered.

Closure with two flaps as suggested by Byars has the disadvan­tage of leaving a mid-line scar and also provides insufficient tissue immediately distal to the meatus. In addition the vascularization of one flap may become random.

The best solution in our view is to close the post-orthoplasty defect by the use of a well vascularised flap, which can be obtained from dorsal skin. This flap is transposed with or without urethra, depending on the procedure chosen (one-stage or two-stage).

Torsion of the penis is sometimes said to be a complication of unilateral flap rotation - however the incidence of initial penile rotation is unknown and torsion should only occur if the corpora are not dissected fully.

2. Deficient dimensions of the urethra

Normally the urethra is an adaptable structure which increases its width with passage of urine and its length during erection of the penis. In an ortho-urethroplasty whether performed in one or two stages, there is a minimum of one longitudinal scar plus two circumferential: commonly one at each end. The scar at the end can be avoided if use is made of the double face island flap shown in fig........ In addition the neo-urethra is made of skin. It is not surrounded by a corpus spongiosum and it does not have the same degree of adaptability. The absence of the corpus spongiosum may allow excessive widening of the neo-urethra whereas scarring promotes narrowing and shortening - these factors combine to produce the irregularities of the neo-urethra so well demonstrated by Townsend (ref.).
Deficiencies in dimension of the neo-urethra may be due to:

a. Inadequate vascularisation of the urethral strip.
Necrosis and loss of urethral lining may occur when vascularisation of a skin flap or graft is compromised by poorly performed dissection, by compression of a flap tunnelled through the glans or by failure of graft take.

b. Inadequate composition of the urethral strip.
Use of more than one flap with the presence of an extra scar may well cause narrowing or shortening whereas use of a graft or slow healing of a graft may result in inadequate lengthening, particularly during erection.

c. Inadequate connection of the urethral strip.
Stenosis of the anastomoses proximally and distally will occur if these are made in circular fashion. Narrowing is avoided by breaking up this scar with a V-shaped interdigitation.

d. Inadequate delineation of the urethral strip.
In attempts to avoid a neo-urethra being too short or too narrow it is often made too wide and too long.
The width should be made in accordance with the urethral calibre accepted as normal for the age of the patient.
The length of the strip is determined by the distance from the apex of the straightened penis and the position of the dystopic meatus.
The use of a two-stage operation allows for correction when a dystopic meatus is too narrow or the urethral lining too short or too long. Complications such as straining due to stenosis, penile curvature in erection and fold formation in the neo-urethra are avoided.

e. Inadequate formation of the urethral tube.
Irregularities of urethral dimension can be expected when the "fixed" strip of Dennis Browne is used. It cannot fold and so tubing of its unsatisfied edges occurs by formation of new epithelium. To prevent this, suturing of the fixed strip is indicated. However folding a soft plable strip by approximation of subcutaneous tissues over the urethra also brings the edges of the the strips together and produces a urethra of equal quality so the more difficult procedure of tubing offers no advantages.

The development of urethral abnormalities may be an ongoing process. There is no guarantee that longitudinal scars will increase in length to match growth. The construction of a neo-urethra which is of adequate length and width and which is capable of an evenly distributed response to the passage of urine is therefore not an easy matter.
3. Deficient protection of the neo-urethra

Fistulas are the most common complications of hypospadias surgery. They occur when healing of skin over the neo-urethra is disturbed and unsatisfied edges of the neo-urethra are allowed to connect with those in the skin. Epithelialization of this tract is unfortunately extremely rapid.

The following are we feel the major causes:

a. Inadequate flap vascularisation.
Flaps used to cover the neo urethra can be too small, thin or too scarred. In each instant devascularisation may result, causing woundhealing problems and fistulae. One well-vascularised flap of adequate size offers a solution to this problem, because it can be sutured without tension and allow an even skin distribution.

b. Inadequate flap fixation.
Unless the flap is sutured carefully, preferably by approximation of subcutaneous tissues in two layers, the wound will heal poorly and fistulae are more liable to occur.

c. Inadequate distribution of tissues.
Urine flow tends to take the path of least resistance, so the part of the wound most at risk is near or at the proximal junction area where the highest pressure is found. The superimposition of one suture line over another, allows a relatively unrestricted passage to flow, hence fistula formation is more likely. Separation of suture line and urethra will reduce the chance of fistula formation, because resistance to the extra urethral passage of urine is increased forcing it to follow the course of the neo-urethra.

d. Inadequate diversion of urine.
In urethro-plasty with its short neo-urethra there is no need for urinary diversion. Contrary to this it is required following an ortho-urethroplasty. Unfortunately catheter drainage is frequently associated with bladder infections and spasms.
Straining will lead to leakage around the catheter and higher urethral pressure. Drainage incisions, at a sufficient distance from the urethra, permit urine to escape and allow the neo-canal to heal before epithelialization of the drainage tract has taken place.
A fenestrated stent passed through the neo-urethra also serve to provide trouble-free drainage. A suprapubic cystostomy is however required if these alternatives fail.
e. Inadequate dressing of penis. Dressings may do more harm than good. Compressive gauze dressings may apply a pressure which is far too high: greater than 150 cms H2O. The dressing does not protect against infection which is usually secondary to haematoma and tissue necrosis, both being worsened by a bad dressing. It may increase resistance of the urine flow, cause strangulation and predispose to the formation of fistulae. Application of a simple sandwich gauze dressing is really all that is required.

