Pediatrik Cerrahi Dergisi 3: 143-146, 1989

Repair of hypospadias

George W, Kaplan MD,
San Diego, California, U.S.A.

Whenever one attempts to repair hypospadias, it is helpful to review and consider all of the problems that may be associated with the hypospadias complex as they pertain to the case in question. These problems include the presence and severity of chordee, the presence of penile torsion, meatal size and position, the presence of dysplasia of the distal urethra, the size and configuration of the glans, the character and distribution of local skin, and scrotal configuration. These problems are usually addressed in the following sequence: chordee release, neourethral construction, glunular reconstruction, skin coverage, and scrotal reconfiguration. Nevertheless, it is quite important to consider each aspect and a potential solution to each prior to embarking upon repair so that, for example, one doesn't find that one has completed chordee release and urethral reconstruction but has no further available skin to cover the penile ventrum.

Chordee release in my opinion should follow a logical sequence of events which is depicted in Fig. 1. This sequence derives from my thouhts regarding the etiology of chordee and proceeds from the simplest surgical maneuver to the most complex in an attempt to compelety release chordee and yet not perform more surgery than is necessary to do so. [1]. After one has presumably released chordee, this should be demonstrated intraoperatively by inducing an artifical erection to prove that chordee release has actually been accomplished [2]. In some instances, especially those associated with the lesser degrees of hypospadias, chordee will be released by ventral incision and rearrangement of the skin and dartos layers alone. Only occasionally will this suffice in patients with difficult hypospadias repairs but one may rarely find that merely by degloving the penis, chordee has been completely released. If chordee release has not been achieved, the next step is resection of fibrous tissue in Buck's fascia [5,6]. This maneuver usually is required in the more severe degrees of hypospadias. It must be emphasized that the fibrous tissue associated with chordee is not limited solely to the middline as often is described but rather is a plate of tissue that extends from the lateral ventral aspects of the glans along the entire penile ventrum to a point proximal to the urethral meatus [3,7]. At times, resection of this fibrous plate requires dissection between the corpora cavernosa to allow complete release of chordee. This is best accomplished by elevating the urethra and incising the inner crural septum which will cause the corporal bodies to rotate laterally [8]. If there is still chordee at this point in the surgical algorithm, it will be necessary to either shorten the long side or lengthen the short side of the corpora cavernosa unless the urethra is short and is acting as a "bow-string" in which case dropping the urethra back (if this has not already been done) will be necessary. Shortening of the corpora cavernosa is accomplished by making parallel incisions in the dorsal aspect of Buck's fascia and the tunica albuginea immediately opposite the concavity of the curve of the chordee [9]. These incisions are placed through Buck's fascia down to the corpora cevernosa (but not necessarily into the corporal bodies) lateral to the dorsal neurovascular bundles. These incisions are oriented longitudinally and closed transversely with nonabsorbable suture, for example, Prolene with the knots inverted so that they are buried. When the penis is somewhat short, in my opinion, it is better to avoid dorsal plication and therefore preferable to lengthen the short side of the corpora cavernosa by making a transverse incision ventrally across and into both corpora cevernosa. The incision is placed at the apex of the concavity of the curve of the chordee. In the mid-

Addres: George W Kaplan MD. 7930 Frost St. STE 407, San Diego, CA 92123, U.S.A.

line, the tunica albuginea needs to be detached from the inner crural septum and the erectile tissue both distally and proximally for about one centimeter to allow the corpora to expand. A free graft of tunica vaginalis is harvested and placed over the resultant defect as a patch [10]. The patch is anastomosed to the corpora with absorbable suture (for example, polygalactic acid-Vicryl). If it is necessary to utilize a patch graft for release of chordee, it is my feeling that construction of the neourethra is best delayed rather than proceeding with a one stage repair at that time to allow for better healing of the graft.

Once chordee has been released, one needs to reconstruct the urethra. In glanular and coronal hypospadias cases, the MAGPI operation has been utilized to advance the meatus onto the glans [11]. Our experience with that procedure has not been totally satisfactory and for that reason ve have tended to utilize ARAP's modification of the MAGPI procedure and have found it far more satisfactory [12]. In this procedure, a coronal incision is made proximal to the meatus. Stay sutures are placed equidistant from the midline and pulled distally. This then creates an M-shaped defect. The two central limbs of the "M" are then approximated to each other with 6 or 7-0 Vircyl sutures thereby creating a floor for the neourethra. The tissue between the two interior and two exterior limbs of the "M" is then erapproximated with horizontal mattress sutures of 5-0 Dexon or Vicryl and the two outer limbs are then approximated to each other with interrupted 6 or 7-0 Vircyl. This then provides a three layer closure of the glans and nicely advances the meatus. No diverting catheters are necessary and, in our experience, this repair has produced a reliably satisfactory functional and cosmetic result [13].

