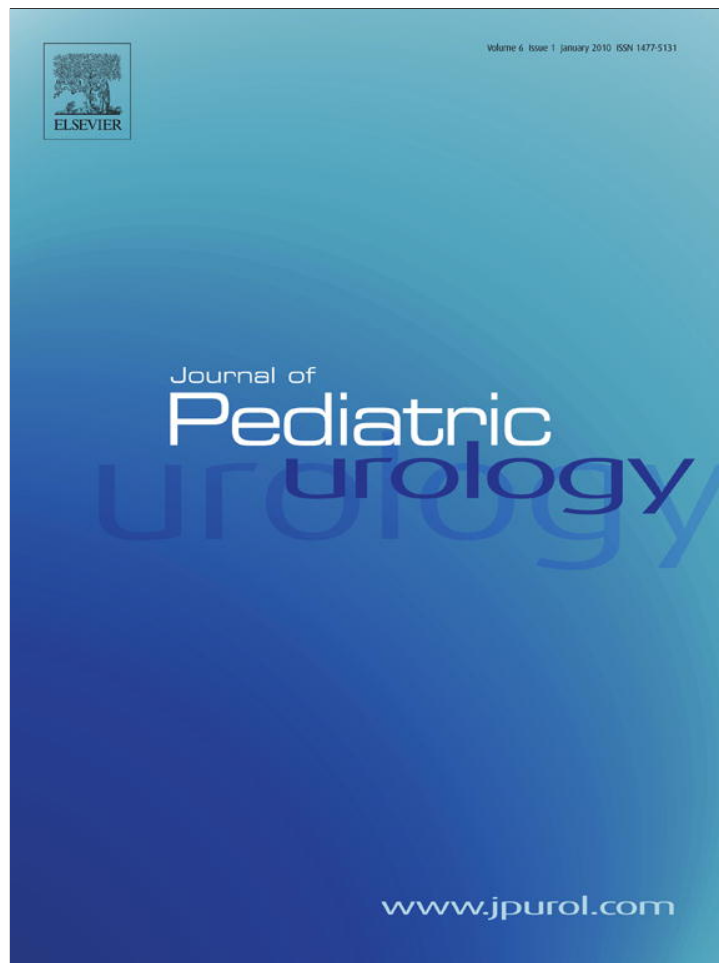


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Outcome of proximal hypospadias repair using three different techniques

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KEYWORDS

Proximal hypospadias;
Preputial flap;
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plate;
Onlay island flap;
Two-stage repair

Abstract Objective: To evaluate the outcome of proximal hypospadias repair using three different techniques.

Patients and methods: The study involved 194 boys with primary proximal hypospadias. The meatus was proximal penile, penoscrotal, scrotal and perineal in 98, 64, 30 and 2 patients, respectively. Tubularized incised plate (TIP) urethroplasty, onlay island flap (OIF) urethroplasty and two-stage repair were used in 96, 57 and 41 patients, respectively. Preoperative anatomical description and postoperative complications were recorded with evaluation of the final functional and cosmetic outcomes for each technique.

Results: Mean age at presentation was 14.43 months (range 6–31). Mean follow-up after second stage was 32.9 months (range 11–54). Complications were encountered in 27 cases (13.9%) with no statistically significant differences between techniques; however, a significantly higher complication rate was found among patients with scrotal and perineal hypospadias and in patients with associated scrotal lesions. Urethrocutaneous fistula was the most common complication, being encountered in 7.7% of patients with a significantly higher rate among patients with scrotal hypospadias (16.7%).

Conclusions: Single-stage repair of proximal hypospadias can be successfully performed when plate preservation is possible, while two-stage repair is applicable when plate transection is necessary. Functional and cosmetic outcomes are satisfactory, with no statistically significant advantage with any technique.

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Introduction

Hypospadias is a congenital abnormality occurring in 1 in 300 live births with proximal hypospadias being identified in

20% of cases [1]. Several factors interact to determine the type of repair, such as meatal site, presence of chordee, availability of the prepuce and quality of the urethral plate, in addition to surgeon's experience [2].

With identification of the urethral plate as an anatomical entity, urologists were able to introduce new techniques for repair based upon plate tubularization or augmentation: tubularized incised plate (TIP) urethroplasty

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[3] or onlay island flap urethroplasty (OIF) [4], respectively. Both techniques were initially described for distal hypospadias repair with minimal or no chordee, but later their application was extended to proximal anomalies [5–12].

