

Results of two-stage transverse preputial island flap urethroplasty for proximal hypospadias with chordee that mandate division of the urethral plate

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Citation: Ali MM, El-Hawy MM, Galal EM, Tawfik ER, Anwar AZ. Results of two-stage transverse preputial island flap urethroplasty for proximal hypospadias with chordee that mandate division of the urethral plate. Cent European J Urol. 2021; 74: 89-94.

Article history

Submitted: Aug. 19, 2020
Accepted: Dec. 27, 2020
Published online: Jan. 15, 2021

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Introduction Reconstruction of proximal hypospadias with chordee remains a difficult task. Our work aims to evaluate the role of two-stage transverse preputial island flap urethroplasty for repair of proximal hypospadias with chordee.

Material and methods This is a retrospective study including 57 children who underwent two-stage transverse preputial island flap urethroplasty. Glans meatus shaft (GMS) score was applied to 24 cases. Patient's characteristics, operative details and complications were assessed. Hypospadias objective scoring evaluation was used for postoperative assessment.

Results The mean age at the first stage operation was 23.6 months (9–84); the mean time interval between the first and second stage operations was 8.1 months (6–12) and the mean follow-up duration was 52.1 months (24–96). Urethral meatus was proximal penile in 18 patients, penoscrotal in 24 and scrotal in 15. The mean degree of ventral curvature (VC) was 51.5° (30–90). After the second stage operation, postoperative complications occurred in 16 (28.1%) patients with urethrocutaneous fistula in 6 (10.5%) cases, diverticulum in 3 (5.3%), glans dehiscence in 5 (8.8%) and meatal stenosis in 2 (3.5%). All cases of glans dehiscence occurred in severe hypospadias and small glans. Moderate GMS score was present in 10 (41.7%) cases and severe GMS in 14 (58.3%). Complications occurred in 7 (29.1%) patients with 5 (20.8%) with a severe GMS score and 2 (8.3%) with a moderate GMS score. The hypospadias objective scoring evaluation showed satisfactory results, with 39 (68.4%) patients achieving a score of 16 points.

Conclusions Two-stage transverse preputial flap is a good choice for repair of proximal hypospadias with an acceptable complication rate of 28.1%.

Key Words: proximal hypospadias ◊ two-stage repair ◊ preputial flaps
◊ urologic surgical procedures

INTRODUCTION

Hypospadias is one of the commonest anomalies of male genitalia, presenting in 1 of 300 live male newborns with proximal hypospadias being present in 20% [1]. Reconstruction of proximal hypospadias with chordee remains a formidable challenge [2, 3, 4]. Currently, two-stage operations have become the standard of care [5, 6, 7], however, selection between flaps and grafts has been a matter of contro-

versy. Recent long-term results of Byar's flap technique revealed high complication rates of 53–68% [8, 4]. Two-stage graft using Bracka's technique [5] showed overall complication rates of 6.3–38% [9, 2]. Staged transverse preputial island flap was introduced but publications are scarce with contradictory results [10, 11]. Herein, we present our long-term results using two-stage transverse preputial island flap urethroplasty for proximal hypospadias with chordee.

MATERIAL AND METHODS

We performed a retrospective study for children with proximal hypospadias who underwent two-stage transverse preputial island flap urethroplasty from January 2008 to December 2017 in our institution. From 2014, the glans meatus shaft (GMS) score previously described [12] was applied to 24 cases. We excluded cases with redo hypospadias and cases who failed to present for follow-up or did not complete the two stages at our institution. Patients' characteristics, operative details and complications were assessed. The hypospadias objective scoring evaluation (HOSE), as previously reported [13], was used as a tool for post-operative evaluation. A consent form was obtained from patients' parents before surgery and the research was approved by the local research committee.

Surgical technique

First stage

The initial incision, dissection and flap harvesting was performed as previously described [14]. A circumferential subcoronal skin incision was started dorsally and extended ventrally alongside the urethral plate and below the urethral meatus. Complete penile degloving was achieved by following the avascular plane between dartos and Buck's fascia. Removal of any tethering band was completed by extensive ventral dissection while preserving the urethral plate. Artificial erection was performed and all the cases showed ventral curvature (VC) more than 30° . Complete transection of the tethered urethral plate and then artificial erection was performed. Residual curvature $<30^\circ$ was corrected by dorsal plication, whereas persistent VC $\geq 30^\circ$ was straightened by either 3 transverse ventral corporotomies (fairy cuts) [15] or single corporotomy and tunica vaginalis graft. A deep midline incision was made in the glans and the glans wings were opened widely. A transverse preputial flap with a width of 12–15 mm and length equal to neourethra length was dissected from the dorsal skin to the penile base and was rotated anti-clockwise to be placed between the original meatus and neomeatus. The flap was sutured to the nearby skin around the original meatus, penile shaft skin and the edges of the incised glans. Urinary diversion was maintained for 7 days by using a urethral catheter. The steps are summarized in Figure 1.

