FROM THE GUEST EDITORS

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Hypospadias surgery, despite its continuous evolution and re-invention, still retains great interest since it represents a very controversial and provocative topic. We were, therefore, surprised to discover that since August 1996 when Larry Baskin edited a superb double-issue discussing both the role of chordee and of the urethral plate and last year’s outstanding issue of Pierre Mouriquand on hypospadias etiology, no further discussion on “formal” hypospadias surgery has been more recently addressed in the Dialogues. We feel that, over the last few years, while an overall consensus has probably been reached for the treatment of distal forms, much controversy still exist on the treatment of more severe forms. Although these represent a true minority of our daily repairs, there is little doubt that they constitute the most challenging task for the reconstructive surgeon. We have, therefore, concentrated in this new issue of Dialogues on an extensive discussion limited only to posterior hypospadias.

We had the privilege to work with a distinguished panel of world expert in the field of hypospadiology and we have asked each of them to comment on different questions. We have chosen a format that has allowed the panelists to freely express their own experience and points of view.

This issue of the Dialogues explores the diversity of approaches for posterior hypospadias repair by world renowned experts in the field. The strength of this issue lies in the often disparate opinions to the specifics of posterior hypospadias management by these experts. While the assessment of a given child with posterior hypospadias may differ, what is clear is that each of the contributors pays exacting attention to the anatomical variations of each case in considering his options and formulating his plans for surgical correction. The readers should pay particular attention to appreciate how these experts have evolved their techniques over time, attempting to continue to improve results.

The organization of this issue and the quality of the questions posed allows one to come away with practical pearls. Tony Manzoni and Alaa El-Ghoneimi are to be congratulated and thanked for all their efforts in organizing a true dialogue.
When and how do you perform a preoperative evaluation?

Bracka

In the United Kingdom system, a baby with hypospadias is usually seen and assessed in the first instance by a pediatrician, who undertakes the appropriate investigations before referring on to a surgeon. Patients will usually have had a routine abdominal ultrasound as a baseline. Asymptomatic primary hypospadias with both testes descended will usually have had no other investigations. More severe proximal cases, particularly when associated with undescended testicles, will have had a gender screening and perhaps hormonal studies as well. My own evaluation, therefore, rarely requires more than a simple physical examination of the deformity in the outpatient clinic setting, together with routine urine screening on admission for surgery.

Canning

For the 85% of hypospadias cases that are mild, with the meatus at the distal shaft or glans, I perform no preoperative evaluation. For the more proximal hypospadias and in particular in all cases when there is associated cryptorchidism (either one or both testes), I routinely perform an ultrasound to evaluate the internal genitalia. Kaefer’s series from Boston suggested that a proximal location for the urethral meatus combined with cryptorchidism may predict disorders of sexual differentiation. I do not routinely perform a voiding cystourethrogram in any patients with hypospadias unless there is some concern for a disorder of sex differentiation.

Khoury

I perform a preoperative evaluation whenever there is any doubt that I may be dealing with a disorder of sexual differentiation, particularly if one or both testes are undescended. I obtain a karyotype and an ultrasound (to evaluate the internal duct structures, the gonads and to rule out other abdominal/pelvic anomalies). I also perform an endoscopic evaluation in these boys at the time of the hypospadias repair to determine if a Mullerian remnant is present. If there is a suspicion of androgen insensitivity syndrome I send a preputial biopsy for molecular studies.

Hayashi

In order to determine the presence of a prostatic utricle and to examine its size and the position of confluence, we usually perform a urethrography when we suspect its presence by ultrasound examination.

Mouriquand

We usually assess the situation of the child with the pediatric endocrinologist during a joint consultation. In all cases of posterior hypospadias, a genetic evaluation (karyotype and genetic consultation if associated with other anomalies), an endocrine assessment to check the testicular function (HCG test, testosterone and precursors, AMH), a urinalysis for proteinuria (Drash syndrome) and urine culture are performed.

Snodgrass

A karyotype is obtained preoperatively when hypospadias is associated with cryptorchidism, but no evaluation is recommended for isolated hypospadias. While some advocate VCUG to visualize an enlarged urethra, this is of relevance most often when it is difficult to pass a catheter during surgery. Since urethroscopy easily can be done to bypass the urethra and place a wire over which the catheter is positioned, foreknowledge of a urethra is unnecessary.

Does pre-operative penile stimulation have any place in your management? If yes please specify when and how.

Bracka

I find that pre-operative androgen stimulation is useful in severe forms of hypospadias when the phallus is very poorly developed, a decision that is made subjectively rather than on any objective measurements. We have used 2% testosterone cream made up in the hospital pharmacy for patients from our local area, and this is applied daily to the penis for a couple of months prior to surgery. Long distance tertiary referrals are referred back to their local pediatric services for this medical management and it is left to the pediatrician’s discretion as to what means are used. The most common practice is to give 2 or 3 monthly depot IM testosterone injections prior to the planned admission date.

Canning

My answer I guess would be no, since I do not perform any formal penile stimulation.

Khoury

In boys with a small penis particularly in girth, I start them on depot-testosterone IM injections 25mg/month for three months, to end one month before the date of their surgery.

Hayashi

We seldom administer testosterone agents to patients except for micropenis with hypospadias.