Alternatively, when transection of the urethral plate is necessary, repair can be completed with tubularization of a pedicle flap or a free graft in either a single- or multi-staged procedure. Some authors prefer single-stage repair [13–15] while others advocate two-stage repair to achieve better functional and cosmetic outcomes [16,17]. In this work, the functional and cosmetic outcomes of proximal primary hypospadias repair using three different techniques were evaluated, recording postoperative complications.

Material and methods

Patients

Between June 2004 and January 2008, 194 boys presented to our out-patient clinic with proximal hypospadias. In 153 patients, complete release of chordee could be achieved without transection of the urethral plate, and the repair was completed using either TIP urethroplasty (96 patients, group 1) or OIF urethroplasty in 57 patients (group 2). Transection of the urethral plate was necessary in 41 patients to straighten the penile shaft, using a two-stage technique (group 3). The preoperative patient characteristics are summarized in Table 1 while the anatomical distribution of the hypospadiac meatal sites is illustrated in Fig. 1.

Before surgical interference, all details and hazards of the operation were discussed with the patients' parents, and informed consent was obtained for each patient. Neither testosterone nor dehydrotestosterone was administered preoperatively to any patient. All procedures were performed by the same surgeon in the same institute following the same protocol.

Surgical technique

Orthoplasty and urethroplasty

Under general endotracheal anesthesia, the procedure began with a sub-coronal circumferential incision 2–3 mm proximal to the corona that extends with two longitudinal incisions along the lateral edge of the entire length of the

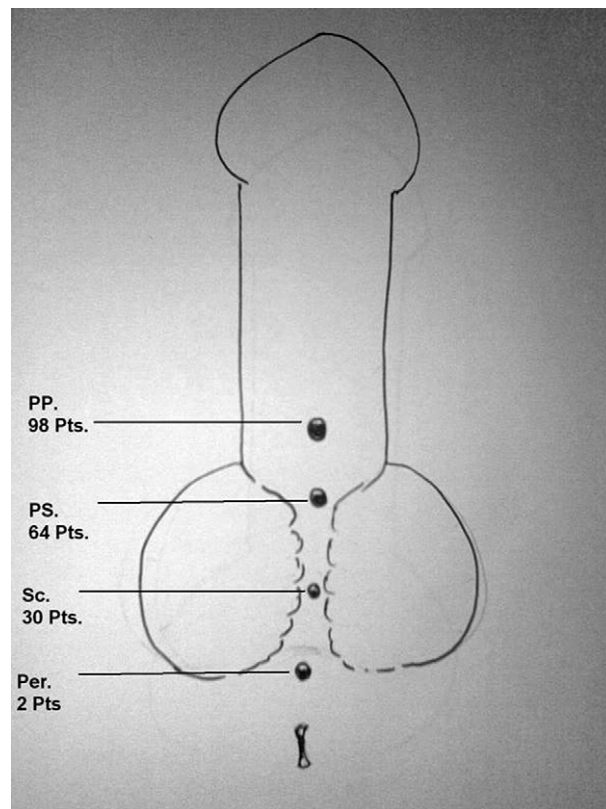


Figure 1 Schematic diagram of hypospadiac meatal sites. PP = proximal shaft, PS = penoscrotal, Sc = scrotal, and Per = perineal.

urethral plate, followed by complete degloving of the penile shaft in the plane between dartos and Buck's fascia, and checking with artificial saline injection. In 11 patients, dorsal plication of tunica albuginea was required to correct minimal residual chordee (<30 degrees) using Nesbit's technique [18]. At this stage, if complete release of chordee could be achieved, the procedure was completed as a single-stage TIP urethroplasty (Fig. 2) or OIF urethroplasty (Fig. 3) on a 10-Ch urethral catheter, performed as originally described by Snodgrass [3] and Elder et al. [4], respectively. In the initial 24 months of the study period, OIF was performed in 42 cases (73.7%) versus 15 (26.3%) cases thereafter, while TIP urethroplasty was performed in 26 (27%) cases versus 70 (73%) cases thereafter.

Table 1 Anatomical description of anomaly.