Second stage

At least six months should lapse before the second stage operation. A U-shaped incision outlining the

flap margins and extending from the proximal meatus to the distal neourethra was performed. The width ranged from 12–15 mm and was adjusted according to patient's age. The edges of the neourethra were separated from the adjacent skin edges by leaving the dartos layer attached to the neourethra without undermining or mobilizing it. Glans wings were dissected laterally and the urethra was tubularized in two-layer closure using 7/0 polyglactin sutures. An additional covering of the neourethra was achieved by mobilizing the previously rotated anti-clockwise dartos pedicle of the preputial flap alongside the closed urethra. This provides a well vascularized additional supportive layer to cover the suture line. The repair was completed by glanular and skin closure leaving a wide slit like meatus. Coban 3M™ Self-Adherent Wrap was used over one piece of paraffin-based dressing impregnated with local antibiotic. Urinary diversion was maintained via a urethral catheter for 10 days. The steps are summarized in Figure 2.

Follow up and outcomes

Follow-up visits were planned at 1, 3 and 6 months, and annually after that. The presence of complications was assessed and recorded. Cosmetic outcome was judged in terms of position of the meatus, pres-

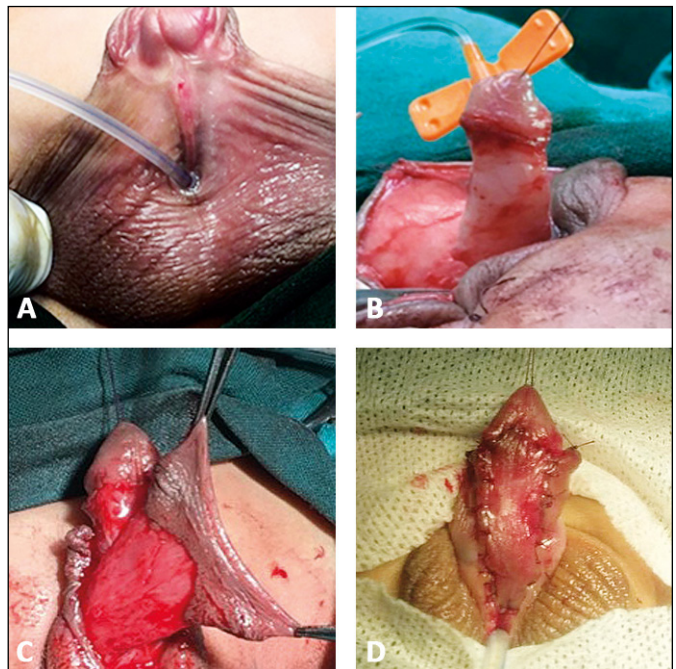


Figure 1. First stage transverse preputial flap urethroplasty. **A.** Penoscrotal hypospadias with narrow urethral plate. **B.** Complete penile degloving and orthoplasty. **C.** Harvesting of the flap. **D.** Skin closure.