(continued on next page)
Editors’ Comments
The purpose of pre-operative hormonal therapy is either to improve the penile length or to facilitate the surgical outcome by improving the quality of tissues and the skin availability for reconstruction. Opinions are subjective and there is no proven evidence of improvement of results or decreased morbidity after a preoperative stimulation. Published data are uncontrolled groups and the results are subjective. The efficacy on long term penile length is controversial. The classical belief is that early exposure to exogenous androgen compromises adult penile length, possibly through down regulation of androgen receptors. This has not been supported by Baskin’s work on human subjects. The only universally accepted indication is the local treatment with dihydrotestosterone in the 5 alpha-reductase deficiency.

GAM, AEG

Mouriquand
There are 2 situations where we regularly prepare the child’s penis before surgery: the small hypospadiac penis and for redo hypospadias surgery.
Classically, there are 3 common treatments to stimulate or prepare the genital tubercle prior to surgery: 1) hCG: our current protocol is 6 intramuscular injections of 1500 IU administered every other day. Surgery is planned the day after the last injection. We have no experience with recombinant gonadotrophin which is now available on the market but not licensed for children in France and also very expensive. HCG is satisfactory to test the testicular function but does not provide the optimal stimulation of the genital tubercle compared to systemic testosterone. 2) Systemic testosterone is administered at a dose of 100mg per m² in 2 to 6 intramuscular injections (1 injection every fortnight or every month). It has a few adverse effects (more erections, behavioral changes, pubic hair etc.) but provides the best possible stimulation. Pediatric endocrinologists are more cautious to prescribe this treatment when the child is older (after the age of 5 years) as it may trigger the pubertal process, increase bone maturation and compromise the adult height of the patient. 3) The third option is the use of topical dihydrotestosterone cream applied on the ventral aspect of the penis during the two months preceding surgery. It is said that this treatment has limited general adverse effects compared to systemic testosterone. If applied by the mother, she needs to wear non-latex gloves.
Androgen treatments have a positive effect on the growth of the genital tubercle although may not facilitate the healing process, as shown in Gilliver’s paper which reported that androgens may slow healing. In comparison, estrogens may facilitate the healing process. Besides sexual hormones, other stimulating agents aiming at improving the quality of tissues and the skin availability for reconstruction. The purpose of pre-operative hormonal therapy is either to improve the penile length or to facilitate the surgical outcome by improving the quality of tissues and the skin availability for reconstruction. Opinions are subjective and there is no proven evidence of improvement of results or decreased morbidity after a preoperative stimulation. Published data are uncontrolled groups and the results are subjective. The efficacy on long term penile length is controversial. The classical belief is that early exposure to exogenous androgen compromises adult penile length, possibly through down regulation of androgen receptors. This has not been supported by Baskin’s work on human subjects. The only universally accepted indication is the local treatment with dihydrotestosterone in the 5 alpha-reductase deficiency.

Snodgrass
Intramuscular testosterone (2mg/kg/dose) is given approximately every 3 weeks for 2-3 injections pre-operatively when the glans appears small. Occasionally postoperative testosterone has been recommended for boys with a small-appearing penis. In 72 patients with proximal shaft to perineal hypospadias operated since 2000, 24 (33%) had preoperative therapy while another 6 (8%) had stimulation after repair.

At what age do you normally operate on your patient?
Bracka
It is well recognised that boys after the age of 1 year, particularly as they approach 18 months, enter an increasingly difficult phase of their psychological development that makes them ill suited to hospitalization. We regard the period from 18 months to 3 years as a no-go time for elective surgery. We, therefore, defer elective surgery until the recognised second window of opportunity, which is between 3-4 years of age. By this time the boys are usually continent and ‘potty trained’. Although they have outgrown the dripping stent and diaper method of urinary diversion, they are generally sufficiently mature and co-operative to cope with Foley catheter and bag diversion.
If I were able to practice in a children’s hospital that is geared up for elective surgery on babies, then I would enjoy the practical advantages of early correction at probably between 6-12 months, but unfortunately I work in a district general hospital. Even if our institution were comfortable with hypospadias operations during the first year of life, the often inefficient UK referral system, National Health Service waiting list problems and the fact that a high proportion of my patients are tertiary referrals, means that this 6-12 month ideal would only be achieved in a modest proportion of patients. Although pediatric psychologists theorise about the potential psycho-sexual benefits from very early intervention, adult follow-up studies on childhood hypospadias repairs do not indicate a significant advantage. Clearly there are convenience factors that make early surgery potentially more appealing and practical for all concerned, but it would appear that ultimately it is the quality of the repair rather than the age of surgery or the number of procedures required that determines the patient’s long-term social and psycho-sexual adjustment.

Canning
I have started to evaluate and operate on children earlier and earlier for hypospadias. From my exposure to the Fetal Treatment Program here at The Children’s Hospital of Philadelphia, and from my own unpublished experience, I believe that wound healing is more rapid in the younger babies. I also believe that the phallic length in many term babies is as great in the newborn period as it is at four to six months.
I try very hard not to operate on a child who is so young that we would need to keep the child overnight in the hospital. In our hospital that means, if it is a term baby, the child needs to be six weeks of age in order to go home with their parents as a single-day surgical procedure. For preemies, the child needs to be 60 weeks gestational age.
If the phallus is of adequate size, for example, if the glans penis is large enough that I can wrap the glans and urethroplasty around a 6 French tube, I have no hesitation to operate in the newborn period with a one-stage procedure. If I am planning to stage the procedure, which is rare in my practice, I do not hesitate to operate in the newborn period. I believe there are some advantages to an early start since the second stage can then be done at age six or eight months.