		TIP	OIF	Two-stage repair	Total
No. of patients		96	57	41	194
Meatal site after chordee release	Proximal shaft	54 (56.3%)	29 (51%)	15 (36.6%)	98 (50.5%)
	Penoscrotal	27 (28.1%)	24 (42%)	13 (31.7%)	64 (33%)
	Scrotal	15 (15.6%)	4 (7%)	11 (26.8%)	30 (15.5%)
	perineal	—	—	2 (4.9%)	2 (1%)
Other findings	Penoscrotal transposition	—	—	6 (14.6%)	6 (3.1%)
	Bifid scrotum	6 (6.3%)	4 (7%)	7 (17.1%)	17 (8.8%)
	Congenital hernia	No	No	No	—
	Undescended testis	No	No	No	—
Previous penile surgery	No	No	No	—	

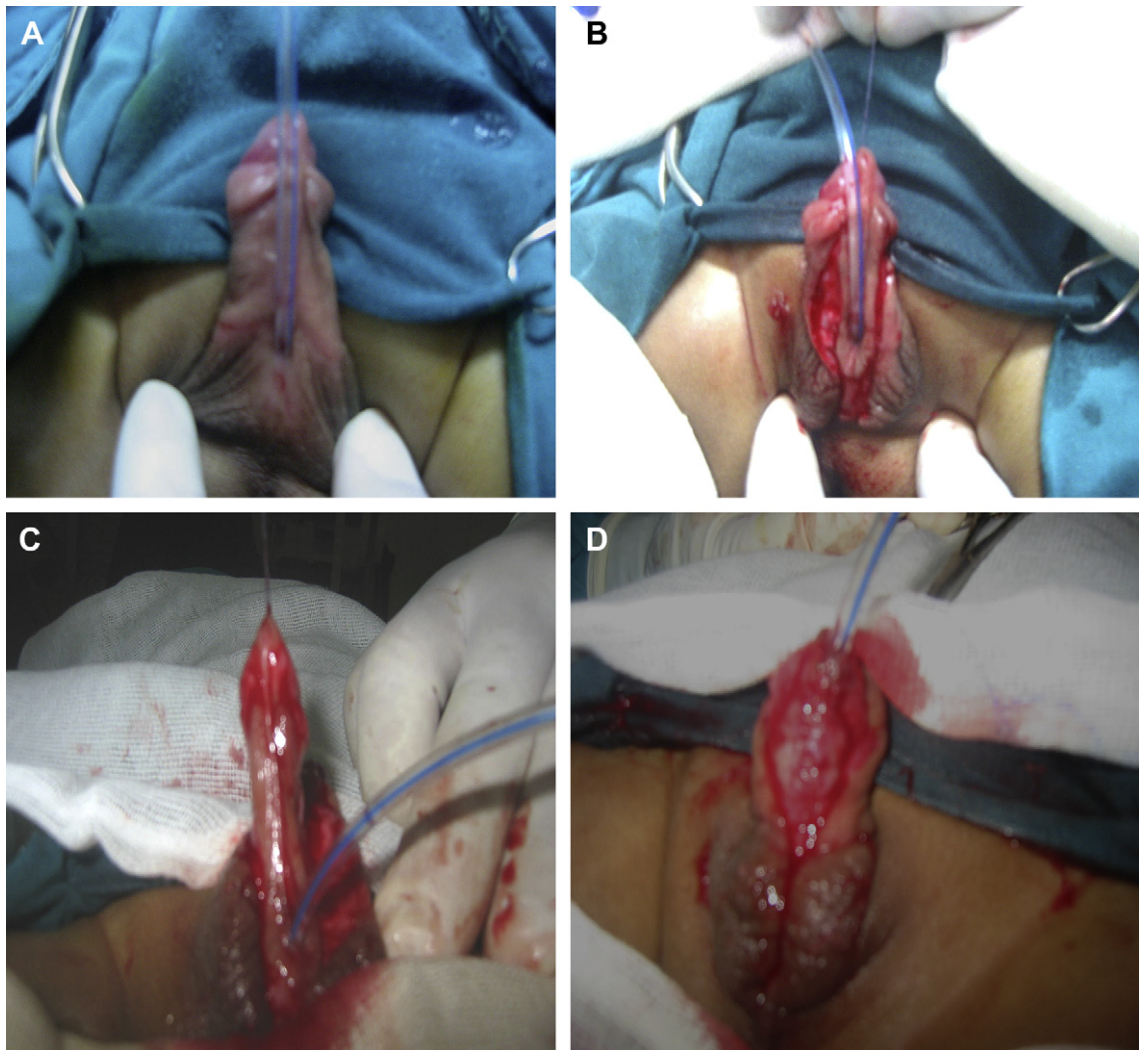


Figure 2 TIP urethroplasty. (A) Preoperative view. (B) Urethral plate separated from shaft skin. (C) Midline incision to widen urethral plate. (D) Urethral plate tubularized over 10-Ch urethral catheter.

If the plate was short and unhealthy, it was transected 2–3 mm proximal to the glans with excision of fibrous bands beneath the plate exposing the distal spongiosum until the level of maximal chordee curvature, and a two-stage procedure was performed (41 patients). A rectangular inner preputial pedicle flap was dissected in the plane between shaft skin and dartos to the penopubic area and then rotated ventrally to be laid distal to the urethral plate. This neourethral plate was then sutured using 6-0 Vicryl sutures proximally to the native plate and distally to the glans, after a deep incision in the midline to receive the preputial flap within the glanular cleft (Fig. 4). Six months later, repair was completed by deeply