

Results of a Two-stage Technique for Treatment of Proximal Hypospadias with Severe Curvature: Creation of a Urethral Plate Using a Vascularized Preputial Island Flap

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Purpose: To present the results of a two-stage technique used for the treatment of proximal hypospadias with severe curvature.

Materials and Methods: The medical records of children with proximal hypospadias and severe curvature were retrospectively analyzed. A 2-stage procedure was performed in 30 children. In the first stage, the release of chordee was performed, and a well-vascularized preputial island flap was created. The vascularized island flap was brought anteriorly and sutured over the ventral surface of the glans and degloved penile shaft. The second stage was performed 6-8 months later. A neourethra was reconstructed by the tubularization of the preputial-urethral plate utilizing the principles of Duplay technique. All surgical procedures were performed between 2005 and 2011.

Results: The mean age of the patients was 4.4 years (1–17 years). The mean duration of urethral catheterization was 6 days after the first stage and 10 days following the second stage. The flaps were viable in all of the children. There was no residual chordee. Following the second stage (n = 30), complications developed in 11 children (36%), namely, a fistula in 7, a pinpoint fistula in 3, and a diverticulum formation in 1. The cosmetic outcome was satisfactory. Uroflowmetry measurements were evaluated, and only one patient had a diverticulum formation at the late follow-up.

Conclusion: Vascularized preputial island flap is an alternative to free grafts for the reconstruction of the urethra. The main advantage of this flap technique is the creation of a thick, healthy and well-vascularized urethral plate. The advantages of this technique include better aesthetic appearance, an acceptable complication rate, and a very low rate of diverticula formation.

Keywords: hypospadias; surgery; postoperative complications; urologic surgical procedures; reconstructive surgical procedures; surgical flaps; urethra.

INTRODUCTION

Division of the urethral plate is inevitable in cases of severe proximal hypospadias with a curvature of more than 35-40 degrees. During the last decade, “two-stage procedures” have increased in popularity for this group of patients.⁽¹⁾ In two-stage techniques for the creation of a new urethral plate, the use of free preputial or buccal mucosal grafts is widely practice.

After release of the curvature by excision of fibrotic tissues in the ventral part and midline dorsal plication, we prepared a rectangular island flap from the inner part of the dorsal preputium with its own vascular supply and transferred it to the ventral part to create a new urethral plate. The main advantage of this technique was the creation of a thick, healthy neourethral plate due to sufficient blood flow from the dorsal penile vessels.

MATERIALS AND METHODS

The medical records of patients with proximal hypospadias (penoscrotal, perineal) and severe curvature were retrospectively analyzed. The inclusion criteria for this two-stage technique were penoscrotal or perineal hypospadias with a severe curvature of more than 35-40 degrees. The degree of hypospadias was determined before the release of the penile curvature. Those patients with a history of circumcision or loss of foreskin due to previous surgery to correct hypospadias were excluded. In spite of every effort to release the penile curvature and protect the urethral plate, division of the urethral plate was inevitable in this series.

First stage (**Figures 1-3**): After complete degloving and the chordee test, fibrotic tissues in the ventral part were excised, and a midline dorsal plication was performed.

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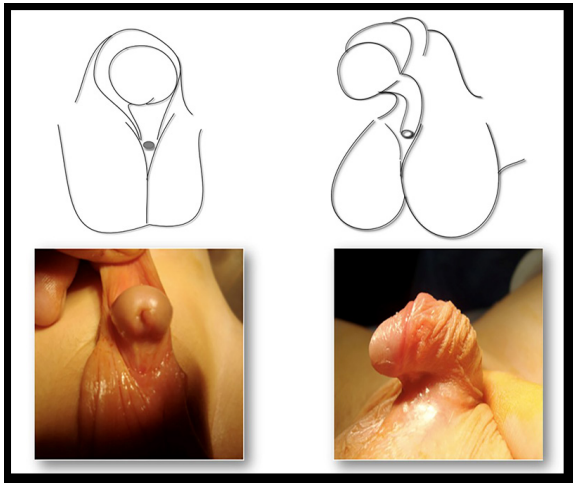


Figure 1. Penoscrotal hypospadias with severe chordee.