Khoury
I try to get them in by 12 months of age. However, because of the long wait for surgery in the Canadian system and the frequent rescheduling of hypospadias cases to accommodate more urgent cases, these boys frequently end up having their surgery closer to 18 months of age.
Recently, in Japan as well as in many other countries, patients with hypospadias tend to undergo a repair by their second birthday. We like to perform hypospadias surgery between 10 months and 2 years old. We actually consider that the suitable operation time is when the diameter of the glans is over 10 mm since we think that the diameter of the neo-urethra required is at least 3 mm, which means a circumference of the neo-urethra estimated to 9 mm. However, we occasionally encounter hypospadiac infants with a glans < 10 mm for which we do not advocate an early repair.

Mouriquand

Usually during the second year of life (12 – 18 months). The penis does not grow significantly between 12 months and 10 years of age although its healing factors and protein balance may mature with time. We find it is important to perform this surgery whilst the child still has reflex micturitions to avoid urine retention after removing the catheter. There is no technical obstacle to perform this surgery at any time after 8 months of age and the anesthetic risk is no longer an issue in pediatric centres.

Snodgrass

Healthy full-term infants with distal to midshaft hypospadias ideally undergo repair between 3-6 months. However, proximal repairs usually are not scheduled until after 4 months to allow effect of any postnatal testosterone surge, and further postponed by preoperative hormone stimulation when it is used. Median age of my 72 patients is 8 months of age and the anesthetic risk is no longer an issue in pediatric centres.

Editors’ Comments

According to our panelists there are indeed consistent differences between the European and the North American attitudes. Is an extreme early reconstructive surgical treatment for complex posterior hypospadias fully justified? Are the potential benefits advocated really worth and free of other risks? How would an already distressed family react to the proposition of a neonatal surgery? We challenge the advocates of such an early indication for surgery to provide convincing data and long-term outcomes before we modify our present approach. It is clear that most of the dedicated centers would try to perform the surgery around one year of age. We must assume that such a complex and demanding reconstructive surgery should be restricted ONLY to highly specialised centres with optimal pediatric facilities. Despite all these considerations for an optimal child management, it is disturbing to underline how often the age at surgery is a health system dependant factor!  

How would you select your surgical strategy between one stage vs. two-stage reconstruction?

Bracka

The determining factor for me is whether it is necessary to transect the urethral plate and therefore create the need for a full circumference urethral reconstruction, or whether the axial integrity of the plate can be maintained so that only a partial circumference reconstruction is required. A 1-stage repair is used if the urethral plate can be preserved lengthways and either tubed directly or tubed in conjunction with a width augmentation procedure. In those situations when transection of the plate is unavoidable, a 2-stage repair is the better choice.

Canning

I very rarely stage a repair since I still like to use flaps for even relatively proximal hypospadias. I believe that near all hypospadias, even severe hypospadias, can be managed with a single-stage procedure. If a boy has a small penis with very severe curvature that requires cutting the urethral plate, and I believe that dorsal plication rather than ventral grafting would significantly compromise the size of the phallus, I consider a two-stage repair that would include grafting the ventrum of the penis. If a graft is required, I rotate a flap of dorsal preputial skin to the ventrum and then build the urethra distally in a second stage.

Khoury

My preference is to carry out a one stage repair whenever possible. The key determinant for me is the amount of preputial skin available. If there is sufficient prepuce to reconstruct the urethra and achieve adequate ventral skin coverage with correction of the penoscrotal transposition, I proceed with a one stage repair.

Hayashi

After correcting penile curvature, we usually try to construct the neo-urethra in a one-stage process as much as possible. However, when a sufficient volume of skin for the whole length of the neourethra cannot be obtained from the dorsal prepuce, we choose a two-stage repair. Among the most recent 100 patients with hypospadias (61 distal, 39 proximal) only 4 patients underwent a two-stage repair: one distal hypospadias with male pseudohermaphroditism.

Mouriquand

In hypospadias surgery, the key issue is the quality of the urethral plate and the availability of the adjacent tissues. In many posterior hypospadias cases, the tissues forming the ventral aspect of the penis are hypoplastic, including the urethral plate. If the urethral plate is wide and healthy, a one stage procedure is possible. If the urethral plate is poor, it needs to be replaced or enhanced either using a one stage procedure or with a multistage procedure.

Snodgrass

Two-stage procedures have been used when ventral curvature led to urethral plate transection to assist in straightening. In my experience, from 2000 to 2005, a total of 55 boys had primary repair of proximal hypospadias, 36 (65%) in 1 stage and 19 (35%) in 2 stages. Since 2005 another 17 patients have been operated, all in 1 stage since it has become apparent that most ventral bending can be straightened without transecting the urethral plate. (continued on next page)
Editors' Comments

It seems evident from all the answers that the two main factors are both the quality of the urethral plate and the amount of preputial skin available. Indeed the vast majority (but not all) of primary cases can be successfully treated in a single stage, but the final decision may often be made only at surgery, especially in primary repairs in which the fate and the possibility to preserve the urethral plate can be assessed only after a sequential and standardized approach. In a minority of cases, penile curvature or poor quality of the urethral plate will require transaction and/or substitution. Judgment of the quality and the amount of available preputial skin will determine whether a single or a staged approach may be safely selected.  