incising the neourethral plate along its entire length with a dorsal midline longitudinal incision, followed by tubularization over a 10-Ch silicon urethral stent using the Snodgrass [4] modification of the standard Thiersch–Duplay technique [19,20]. Several layers of subcutaneous tissue were placed along the neourethra with a tension-free closure over the repair (Fig. 5). Urinary diversion was accomplished by a suprapubic cystocath.

Glanuloplasty

The meatus was achieved at the tip of the glans by creating glanular wings lateral to the plate to be dissected off the dome of the corpora cavernosum. The wings were then closed using 6-0 Vicryl sutures over the neourethra.

Scrotoplasty

Six patients had associated penoscrotal transposition that was repaired (in the first stage of the two-stage technique) by creating two large scrotal flaps and rotating them inferiorly underneath the penis as described by Glenn and Anderson [21], and leaving a skin bridge between the medial borders of the transposed scrotal skin flaps to maintain the viability of the dorsal penile skin as suggested by Ehrlich and Scardino [22].

Bifid scrotum (17 patients) was repaired as a single stage in 10 patients (6 TIP cases and 4 OIF cases) with incorporation of the midline smooth hairless scrotal epithelium in continuity with the urethral plate in the neourethra, and bringing the lateral scrotal halves together in two layers. It was repaired in the first stage of the two-stage procedure in