For more proximal forms of hypospadias, Duckett [14], Asopa [15], and Hodgson [16] have all utilized vascular flaps of penile skin to construct a neourethra. Duckett and Asopa have utilized the inner face of the prepuce for the neourethra while Hodgson has employed, on different occasions, either the inner face or the outer face of the prepuce. In my opinion, a limiting factor in utilizing such vascularized pedicle flaps is the length of skin that is available to from the neourethra. For this reason, it is my preference to utilize a free graft of preputial skin to bridge the distance between the native unetral meatus and the tip of the glans because I feel this allows more versatility than does a vascularized pedicle flap [17]. The inner face of the prepuce is carefully unfolded by incising the junction of the inner face and the outer face laterally and dissecting the subepithelial tissues from the inner face as if one were defatting a free skin graft. Once the prepuce is unfolded it is measured for both the length and width. The length of the graft should correspond to the distance between the urethral meatus and the tip of the glans when the penis is stretched (pulled distally by an assistant). The width of the graft should correspond to the circumference of the native urethra (as determined by bougienage). Once the graft is harvested, it is pinned on a board and subcutaneous tissues removed. The graft is then rolled into a tube over a stenting catheter of the size that one wishes the neourethra to be. The graft is fashioned so that the preputial epithelium is the inner aspect of the tube. After the tube has been constructed,the stenting catheter is removed and a small silicone Foley catheter is passed through the graft, through the native urethral meatus, and into the bladder. Prior to inserting the catheter, the native urethra should be trimmed back to normal corpus spongiosum and spatulated. The graft is anastomosed to the native urethra with interrupted fine polygalactic acid sutures. The distal end of the graft is attached to the glans by triangulating the glans as described by Devine and Horton [17]. Although one can tunnel the graft through the glans, as popularized by Duckett [14], the former is my preference as I feel that inadequate tunneling will result in meatal stenosis and possible fistula while inadequate triangulization will probably only result in a coronal meatus.

The last aspect of concern is skin cover for the ventrum of the penis. Too often in hypospadias repairs, this becomes an afterthought and it is only after the urethroplasty and glanuloplasty are completed that one realizes that there will nat be adequate skin to cover the repair without tension. Primary closure of the skin defect has been uti-

lized in the past either with or without relaxing incisions on the dorsum to reduce tension on the closure [18]. Using primary closure, there is almost always a great deal of tension especially at the penoscrotal junction. This is not relieved even with the use of a relaxing incision. Tension with probably lead to failure of healing of the ventral skin closure with a resultant fistula.

Two very popular means of transferring skin from the dorsum to the ventrum are those employed by Nesbitt and Byars. In the Nesbitt transfer [17], a buttonhole is made in the dorsal skin and the glans is brought through this buttonhole so that the distal dorsal skin is used as an apron to close the ventral defect. This tends to leave dog ears laterally which are cosmetically unsightly. For this reason, it is rarely personally employed. Byars divided the dorsal skin in the midline and brought each half around as a flap to provide ventral skin cover [20]. If this is to be used, one must pay special attention to the blood supply of the dorsum so that one flap or the other is not devascularized in so doing [21].

Other methods of providing ventral skin cover include burying the ventrum of the penis in the scrotum and then secondarily removing it from the scrotum incorporating scrotal skin as skin cover [22]. This method may result in a retrusive meatus because the penis tends to pull away from the scrotum. Even when successful, it is not totally satisfactory because hair bearing skin is transferred to the penis. A free graft of skin can also be applied to cover the ventrum if the neourethra is not fashioned from a free graft but this will robably result in failure as the suture line of the neourethra may interfere with vascularization of the graft so that a fistula results. If free grafts were used for both the neourethra and skin cover, both would probably necrose as neither would be vascularized. Rotation or pedicle flaps of scrotum could be utilized to provide ventral skin cover. They are usually well vascularized but have the disadvantage of being hair bearing skin and cosmetically unsatisfactory.

Recently I have been employing a vascularized pedicle flap of dorsal skin using the outer face of the prepuce as the flap and relying on the intrinsic blood supply of the dorsal skin for dorsal shaft vascularity. Even in relatively lengthy defects, this has proved quite satisfactory and has the added advantage of bringing an additional blood supply to nourish a free graft [23].