GAM, AEG

What is your preference for a single stage repair?

Bracka

I no longer use any skin flap based urethroplasties. In the occasional situation where the urethral plate is already of adequate width and depth, then it can be tubed directly. This is in effect progressing straight to the second stage of my 2-stage repair. Usually, however, the plate needs to be augmented in width before it can be tubed. For most primary corrections in childhood this is achieved using the Snodgrass TIP repair. In adult primary repair where the TIP dorsal release is relatively wide in absolute terms, and wound healing likely to be slower, then the procedure is modified to quilt a graft into the dorsal wall defect, i.e., a ‘Snodgraft’ repair.

Canning

I am still somewhat less comfortable with using the TIP repair for more proximal repairs and continue to use an onlay flap repair. If there is severe curvature, I have mobilized the urethra in some cases without detaching the urethra distally as a modification of Koff’s idea and use an onlay repair. I am less hesitant now, however, to cut the urethral plate since the modified island tube repair has given us what I believe are better results than we enjoyed with the old-fashioned tube repair. My fistula rate, however, can be as high as 50% following a “single stage” repair for perineal hypospadias. I still think I am better off, though, in having to operate on only 50% of the children with two operations rather than condemning all of them to a two or sometimes three-stage repair if there is a fistula after the second stage.

Khoury

I routinely use a double-faced onlay-tube-onlay repair for the urethroplasty. I specifically do not perform a long TIP repair combined with dorsal plication when the urethral plate is short. I have seen several poor outcomes with this approach resulting in a smaller/buried penis. I much prefer to lengthen the urethra by adding tissue in the form of a flap or a graft.

Hayashi

Modification of the Duckett procedure or Koyanagi procedure are our surgical options for those whose urethral plate has to be transected due to severe curvature. End-to-end anastomosis between the native meatus and reconstructed neourethra should be done in the Duckett repair, which tends to induce stricture at that point. The Koyanagi repair is a urethroplasty with a para-meatally based and fully extended circumferential preputial skin flap and does not require an end-to-end anastomosis. However, because of the incidence of complications, which seem to be caused by insufficient blood supply to the neourethra, we modified the method to preserve vascularity to the peripheral portion of the neourethra. Furthermore, we utilize the distal portion of the divided urethral plate to construct the neourethra, incorporating the para-meatral skin flap when it looks healthy, in order to increase the caliber of the neourethra and to provide additional blood supply to the peripheral portion of the neo-urethra from the plate.

Mouriquand

If the urethral plate is wide and healthy, we favor the onlay urethroplasty using a pediculated flap of inner prepuce. If no foreskin is available, we would perform an onlay buccal graft urethroplasty. If the urethral plate is poor, it needs to be replaced or enhanced (Duckett, buccal graft, Koyanagi). Our experience with the Duckett tube is not satisfactory on a long-term basis as most of our patients required a subsequent surgical revision. When the urethral plate, the adjacent tissues and the inner aspect of the preputial hood are available we then favor a 1-stage Koyanagi procedure. This is the most common situation.

Snodgrass

TIP. In our early experience (before 2005), overall complications were noted in 37% of patients, 54% initially decreasing to 25% when several modifications were made including 2 layer subepithelial urethroplasty and spongioplasty. In the last 17 patients since 2005 there have been no urethroplasty complications, indicating increased experience and now universal use of tunica vaginalis as the barrier flap.

Editors' Comments

There is much more discrepancy of views with regard to the type of single stage repair to be selected. The growing interest for an extension of the TIP repair to almost all forms, even in the most severe cases without dividing the urethral plate, is indeed intriguing. We share concerns on the potential dangerous long-term implications, especially during pubertal development, with the risk of producing a recurrent ventral penile curvature and a buried penis. Only long term follow-up will be able to confirm and prove the safety of this approach and persuade the more reluctant to accept and consider the “extreme TIP” a viable option. Whenever the urethral plate can be preserved it should be preserved and used! Interestingly in the adult experience the combination with a graft (“Snodgraft” concept) seems quite important and necessary to avoid further complications. Onlay pedicled flaps are generally preferred to tubes but can obviously be used in different combinations, and despite a high risk of anastomotic strictures, overall results are acceptable and very reliable. The use of para-meatally based and fully extended circumferential foreskin flaps as initially proposed by Koyanagi have been widely accepted and several modifications described. This procedure is applicable to any type of proximal hypospadias, even cases with bifid scrotum and penoscrotal transposition, the overall degree of tissue mobilization is reduced and the need for a circumferential anastomosis is eliminated. The main drawback is the complete commitment at the beginning of the procedure when you make your initial skin incisions, which might overestimate the need for this type of repair.  

GAM, AEG
What is your preference for a staged procedure?

Bracka

I use the Bracka 2-stage repair. This offers versatility in that the neo-urethra can be made from an inner preputial graft when the foreskin hood is still present, or from extra-genital grafts such as buccal mucosa when the patient is already circumcised or when skin is contraindicated because of the presence of BXO. A valid criticism of the original technique is that the urethral plate is transected from the outset, thereby making an immediate commitment to two stages. Our contemporary understanding of penile anatomy and the mechanisms of curvature mean that we are increasingly able to preserve the urethral plate and so more often make use of single stage repairs. Therefore, when there is a realistic prospect of preserving and utilizing the urethral plate for a 1-stage repair, it is preferred to start out as for a TIP, and only if this does not progress satisfactorily does one cut the losses, transect the plate and convert to a 2-staged repair. Unlike 1-stage flap options such as the Koyanagi, the 2-stage graft repair is far more versatile because its use does not have to be pre-determined. Whilst the urethral plate can be divided and a commitment made to 2 stages from the outset, equally this repair can also be used as a convenient and safe ‘fall-back’ option, after getting into difficulty with an extended TIP or other 1-stage solution.