A completely straight penis was created. Then, the distance between the ectopic meatus and the glanular tip was measured. A transverse rectangular vascularized island flap (same length with the measured distance) was fashioned according to the principles of Standoli and Duckett (**Figures 1 and 2**).⁽²⁻⁵⁾ This flap was rotated ventrally and laid between the ectopic orifice and inner part of the glanular wings. The proximally located orifice was surrounded with 2 short wings from the preputial flap to position non-hair-bearing tissue around it (**Figure 3**). To prevent serum accumulation under the vascularized flap, 4-5 tiny incisions were made on the plate, and 5-6 fixation sutures were placed to ease the adhesion between the flap and tunica albuginea (**Figure 3**). The edges of the flap and the glanular wings and penile skin were stitched with 7/0 Vicryl sutures. A Foley catheter was used for drainage for 6 days. The dressing consisted of a combination of bactigras and sponge.

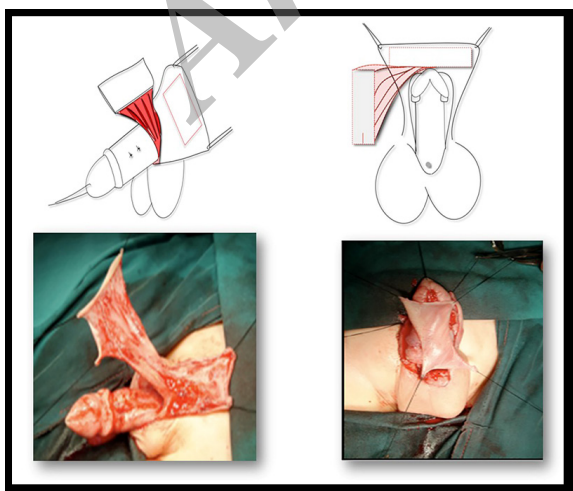


Figure 2. Following the correction of the ventral curvature, a rectangular vascularized flap is prepared from the dorsal preputial mucosa.

Table 1. Clinical and demographic characteristics of study patients.

Variables	Values
Age, years (mean)	4.4 (1-17)
Type of Hypospadias, no.	
Penoscrotal	25
Perineal	5
Penoscrotal transposition, no.	4
Follow-up, years (mean)	6.5 (4-10.5)

Second stage (**Figures 4 and 5**): Six to eight months after the initial operation, a two-layer urethroplasty using Duplay's principle was performed. A ventrally transposed thick and healthy dartos tissue near the plate were used to cover the neourethra. In cases of insufficient or thin Dartos tissue, a healthy, thick tunica vaginalis flap was used as a second layer coverage.

Glanular wings were re-approximated by glanuloplasty, using 6/0 Vicryl sutures (**Figures 4-7**). A silicon catheter was inserted for 7-10 days, and a silicon foam dressing (Smith-Nephew Co. Cavi-Care, Hull, UK) was applied for 5 days. The follow-up studies included a physical examination, direct observation of the urinary stream, and review of mobile-phone videos of urination in the home environment. Postoperative cosmetic evaluation was performed using the Hypospadias Objective Scoring Evaluation (HOSE) scoring system. The uroflowmetry parameters of patients who had a uroflowmetre over 5 years were summarized. The maximum flow rate (Q) max values were compared to the uroflowmetry normogram in healthy boys between 5 and 15 years of age.⁽⁶⁾ In 4 of these 30 cases, there were minor (2 cases) and prominent (2 cases) forms of penoscrotal transposition. Minor ones were corrected during the 2nd operation, while prominent ones were corrected with an additional 3rd operation. Under general anesthesia, a caudal or pudendal block (using ultrasound microprobe) was administered during each stage by the pediatric anesthesiology team.

RESULTS

This 2-stage technique was used in 30 patients with the above-mentioned inclusion criteria. The mean age was

Table 2. Reoperations due to various complications and final location of the neomeatus in 30 patients.

Reoperations, no. (%)	Final Location of Neomeatus, no.	
Pinpoint fistula 3	Glanular region	22
Urethral fistula 7	Subcoronal region	8
Diverticulum formation 1	—	—
Total reoperations 11 (36)	—	—

Table 3. Postoperative cosmetic evaluation with the HOSE scoring system.

Variables of HOSE	HOSE Score	Number of Patients (n = 30)
Meatal location, no.		
Distal glanular	4	15
Proximal glanular	3	7
Coronal	2	8
Penile shaft	1	—
Meatal shape		
Vertical slit	2	22
Circular 1	8	—
Urinary stream		
Single stream	2	30
Spray	1	—
Erection		
Straight	4	25
Mild curvature (< 10)	3	5
Moderate curvature	2	—
Severe curvature	1	—
Fistula formation		
None	4	20
Single-subcoronal or more distal	3	7
Single-proximal	2	3
Multiple or complex	1	—

Abbreviation: HOSE, Hypospadias Objective Scoring Evaluation.