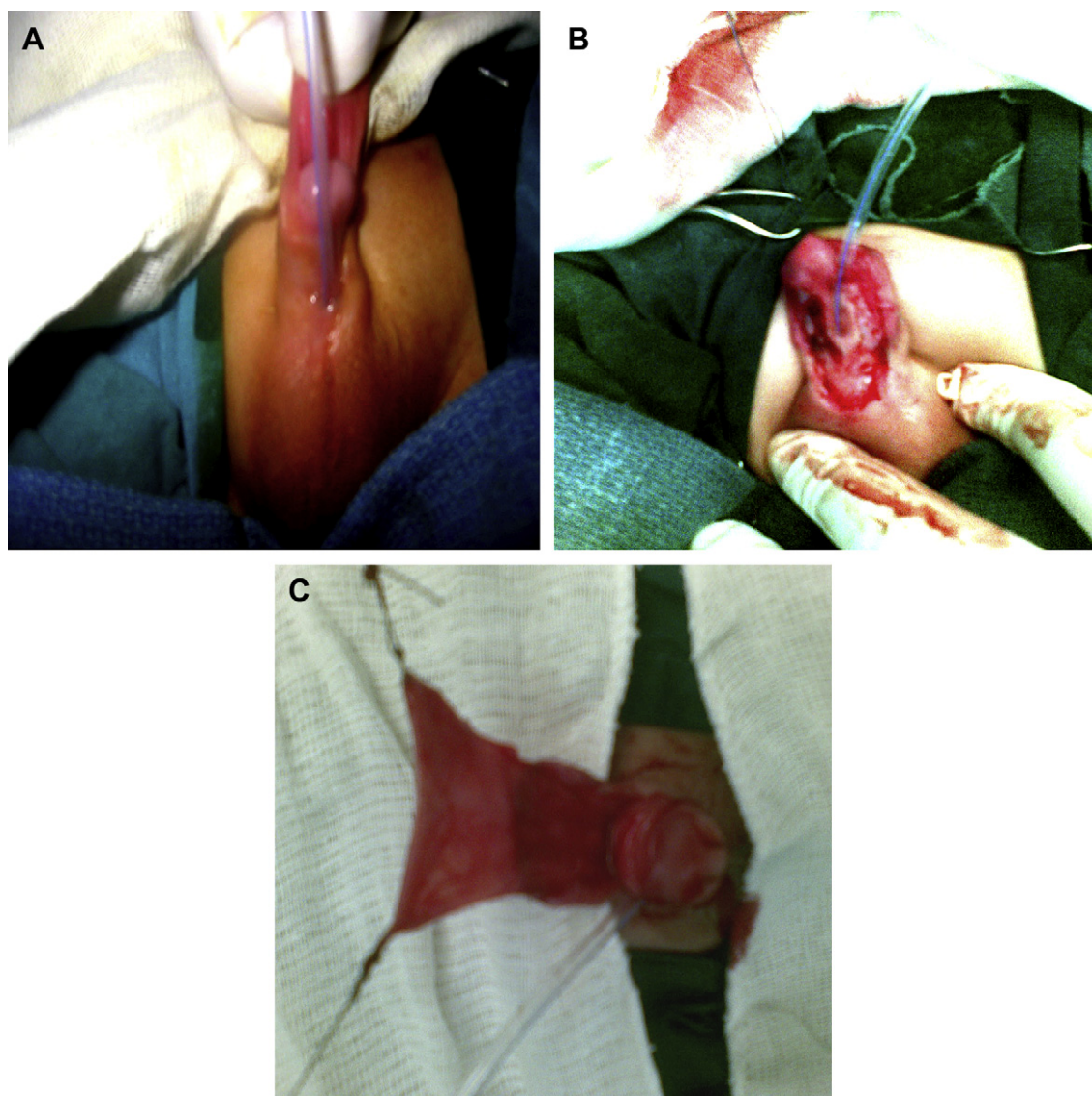


Figure 3 OIF urethroplasty. (A) Preoperative view. (B) Urethral plate that does not have a supple appearance. (C) Inner preputial pedicle flap is pediculated to perform OIF.

7 patients by excising the midline scrotal tissue and then bringing the scrotal halves together.

Postoperative care

All patients began oral intake 3 h after surgery with a hospital stay of only 24 h. Prophylactic broad-spectrum antibiotic (Augmentin) was administered for 7 days. In patients with single-stage repair, urethral catheters were removed on the 8th postoperative day. In two-stage repair patients, the urethral catheter was removed on the 5th postoperative day after the first stage and on the 8th postoperative day after the second stage, and then the suprapubic cystocath on the 14th postoperative day.

The patients were checked twice weekly for 3 months and every 3 months thereafter. At each visit, they were assessed both clinically and by uroflowmetry to record any postoperative complication, evaluate the final cosmetic and functional outcomes, and assess the voiding pattern.

Results

The mean age of the patients at presentation was 14.43 months \pm SD 5.322, with a mean follow-up period of 33.2 months \pm SD 9.156 (Table 2). The native meatus was proximal shaft, penoscrotal, scrotal and perineal in 98, 64, 30 and 2 patients, respectively (Table 1). Repair was performed using TIP urethroplasty (group 1 = 96 patients), OIF urethroplasty (group 2 = 57 patients) and a two-stage procedure (group 3 = 41 patients). Penoscrotal transposition was repaired in 6/41 of the two-stage repair group, while bifid scrotum was repaired in 17 patients with 6, 4 and 7 being in the TIP group, OIF group and two-stage group, respectively. The overall complication rate was 13.9% (27/194 patients) with no statistically significant advantage with any technique, complications being encountered in 13 (13.6%), 8 (14%) and 6 (15%) of the TIP group, OIF group and after the second stage of the