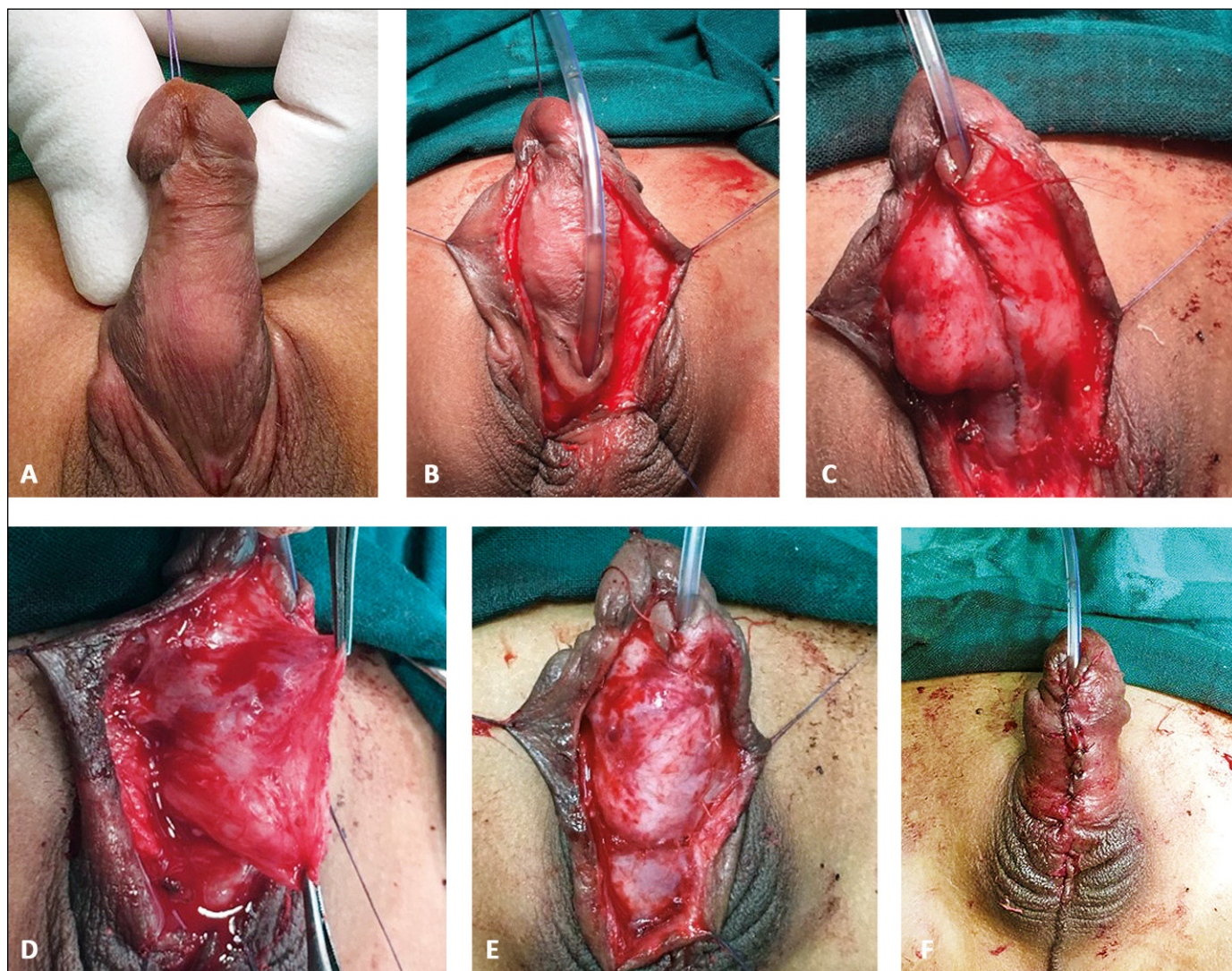


Figure 2. Second stage transverse preputial flap urethroplasty. **A.** Preoperative smooth wide plate strip. **B.** Outlining the neourethra **C.** Urethroplasty completed. **D.** Mobilization of dartos pedicle. **E.** Coverage of the neourethra. **F.** Skin closure.

ence or absence of curvature and global genital view. Functional evaluation was assessed by observing the urinary stream by the parents and the surgeons, meatal calibration when suspected stricture. Erection status was observed by parents and occasionally in office examination to report any curvature.

RESULTS

The study included 57 patients who met the inclusion criteria. Patients' demographics are shown in Table 1. Preoperative testosterone was used in 27 (47.4%) patients with small penis and glans by intramuscular injection in 2 or 3 doses 2 weeks apart and stopped one month before surgery. Moderate to severe VC was present in all the cases after penile degloving. The mean degree of VC was

51.5° (30–90). Correction of penile curvature consisted of transection of the urethral plate in all cases and was the only method in 32 (56.1%) cases, dorsal plication in 10 (17.6%), 'fairy cuts' in 12 (21.1%), and single corporotomy with grafting in 3 (5.3%) cases. All the cases completed the first stage without any complications. After completion of the second stage, the cosmetic appearance was excellent, the urethral meatus was ultimately in a glanular position in 54 (94.7%) cases and in a coronal in 3 (5.3%) because of small glans and fear of tightening the urethra. With follow-up the total Post-operative complications occurred in 16 (28.1%) patients; including fistula in 10.5%, glans dehiscence in 8.8%, diverticulum in 5.8 and meatal stenosis in 3.5% of patients. All cases of glans dehiscence occurred in patients with severe hypospadias and

small glans. Complications and their management are shown in Table 1.