4.4 years (range, 1-17 years). The mean follow-up time was 6.5 years (range, 4-10.5 years) (Table 1). Early postoperative controls were performed on the 7th day and at 1 and 3 months. Late controls were performed at the end of the 1st year and the 5th to the 10th postoperative year (Figures 4-7). A healthy, thick and elastic urethral plate was created in all patients. Small tiny incisions and fixation sutures between the flap and corpora appeared to be responsible for the existence of a thick and healthy neourethral plate. Due to the nice, elastic and well-vascularized texture of the neourethral plate, it was easy to perform a Duplay urethroplasty in each case. The number of additional operations due to various types of complications and the position of the neomeatus is presented in Table 2.

From the surgeons' perspective, end aesthetic results appeared to be much better than our previous experience with patients treated with single-stage procedures. The satisfaction rate was similar for parents and surgeons as well. The HOSE scoring system was used to conduct the postoperative cosmetic evaluation, and the mean HOSE score was 15 (range, 12-16). The results are presented in Table 3.

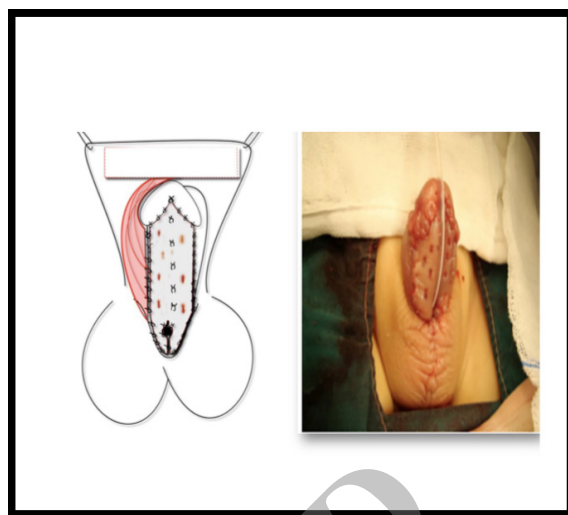


Figure 3. This non-tubularized flap is laid between the original urethra and the tip of the glans.

A group of patients who had undergone the operation 5-10 years ago were investigated for urethral dilatation and/or diverticulum formation. We detected only one case of diverticulum formation (Table 2). Uroflowmetry findings are summarized in Table 4. We excluded five patients less than 5 years of age and compared the uroflowmetry parameters of 10 patients between 5-15 years of age based on nomograms for healthy boys. The Qmax value was between the 25th-50th percentile in 5 patients (mean age 6.2, range, 5-7 years) and was greater than the 50th percentile in 5 patients (mean age 10.8, range, 9-15 years). Due to the formation of the neourethra using a well-vascularized thick urethral plate and the reinforcement of neourethra with dartos and/or a tunica vaginalis flap, neither diverticula formation nor urethral dilatation was observed in this series.

We did not detect any urination problem with visual examination of the patients during urination and a review of short voiding videos created by the parents. Because the follow-up did not exceed 10 years, we have no information with regard to problems with ejaculation.

DISCUSSION

The choice of single- or double-stage operations for the

Table 4. Results of late uroflowmetric analysis in 10 patients.

UFM Parameters	Range	Mean
Qmax, mL/s	6-22	13.1
Time to maximum flow, s	7-37	17.4
Duration of flow, s	17-55	31.5
Mean flow, mL/s	4-17	13.2
Urine volume, mL	109-760	253

Abbreviation: UFM, uroflowmetry.

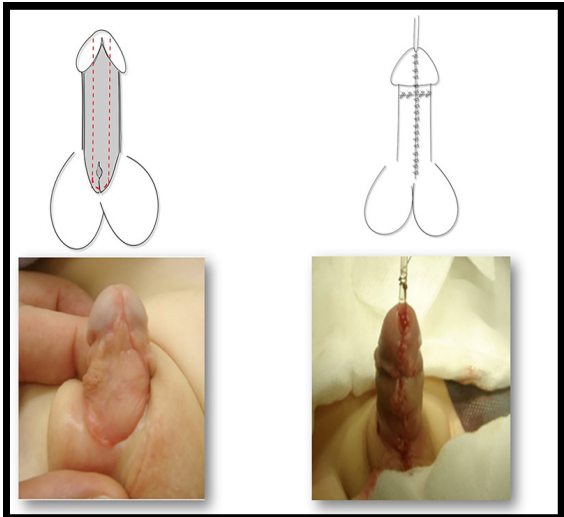


Figure 4. Urethroplasty is performed by tabularizing the neourethral plate. A urethral catheter is placed.

treatment of severe hypospadias with a severe curvature problem is under debate. Duckett drew our attention to single-stage techniques in the early 80s.^(3,4) According to and colleagues, there was only a 10% complication rate with the single-stage transverse island flap technique.⁽⁷⁾

However, over the past 10-15 years, two-stage techniques have been re-popularized, especially with the efforts of Braca who used free buccal mucosal grafts.^(8,9) This was a type of revolution in the treatment of severe proximal cases of hypospadias with prominent curvature and that of patients with crippled hypospadias who had insufficient healthy penile skin. Today, the 2-stage techniques using free grafts from the oral cavity or inner prepuce appear to be the most popular methods



Figure 5. Silicone foam dressing (Smith-Nephew Cavi-Care) intact for 5 days.