Canning

With a staged repair, if it is not a redo or an “hypospadias cripple”, in the unusual case where I feel like I have to graft the ventrum of the penis, then I would rotate an island flap and sew that into the ventrum of the penis usually through a buttonhole. I would then come back in six months and roll the tube. I have not used a buccal mucosa in these cases because I am still somewhat concerned about the long-term results of buccal mucosa. I suspect that the results are going to be much better with Bracka’s approach as popularized by Warren Snodgrass in this country. With the few hypospadias cripples that I have had to correct using buccal mucosa, I have been very pleased with what I have seen as many as four years out from the repair, and I am beginning to use this technique more.

Khoury

If I have to carry out a staged procedure, I use either a preputial or a buccal mucosa graft unless I have had to lengthen the ventral aspect of the corporal bodies to correct curvature. In those situations I prefer to lay down a preputial flap on the ventral side of the penis.

Hayashi

When there is an inadequate amount of prepuce for both the urethroplasty and penile coverage, a staged repair is selected. We use modified Byars flaps ventrally rotated and after nearly 6 months we perform the second stage based on the Thiersch-Duplay principle.

Mouriquand

If the urethral plate is poor, it needs to be replaced or enhanced using either a two stage Cloutier Bracka technique either with foreskin or buccal mucosa.

Snodgrass

Of the 19 patients mentioned above, 6 had Byars/TIP (using skin flaps on the shaft while preserving the urethral plate in the glans), 12 had buccal grafts (7 completely replacing the urethral plate and 5 interposed on the shaft between the native urethra and the glanular urethral plate) and 1 a prepuce graft. Complications occurred in 5 of 6 patients with Byars/TIP, including 4 diverticula and 1 coronal stricture. The high rate of diverticula was attributed to ballooning of the elastic foreskin in the presence of relative obstruction resulting from good glans closure despite the fact there was no meatal stenosis.

Complications from grafts included 3 glans dehiscences, 2 coronal strictures, 2 diverticula (the first reported with buccal grafts!) and 1 fistula for an overall rate of 62%.

Bracka has long been an advocate of 2 stage prepuce grafts for proximal hypospadias, but during this period I only performed it once. After transecting the urethral plate the next step in straightening often was ventral corporal grafting and I was not willing to place a graft on a graft. When it became apparent the Byars/TIP combination was problematic, I decided to use buccal grafts placed over the corporal incision, thinking their relative thickness and limited elasticity would allow use to both close the corporotomy and later create the neourethra. Results with this approach were also suboptimal, but during this time I realized ventral lengthening could be achieved with multiple superficial transverse corporotomies as suggested earlier by Devine and Horton, rather than single incisions with grafting.

The end result of these experiences was increased desire to maintain the urethral plate while straightening the penis, since urethroplasty using the plate gives better outcomes.

Editors’ Comments

Urethral plate substitution can be achieved with the prepuce (when still available) which can be used as a free graft (Bracka), as a ventrally transposed island flap or with standard Byars flaps. In re-operative complex cases buccal mucosa free graft (Bracka) presently represent the most accepted staged approach. The main limiting factor to the choice of a free graft is represented by the need to correct a severe ventral curvature with a concomitant ventral lengthening procedure (i.e., with dermal graft, tunica vaginalis or other materials). The potential risk of an overlapping “double-graft” is quite obvious and the preference for Byars flaps seems more rationale and secure. The main criticism against the staged repair philosophy resides in the potentially high complication rate (diverticula, fistulas, stenosis) requiring further surgery and the initial commitment to a pre-determined second operation from the beginning. Strict adherence to the surgical details with the “classic” Bracka technique can achieve a very safe and reliable, reproducible procedure.

We must be always aware of the potential long-term risks, regardless of the selected surgical technique, since the reconstructed urethra is by definition abnormal and lacking of spongiosum!  

GAM, AEG
Penile Curvature: How do you assess it? At which step of your surgery? Which type(s) of correction do you prefer?