The GMS score data were available in 24 cases. Moderate GMS score (7-9) was present in 10 (41.7%) cases and severe GMS (10-12) in 14 (58.3%). Complications occurred in 7 (29.1%) cases; in 5 (20.8%) with a severe GMS score and 2 (8.3%) with a moderate GMS score.

The HOSE results are shown in Table 2. Thirty-nine patients (68.4%) achieved a score of 16 points.

DISCUSSION

The goals of repair in proximal hypospadias include; straight penis, adequate caliber of the neo-urethra, slit-like meatus with a well-formed glans, and normal voiding with adequate stream and minimal postoperative complications [3, 16]. There is a universal trend towards two-stage repair for repair of proximal hypospadias [5, 6, 7], however; the choice between flaps and grafts depends on institution preference [17]. The aim of the current study is to present our long-term results of two-stage transverse preputial island flap urethroplasty for proximal hypospadias and compare other related reports using two-stage repair.

The presence of VC is a unique feature of proximal hypospadias. Methods to correct curvature include ventral lengthening, dorsal plication, fairy cuts and corporal grafting [18]. In moderate to severe curvature, urethral plate transection is mandatory, preservation of the urethral plate and dorsal plication was associated with recurrent curvature in 27.9% compared to 9.4% when the urethral plate was transected and ventral lengthening was performed [19]. Snodgrass and Bush achieved penile straightening by plate transection in 35% and by fairy cuts in 65% [20]. Özcan et al. performed plate transection and dorsal plication only [10]. Stanasel et al., [4] used more than one manoeuvre including transection of the plate in 71%, fairy cuts in 5% and corporal grafting in 34% of patients. In our series, VC was treated by transection of the urethral plate in all cases and was the only method in 32 (56.1%) cases, dorsal plication in 17.6%, 'fairy cuts' in 21.1%, and single corporotomy with grafting in 5.3%. One of the proposed advantages of flap over graft, is that it can be used in conjunction with grafting of the corpora, although this may increase complication rates [4]. This may be attributed to increased severity of hypospadias with grafting, in addition to changes in the corporal bed [4, 8].

Two articles have been published addressing staged transverse preputial island flap for proximal hypospadias. Özcan et al. published their study including

Table 1. Patients' characteristics and postoperative complications

Demographics	Mean	Range
Age at the first stage	23.6 months	(9-84)
Time interval between the two stages	8.1 months	(6-12)
Follow-up duration	52.1 months	(24-96)
Meatus position	No. of patients	(%)
Proximal penile	18	31.6
Penoscrotal	24	42.1
Scrotal	15	26.3
Total	57	100
Postoperative complications	No. of patients (%)	Management
Fistula	6 (10.5%)	Simple closure /all successful
Glandular dehiscence	5 (8.8%)	Nothing done/family satisfied and refused further intervention
Diverticulum	3 (5.3%)	Diverticulum excision in 2 symptomatic /1 follow-up
Meatal stenosis	2 (3.5%)	Meatotomy
Total complications	16 (28.1%)	

Table 2. Hypospadias objective scoring evaluation (HOSE)

Variable	Score	No. of patients
Meatal location		
Distal glandular	4	39
Proximal glandular	3	10
Coronal	2	8
Penile shaft	1	0
Meatal shape		
Vertical slit	2	39
Circular	1	18
Urinary stream		
Single stream	2	52
Spray	1	5
Erection		
Straight	4	47
Mild angulation (<10)	3	10
Moderate angulation (>10 but <45)	2	0
Severe angulation (>45)	1	0
Fistula		
None	4	51
Single-proximal	3	4
Single distal	2	2
Multiple or complex	1	0

30 cases with a reported complications rate of 36%, mainly fistula in 33% and diverticulum in 3% of patients [10]. Tiryaki et al. reported the worst complications rate of 95% in 38 cases mainly in the form of diverticulum in 21.1%, fistula in 18.4% and com-

bined together in 42.1% [11] of patients. Our results included the largest number of cases, with a total of 57, and our results demonstrated a complications rate of 28.1% including; urethrocutaneous fistula in 10.5%, diverticulum in 5.3%, glans dehiscence in 8.8% and meatal stenosis in 3.5% of patients.

Results of Byar's flap two-stage repair revealed complications rates ranging from 3.3–68% [4, 6]. Shukla et al. reported their experience with 700 patients, with a complications rate of 3.3% [6]. Yang et al. reported a complications rate of 11.8% in the form of fistula in 5.5% and dehiscence in 3.9% [21]. McNamara et al. published long term follow-up of cohort study including 134 patients, complications occurred in 53% of patients, fistula occurred in 29.1%, glans dehiscence in 14.2% meatal stenosis in 12.7% and diverticula in 9% [8]. A high complication rate of 68% was reported by Stanasl et al. including fistulas in 57%, urethral stricture in 14%, diverticula in 14%, meatal stenosis in 9%, and glans dehiscence in 5% with more than one complication occurring in the same patient [4]. Reported overall complication rates of the two-stage graft using Bracka's technique were 6.3%, 20%, 22%, 32% [9, 7, 19, 2].