Figure 6. Postoperative slit like meatus (first post-operative year).

for treating such cases.

Based on clinical practice, the use of 2-stage techniques to treat patients with penoscrotal or perineal hypospadias with severe curvature, in whom division of urethral plate is inevitable, may provide better surgical and aesthetic results.

Zheng and colleagues compared the results of single- and two-stage techniques and reported similar complication rates in 66 cases of proximal hypospadias treated by single or 2-stage procedures.⁽¹⁰⁾ However, in 2 reports, Castagnetti and colleagues claimed that a lower complication rate and less favorable cosmetic results were associated with 2-stage techniques.^(1,11) We used a well-vascularized preputial island flap with an attached healthy and thick dartos pedicle. This healthy and thick



Figure 7. Postoperative coronal meatus (first post-operative year).

dartos tissue served as a safe, 2nd layer for the reinforcement of the urethral tube in the 2nd stage.

According to Snodgrass, better results can be obtained if free preputial grafts are used instead of vascularized flaps.⁽¹²⁾ Conversely, Powell and colleagues did not find any significant difference in complications rates when using free grafts or vascularized flaps.⁽¹³⁾

Some have criticized the use of vascularized flaps because of reports of a higher rate of diverticula formation.⁽¹⁴⁾ However, a tight adhesion can be created by inserting tiny incisions on the flap and placing several stitches between the flap and corporal body. In case of insufficient or inadequate Dartos tissue, we always used tunica vaginalis flaps as a 3rd reinforcement layer. These additional techniques appeared to be effective in preventing diverticula formation, at least as of the 5-10 year follow-up.

In this group, our aim was always to create a slit-like, wide meatus in the tip of the glans. However, if the meatus was located in the coronal area and if there was no problem with the calibration and direction of urination, we did not attempt to advance the meatus to the tip of the glans penis. A wide neomeatus, located in the coronary sulcus, may occasionally be helpful in preventing possible complications such as diverticula formation, meatal stenosis or fistula formation.

McNamara and colleagues reported a reoperation rate of 49% in 134 cases treated for proximal hypospadias.⁽¹⁵⁾ Haxhirexha identified a 40% incidence of voiding and ejaculation problems at long-term follow-up in those cases treated with 2 stage techniques.⁽¹⁶⁾ Our reoperation rate of 36% therefore appears to be reasonable for a very select group of patients with proximal hypospadias and remarkable curvature problems.

Uroflowmetry findings are not trustworthy in patients less than 5 years of age because of difficulties in evaluation. We compared Qmax values from 10 patients with the nomograms of healthy boys.⁽⁶⁾ The Qmax value was < 5th percentile in 2 patients (mean age, 6 years), between the 5-10th percentile in 4 patients (mean age, 6.5 years), between the 25-50th percentile in 2 patients (mean age, 8 years), and between the 50-75th percentile in 2 patients (mean age, 15.5 years). Though age-dependent improvements in uroflowmetry patterns and values after hypospadias repair have been reported,⁽¹⁷⁾ we did not have sufficient data from consecutive uroflowmetry studies to investigate this outcome.

There are some limitations to this technique. For instance, previous circumcision or operations for hypospadias with a loss of foreskin make patients ineligible for this procedure. Moreover, we were not able to

obtain sufficient information regarding the incidence of sexual and ejaculation problems in this series.

CONCLUSIONS

Creation of a healthy urethral plate using a well-vascularized transverse rectangular island flap from the inner part of the foreskin is a nice alternative in cases of proximal hypospadias with severe curvature when division of the urethral plate is inevitable. Effective strategies to prevent diverticula formation at long-term follow-up include a) the development of dense adhesions created by tiny incisions and small fixation sutures between the tunica albuginea and the flap and b) the reinforcement of the neourethra using a thick and well-vascularized dartos patch and/or the tunica vaginalis. Prolonged follow-up is necessary for the evaluation of sexual and ejaculatory problems.

CONFLICT OF INTEREST

None declared.

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