Bracka

Sometimes one is fortunate to witness a natural erection either in the outpatient clinic or at induction of anesthesia. In the absence of such information, as a baseline, I usually do a saline erection test on table at the commencement of surgery. If planning for a 1-stage repair, I repeat it after completing the ventral dissection and skin mobilization. If mild to moderate curvature persists on a penis of reasonable length, then I would consider dorsal midline plications to complete the straightening (using 5/0 Ethibond or similar braided non-absorbable sutures for a child). In adults simple tunica plications alone are inadequate and usually lead to recurrent curvature, therefore, it is better to use a more radical tunica incising/excision procedure such as a variant of the Nesbitt. I do not have an objective formula to determine my limits for dorsal shortening. The decision is an individual and subjective one taking into account the degree of curvature, penile length, parental views, and patient preference (when dealing with older age groups). If the dorsal shortening requirements are perceived to be excessive and the urethral plate appears to be a possible contributory factor for the curvature, I then divide the urethral plate and convert to a 2-stage repair. If despite a meticulous further ventral dissection, from mid-lateral to mid-lateral and with release of any tethering midline septal tissue, there is still some inherent corporal disproportion remaining, then I may resort to minor relaxing incisions in the tunica, the so-called ‘fairy cuts’ to which Snodgrass refers, and cover these narrow defects with the first-stage free graft. I am reluctant to create a major ventral tunica defect because this then requires formal repair of the defect with a flap or graft and it raises concerns as to how this might impact on potency in later adult life. When performing a first stage repair, to discourage the re-creation of curvature, the graft for the new urethral plate is applied and fixed with the penis slightly hyper-extended, and the bolus tie-over dressing tries to maintain this position during the period whilst the graft ‘takes’. At the second stage, after the urethral strip has been incised and the penis deglove, another erection test is performed. If there is still some residual curvature remaining from the first stage then this is corrected by a dorsal shortening procedure. Adults presenting with residual curvature associated with an otherwise acceptable hypospadias repair are given 2 options. 1) They can try a non-surgical solution in the first instance using a penis traction device. The ‘Jes Extender’, the ‘Andro-penis’ and similar devices, whilst primarily intended for non-surgical penis lengthening, are now also being promoted for length preserving correction of moderate Peyronie’s deformities. A well-motivated patient who wants to avoid a shortening procedure and is prepared to persevere with 6 months of prolonged daily stretching may try this option. 2) Other patients, particularly if the penis is of good length, may prefer a quicker and more certain solution with a surgical Nesbitt procedure, and accept the extra risks and associated shortening.

Canning

I measure penile curvature using the Gittes test after I have completed the skin degloving. If there is significant curvature, for example, if there is enough binding of the ventrum of the penis that a dorsal plication would be at risk to place the entire penis on compression, I cut the urethral plate. I then place some plicating sutures and, in my experience in nearly all cases, I do not believe that I lose length by dorsal plication. In a child with a severe handicap, for example a very small penis, if it appears that I am compromising length for the dorsal plication, I take a dermal graft and sew that into the ventrum of the penis. Although I have not used AlloDerm® yet, based on my experience I would be hesitant to use this or even tunica vaginalis patch onto the ventrum as well. My experience, however, with grafting the ventrum of the penis is not as large as I am sure many of the other experts in this edition.

Khoury

I obtain an erection test at the beginning of the case, after the following steps: degloving, mobilization of the spongiosum and the urethra. If the degree of curvature is >40° after these manoeuvres I proceed with ventral lengthening using a tunica vaginalis flap. I have had significantly better results with tunica vaginalis flaps compared to grafts on long-term follow-up.

Hayashi

First, the skin and dartos are mobilized and released, preserving the urethral plate or the urethra in principle. Artificial penile erection is performed to determine the degree of penile curvature with a protractor. When the degree of penile curvature ranges from 0 to 15°, we consider it a permissible range and usually perform the urethroplasty without further manipulation.

When the degree of penile curvature is between 15 and 45°, dorsal tunica albuginea plication is performed at 12 o’clock. When the degree of penile curvature is >45°, the urethral plate and spongy tissue beneath the plate are transected. After manipulation of the ventral side, penile erection is attempted again and the degree of penile curvature is measured with a protractor.

When the penile curvature decreases below 15°, urethroplasty is performed. When the degree of penile curvature remains between 15 and 45° even after transecting the urethral plate, dorsal tunica albuginea plication is conducted at 12 o’clock in order to straighten the penis and finally urethroplasty is performed. However, with a very short penis, penile curvature is corrected by ventral separation and outward rotation of the corpora instead of dorsal plication.

When the degree of penile curvature remains >45° even after transecting the urethral plate, a tunica vaginalis flap is patched into the ventral defect after cutting the tunica albuginea.

Mouriquand

In all cases of proximal hypospadias, an erection test is performed once the ventral dissection is completed. In the Koyanagi procedure, the curvature is amazingly corrected in most cases when the ventral dissection is completed. It is, therefore, rare to need to perform some form of dorsal corporal plication after a complete freeing of the ventral tissues.

For the other procedures, if curvature persists after a full dissection of the hypoplastic tissues, we consider a dorsal TAP procedure performed on the dorsal midline of the penis. Since Larry Baskin’s work on the dorsal neurovascular bundle of the penis, we perform the dorsal plication on the strict dorsal midline of the penis. We have no experience at all of any ventral corporoplasty or grafting to correct persistent penile curvature in posterior hypospadias.

(continued on next page)
My general impression is that curvature is less an issue in hypospadias surgery than it used to be. Nobody really knows what the natural history of penile curvature is and adult urologists do not seem bothered by its persistence after an hypospadias correction performed during childhood.

Snodgrass

The extent of curvature cannot be accurately determined before the penis is degloved and ventral dartos tissues dissected. For this reason I do not use Koyanagi-type procedures because the decision to transect the urethral plate is made at the outset. Furthermore, since I now uniformly perform spongiosplasty, dissection to elevate the corpus spongiosum running alongside the urethral plate from the underlying corpora cavernosa is also completed before artificial erection. Curvature persisting at this point previously was corrected by a single 6-0 polypropylene midline dorsal plication (curvature <30°) or transection of the urethral plate with ventral corporal grafting (curvature >30°). However, as mentioned, outcomes from 2 stage urethroplasty following plate transection led to consideration of additional measures to preserve the urethral plate.