When the scrotum is bifid, it is best to excise the midline of the bifid scrotum and reanastomose the scrotum along the midline to remove the bifid configuration. If there is a marked degree of pnesocrotal transposition, this is often best dealt with at a subsequent stage to avoid compromising the blood supply of the penile skin during the healing of the urethroplasty itself. Penoscrotal transposition is often best handled by either a V-Y plasty on each side of the penile base to drop the scrotal skin more caudad or by rotation flaps of the scrotum rotating the scrotum more caudad to rid the patient of the transposed scrotal skin [24-26].

It has often been stated that there is a learning curve through which everyone who attempts the repair of hypospadias must travel. No where is this learning curve more severely tested than in the repair of difficult hypospadias. Although I have attempted to outline the problem somewhat algorithmically, it must be recognized that there is very definitely an experiential factor that comes into play and markedly although unmeasurably affects the success or failure of the endeavor.

References

1. Kaplan GW, Brock WA: The etiology of chordee. Urol. Clin North Am 8:383, 1981.
2. Gittes RF and McLaughlin AP: Injection technique to induce penile erection. Urology 4:473, 1974.
3. Smith DR: Repair of hypospadias in the preschool child: A report of 157 cases. J Urol 97:723, 1967.
4. Allen TD, Spence HM: The surgical treatment of coronal hypospadias and related problems. J Urol 100:504, 1968.
5. Duplay S: De L'hypospadias perineo-scrotal et de son traitement chirurgical. Quoted by culp, D.S. and McRoberts, J.W.
6. Culp DS, McRoberts JW: Hypospadias. In Encyclopedia of Urology. Alken CE, Dix VW, Goodwin WE, Weyrauch HM, Wildboe E (eds) Springer

vature causing structures in hypospadias. Scand J Plast Reconstr Surg 14:249, 1980.
8. Koff SA, Eakings M: The treatment of penile chordee using corporeal rotation. J Urol 131:931, 1984.
9. Nesbitt RM: Congenital curvature of the phallus: Report of three cases with description of corrective operation. J Urol 93:230, 1965.
10. Perlmutter AD, Montgomery BT, Steinhardt GF: Tunica vaginalis free graft for the correction of chordee. J Urol 134:311, 1985.
11. Duckett JW, MAGPI (Meatoplasty and Glanuloplasty): A procedure for subcoronal hypospadias. Urol Clin North Am 8:513, 1981.
12. Arap S, Mitre MI, Degoes GM: Modified meatal advancement and glanuloplasty repair of distal hypospadias. J Urol 131:1140, 1984
13. Scherz HC, Kaplan GW, Packer MG: Modified meatal advancement and glanuloplasty (ARAP Hypospadias Repair). Experience in 31 patients. J Urol (in press)
14. Duckett JW: The Island flap technique for hypospadias repair. Urol Clin North Am 8:503, 1981.
15. Asopa HS, Elhence IP, Atri SP, Bansal NK: One stage repair of hypospadias using a foreskin tube. A preliminary report. Int Surg 55:435, 1971.
16. Hodgson NB: Use of vascularized flaps in hypospadias repair. Urol Clin North Am 8:471, 1981.
17. Devine CJ Jr, Horton LE: Hypospadias repair. J Urol 118:188, 1977.
18. Brown D: An operation for hypospadias. Lancet 1:141, 1936.
19. Nesbitt R: Plastic operation for correction of hypospadias. J Urol 45:699, 1941.
20. Byars LT: A tecnique for consistently satisfactory repair of hypospadias. Surg Gynecol and Obstet 100:184, 1955.
21. Juskiewenski S, Vayasse P, Moslovici J, Hammoudi S, Bodissou E: A study of the arterial blood spply to the penis. Anat Clin 4:101, 1982.
22. Culp OS: Early correction of congenital chordee and hypospadias. J Urol 65:264, 1951.
23. Kaplan GW: Repair of proximal hypospadias using a preputial free graft for neourethral construction and a preputial pedicle flap for ventral skin coverage. J Urol 140:1270, 1988.
24. Glenn JF, Anderson EE: Surgical correction of incomplete penoscrotal transposition. J Urol 110:603, 1973.
25. Datta NS, Singh SM, Reddy AVS, Chakravarty AK: Transposition of penis and scrotum in two brothers. J Urol 105:739, 1971.
26. Ehrlich RM, Scardino PT: Simultaneous surgical correction of scrotal transposition and perineal hypospadias. Urol Clin North Am 8:531, 1981.