4. Deficient position and dimension of the neo-meatus

Terminalisation of the meatus is a major objective of hypospadias operations. It can be achieved by glans closing, glanssplitting and glanstunnelling procedures. Each of these techniques has its specific advantages and disadvantages affecting size and site of the meatus.

Size of meatus

Narrowing of the meatus is often seen in glans tunnelling procedures. Perhaps this problem can be avoided by coring out a tunnel and by interdigitation of V-shaped flap as already mentioned. Widening of the meatus is observed following glans-closing procedures. It may occur as skin relaxes reducing the amount of the urethral support. It results in problems such as spraying. However abnormalities in the shape of the meatus and the angulation of the glans or the penile shaft may equally be responsible.

Site of meatus

Protrusion of the urethral lining is rare and probably due to presence of surplus skin. Retrusion of the meatus is much more common. It seems to occur, when stretching of scar tissue in the neo-urethra or skin does not keep pace with growth. (R.) As a result the terminal meatus may acquire a more ventral position necessitating further surgery.

Glans tunnelling is quick and apparently effective but has an increased risk of stenosis, back-pressure and higher fistula rate. On the other hand glans closing procedures take longer initially and are associated with an increased risk of widening, resulting in spraying and urinary deflection. Correction of the problem is however much easier. The solution to this dilemma is probably found in a glanssplitting procedure, but further study is still required.
B. Problems concerning appearance

Following surgery many patients feel conscious of the resultant abnormal appearance; dog-ears and asymmetrical skin being the main complaints rather than a dystopic meatus. Other problems are skin tags, sinuses, scars, contractures and skin discoloration. Bracka reported that patients attached as much value to the appearance of their penis as they did to its function. A normal looking penis is however a difficult goal to achieve. The repaired penis is circumcised, the glans is not of normal shape, the meatus is rarely slit-like and there is no ventral mid-line raphe – never the less the appearance should be acceptable if surgical care is taken.

Conclusions

The question raised in the title of this article cannot be answered by a simple yes or no. A one-stage correction used for a patient who does not require straightening and therefore only needs a urethroplasty, cannot be compared with a one stage correction for a patient that does need straightening and therefore require an ortho-urethroplasty. A clear distinction between anomalies belonging to the first or second category is therefore necessary. We feel that a patient belongs to the first category when his penis is straight in erection or becomes straight following injection with saline or release of deficient or tethering skin and fascia. Retro-positioning of the dystopic meatus will not be required and correction is always attempted in one stage. This is a first degree hypospadias and the majority of patients belongs to this category. All other patients not belonging to this category are therefore second degree. This means that a choice can be made between an ortho-urethroplasty, attempted in one stage or correction in separate stages. The question is there still a need for a two-stage Hypospadias repair can therefore only apply to the correction of a 2 degree hypospadias.

Before answering this let us first say that a one stage ortho-urethroplasty is an attractive concept. Island flaps have been used by the first author in the early seventies and a double faced island flap (Janusflap) similar to the one reported by Asopa 1984 and Duckett 1986 was reported by the first author in 1986).
In spite of this the concept was never pursued, because the objective was felt to be one bridge to far. The reasons for this view are the following:

1. The complication rate of a one-stage ortho-urethroplasty is persistently high (Harris). Fistulas or stenosis is observed in 35% of patients.
2. The operation is more difficult, the margins for error are small and the learning curve is corresponding longer (Harris).
3. The failures that occur are less easy to correct and adjustments cannot be made.
4. The technique is not sufficiently straightforward to be undertaken by any competent surgeon.

As a result it cannot be used in any part of the world.

If all adverse factors could be eliminated or controlled then a one-stage ortho-urethroplasty would be acceptable. However a technique with a high complication rate also becomes a multi-stage procedure in a significant number of cases. How many stages on average will not be known for a long time. Consequent it is not certain that the average one-stage procedure over the years will take less time then the average two-stage procedure. No data exist: nor will they exist before consensus is reached on the optimal goal that can and should be achieved.

The two-staged ortho-urethroplasty that we have used (fig...) is also a multi-stage procedure in the majority of cases. On average 3 operations were needed in the examined series of cases before patient, parent and surgeon were satisfied. On several occasions urethral reconstruction was postponed, because of skin contractures or irregularities that had to be corrected first. In a few patients urethral reconstruction was performed in stages, because lack of sufficient skin, made this imperative. Until recently repair was catheter free. Urinary diversion was facilitated by drainage incisions or utilization of an urethral stent, a supra pub catheter was only utilized in case of emergency.

Considering that:

1. A minority of the patients (+15%) requires an ortho-urethroplasty.
2. A majority of all patients (86%) feels that the number of operations is not very important provided that treatment is completed by school age.
3. A two-stage procedure gives one the opportunity of checking the penis for straightness scar contractures, stenosis etc. before urethral reconstruction os begun.
4. Hypospadias patients throughout the world are generally treated by non-specialists and not by masters like Asopa, Duckett, Horton and Standoli etc.

The answer to the question in the title should be yes if it refers to ortho-urethroplasties.
References


Dear Charlie,

Enclosed you will find my chapter on hypospadias repair. The photographs and illustrations will be sent by separate post in a few weeks.

Please let me know whether this is satisfactory.

With warmest regards,

Prof. Dr. J.C. van der Meulen.