Mollard first recommended urethral plate elevation from the corpora cavernosa to reduce curvature, but Duckett condemned the idea based in his opinion that dissection would disrupt its vascularity. I began using this additional step for straightening when degloving, ventral dartos dissection, and release of spongiosum from the cavernosa left persisting curvature. When the plate was preserved TIP could still be used, since midline incision did not divide it into separate strips. To minimize the length of the neourethra, I mobilized the native urethra proximally to the bulb and advanced it distally trying to stretch it without tension onto the proximal penile shaft.

Bhat has presented this concept of similarly mobilizing the native urethra left in continuity with the urethral plate. He reported that this manoeuvre reduced need to transect the plate to isolated cases with the greatest degree of bending. I have used urethral plate elevation (n=3) and, in the past 2 years, combined urethral plate/native urethra mobilization (n=9) to date have no cases with recurrent curvature and none with urethroplasty complications. When the plate is mobilized I find subsequent artificial erection more difficult due to inevitable leakage, and so for boys undergoing circumcision a single dorsal plication is done. In 2 boys not desiring circumcision the dorsal aspect of the penis was not exposed and so plication was not possible. Furthermore, in 6 of the 12 cases so called “fairy cuts” – 3 or 4 ventral superficial transverse incisions into the tunica albuginea of the corpora without exposing erectile tissues – were used in the region of greatest bending rather than a single deeper incision needing grafting.

Mobilization of the urethral plate/native urethra follows the same principles used for urethral stricture surgery to facilitate excision with primary re-anastomosis. If ventral bending exceeds 90° this manoeuvre likely would not be possible even considering the mobilized urethra might still tether the penis, but in usual cases the additional length gained allows the penis to be straightened while preserving the urethral plate without tension.

Skeptics may not be convinced mobilization is a safe and reliable technique, but certainly the presumption that proximal cases with curvature are best corrected in stages is hereby challenged.

Editors' Comments

What a controversial issue and we still have no definitive answers or certain conclusions! It is quite true that the natural history of penile curvature is still in a “gray zone” and an over-aggressive attitude in the first few years of life should be restricted to very selected cases, which in current practice remain exceptional. Fortunately, in the vast majority of cases there is a persisting minor degree of curvature requiring either no treatment or a limited dorsal corporoplasty. According to personal preferences or experience this can be achieved “classically” (Nesbit, TAP, and variations) with neuro-vascular bundles mobilization or in the midline as proposed by Baskin. The hot issue is truly represented by the most severe degree of curvature (>40°) where we still have major controversies.

Complete ventral curvature correction with preservation of the urethral plate and with extensive mobilization of the “normal” native urethra, as suggested by Bhat and Snodgrass, is a very provocative issue. It is the presence of severe curvature due to an abnormal hypoplastetic and inelastic plate better treated by complete excision of this “abnormal” tissue or by its preservation and further mobilization (unjustified and perhaps hazardous) of the native normal urethra? Are ventral lengthening procedures, either with dermal or tunica vaginal flaps, rather than tunica vaginalis grafts, safe and secure options? We are still awaiting long-term post-pubertal follow-up data. (GAM, AEG)

Long-term assessment: What is your short and long-term follow-up protocol?

Bracka

Unless the patient returns earlier than planned to address any complications or concerns, the first formal follow-up is 6-8 weeks after surgery. If the patient has had a straightforward primary correction, and has a perfect stream and no symptoms or worries I may leave it until 2 years post-op before the next planned review. However, sometimes an intermediate review(s) may be arranged to address any surgeon or parental concerns regarding the patient’s progress. Unlike in the USA, geographical considerations and the mechanisms of health service provision in the UK currently still make it a realistic proposition to undertake long-term follow-up on patients. I, therefore, try to maintain contact with the patients periodically (say every 3 years or so) up until at least mid-teens, even though this does generate an onerous outpatient workload. In those healthcare systems where follow-up is feasible, it should be undertaken because we do need to get long-term outcome data on different types of repairs, on the various curvature correction procedures, on the behaviour at puberty of buccal mucosa and other non-genital urethral grafts, and on the functional fate of foreskin reconstructions. Adult studies have shown that we simply cannot rely on patients to report complications or concerns of their own volition.

Canning

Our short-term protocol includes removal of the urethral catheter at about two weeks, a follow-up appointment six weeks later, again another follow-up appointment at one year, and then a follow-up appointment at five years. I follow patients at least through age five to
six, but we have the ability here at the Children’s Hospital to follow patients right through adulthood. I have been encouraged by Howard Snyder’s long-term results with his large series. We are in the process of working on identifying and following John Duckett’s extensive series as well. My experience, however, so far suggests that these patients can do quite well with long-term management. If there is any concern about the position of the urethra, the appearance of the penis, I do not hesitate to follow patients through adulthood.

Khoury

I see the patients at one week when their urethral stents are removed, then at 2 months and one year post-op. I maintain a very long-term follow-up and commitment to these boys. I see all my posterior hypospadias patients annually with a uroflow and ultrasound post-void residual until their eighteenth birthday. This long-term follow-up has taught me much about the psychology of the hypospadias patient, and has helped me tweak my surgical technique, particularly the meatal configuration, glansplasty and skin coverage to achieve a normal looking penis in these challenging cases.