Comparison between literature series addressing proximal hypospadias repair is difficult because of variation in severity and heterogeneity of series and wide range of results that make comparison between these studies difficult [4, 19].

The incidence of diverticula is high in preputial flaps [22]. It may be secondary to distensible transposed skin, lack of urethral fixation and high pressure from tight distal glans [23]. In contrast to graft which is well fixed to the corpora and has less ability to form diverticulum [20]. The reported rates for diverticula in two-stage flap operations varied from 0–63% [6, 11]. Fixation of the flap to the underlying corpora may be effective in reducing the incidence of diverticulum [10] while others denied this effect [11]. In the current study, the incidence of diverticulum was 5.3%, we did not use any additional sutures to fix the flap to the underlying corpora, however, the following maneuvers were used; adjusting the width of the neourethra, leaving the dartos layer attached to the neourethra, covering the neourethra by dartos pedicle of the preputial flap and finally maintaining a wide distal meatus. If there was any suspicion of narrow and tight glans, the meatus was ended in a coronal position; this occurred in 3 patients and was in agreement with other studies [10]. Glans dehiscence is loss of glans configuration with proximal migration of the meatus. The incidence of glans dehiscence in two-stage flap operations ranges from 3.9% to 14.2% [22, 8]. Bush et al. concluded that small glans width <14 mm is an independent

risk factor for occurrence of postoperative complications [24]. McNamara et al. reported increased glans dehiscence in small glans and in early age of repair [8]. The use of preoperative testosterone increases glans circumference and diminishes the risk of glans dehiscence [8]. A pediatric urologist will still prescribe testosterone in cases with reduced glans size, small penis and narrow urethral plate [25]. In our series, preoperative testosterone was used in 27 (47.4%) patients with small penis and glans dehiscence occurred in 8.8% of patients. We included glans dehiscence in cases with <2 mm glans fusion as previously described [20]. All cases with glans dehiscence occurred in patients with severe hypospadias and small glans.

The GMS score was introduced to assess preoperative severity of hypospadias and correlated with postoperative results [12, 26]. Mild GMS, moderate GMS and severe GMS scores were associated with 5.5%, 14.6% and 33.9% complication rates, respectively (26). In the current series, we applied GMS score in 24 patients; moderate GMS was present in 10 (41.7%) cases and severe GMS in 14 (58.3%). Complication rates were 20.8% in patients with a severe GMS score and 8.3% in those with a moderate GMS score and this is in agreement with previous reports [26].

The HOSE is a certified tool for postoperative evaluation [13, 27]. A total score of 14 or more is defined as acceptable results in distal hypospadias repair [13]. Hussein et al. used HOSE in 55 patients who underwent two-stage hypospadias repair using mixed techniques for repair, 19 patients had satisfactory results and 36 had non-acceptable results [27]. Özcan et al. [13] achieved a score of 16 in 50% of cases. In the current study, we used HOSE in 57 patients using the same technique and we achieved excellent results of 16 points in 68.4% of patients. Use of the HOSE tool would standardize the postoperative follow-up of hypospadias.

The current series included 57 patients with severe proximal hypospadias with a complication rate of 28.1%. Penoscrotal and scrotal hypospadias constituted 68.4% of cases; moderate to severe VC was present in all the cases with a mean of 51.5° (30–90), in addition to high GMS score. All the previous factors may explain complications rate. Further refining of the technique and experience are needed to reduce complications in the future.

The current study has some limitations similar to all series of proximal hypospadias [4, 7, 8]. These include its retrospective nature, the multiplicity of surgeons, the variability of severity and the wide range of procedures. However, we have several good points favouring the current study. This was a single centre study, the technique had few publications

with variable results, two surgeons of sufficient experience performed the same technique, and there were sufficient preoperative and postoperative evaluations and long-term follow-up.

CONCLUSIONS

Proximal hypospadias presents with a wide range of severity and its repair is a challenging procedure. The

use of two-stage transverse preputial flap is among the good choices for repair with accepted complications rate of 28.1%. Although in the current status comparison between different series of hypospadias are difficult, futures studies with randomization and objective assessment will be further needed.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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