Hayashi

In toilet-trained boys, uroflowmetry is performed every few months during the first year after surgery and then every year until at least five years postoperatively. Uroflow data are plotted on age-dependent uroflow nomograms that indicate the normal range of maximum flow rate and voided volume. Flow rates are defined as low if they decrease below 2 standard deviations of the expected normal mean and calibration of the neourethra is indicated to evaluate sub-clinical stricture. However, we recently employed the uroflow evaluation method recommended by the International Children’s Continence Society (ICCS) in 2006. If the square of the maximum flow is equal to or exceeds the voided volume, the recorded maximum flow is considered as within the normal range. On the other hand, boys in diapers undergo periodic calibration until they are toilet trained. The calibration interval depends on the results of the previous calibration.

While urethro-cutaneous fistula, neourethral stricture, meatal stenosis, neourethral diverticulum or neourethral dehiscence are early complications of hypospadias repair, urethral calculus is a late complication when hair-bearing scrotal skin is included in the neourethra. We have followed hypospadias patients once a year for as long as possible until adulthood for the purpose of detecting sub-clinical complications and offering counselling about their sexual function and voiding function.

Mouriquand

Posterior hypospadias usually keep a transurethral catheter (CH8 Vigon silastic catheter) for 10 days or 2 weeks (Koyanagi). Prophylactic antibiotic coverage (cotrimoxazole for onlay urethroplasties; Amoxicillin with Clavulanic acid for Koyanagi and buccal graft urethroplasties) is commonly used until the catheter is removed. All patients keep a “daisy dressing” for 10 to 15 days with one change of dressing on day 4. The penis is coated with an anti-inflammatory ointment (hyaluronic acid + argentic sulfadiazine: Ialuset Plus®), wrapped with a silastic mesh (Mepitel®) and a kling bandage which is solidly kept in place with a strip of Elastoplast® (daisy dressing).

When everything goes well, the patient is seen again in the outpatient department 2 months and 12 months after surgery and, if possible, at puberty. During these follow-up visits, the cosmetic aspect of the penis is assessed. Parents are asked if the child had any episode of pain or urinary tract infections. When possible, we watch the child urinating. We do not perform systematic urine flow studies as the curves are often flat even if there is no urethral stenosis. This is due to 2 main factors: 1) the difference of intrinsic compliance between the native urethra and the reconstructed urethra; 2) the bladder behavior which often changes after hypospadias surgery with restraining flow patterns.

Parents need to be fully informed of the potential problems met with hypospadias and especially with posterior hypospadias. A detailed brochure on pre, peri and postoperative management of hypospadias is given to the parents. In posterior hypospadias, a majority of patients requires further surgical attention during their life. Parents should know this from the first consultation.

Snodgrass

The first postoperative visit (after catheter removal at 10-14 days) is at 6 weeks, followed by assessment at 6 months and then annually. Patients not toilet trained 6 months after surgery have a urethral sound passed through the repair, whereas those able to do so provide uroflows. Patients who have had urethral plate/native urethral mobilization have had scheduled urethroscopy at least 6 months after surgery to confirm urethroplasty outcomes. I would prefer to follow patients until after toilet training, but for many reasons this is difficult in the U.S.

Optimal duration and means of follow-up are not well defined. Uroflowmetry is touted by many, but patients with low flow rates often have not been further evaluated to rule-out urethral stricture, and the significance of reduced flow in boys without anatomic obstruction is unknown. We should not be surprised that the neourethra demonstrates altered function compared to healthy native urethras, but whether any technique for urethroplasty offers advantages in this regard also is unknown at present.

Beyond function, too little concern has been given to cosmetic outcomes after proximal hypospadias surgery.

Editors’ Comments

The main take home message is that long-term follow-up is mandatory with all these complex patients. This follow-up should not be limited to symptomatic children or for those that the surgeon would feel unsatisfied with “his” results. Both the routine, mid and long term thorough follow-up will give us crucial data on our current practice.

We are well aware that long-life commitment is due and that post-pubertal changes may indeed occur and modify the initial outcome. Adult reports on the final outcome of pediatric patients with hypospadias repairs performed at a young age are often disturbing and disappointing indicating that over the years things may change. Our present enthusiasm on current results may not be so secure and correct.

We must be aware that any present type of urethroplasty is unable to reproduce a normal urethra and that the main lacking structure is represented by the spongiosal tissue. Post-pubertally we are faced with two major functional changes in penile activity: a significant increase of recurrent physiologic erections and the beginning of sexual activity. We may speculate that both these factors may produce a “mechanical stress” with repeated alterations and eventually be responsible of the failure of the early reconstructed neourethra. If this is a limited problem in distal hypospadias it represents a major issue in posterior forms.
Guest Editors’ Conclusions

Out of this debate the final product has been extremely stimulating and interesting and we hope that all readers will enjoy it as much as we have. This issue has confirmed how the approach to the management of posterior hypospadias is indeed controversial and open to different opinions. There are still open major questions… and we will have to wait longer for some final answers!

Our main concern is the lack of reliable answers on long term outcomes. “Modern” hypospadias surgery is now quite dated, and results into adulthood of these procedures should by now be available. Although all current hypospadias surgeons are convinced that the only way to assess the results of the severe forms is by the long-term functional and cosmetic outcomes, the hard reality is that no such results are available yet.

We would like to take this opportunity to sincerely express our deep gratitude to all our panelists for their frank and honest answers and for their outstanding contribution to this issue.

References

(A list of references mentioned by the all contributors, grouped by different topics)

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