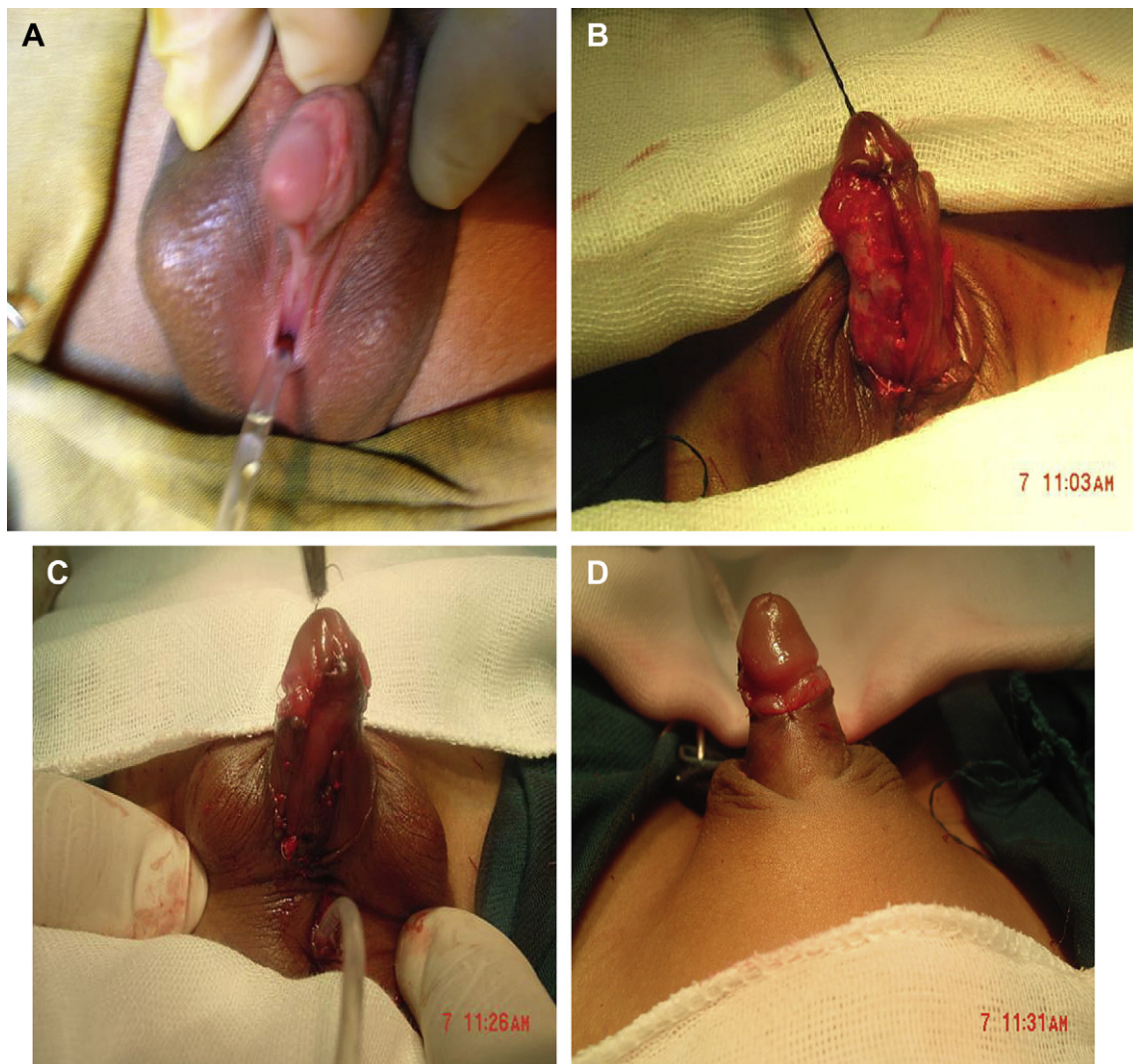


Figure 4 Two-stage technique (first stage). (A) Preoperative view. (B) The neourethral plate rotated ventrally and sutured to the glans distally and native plate proximally. (C) Immediate post-operative first stage view (ventral aspect), (D) Dorsal aspect.

two-stage group, respectively, with no complications after the first stage (Table 3). However, a significantly higher complication rate was found among patients with scrotal and perineal hypospadias (23.3% and 100%, respectively) (Table 4). The most common complication was urethrocutaneous fistula being detected in 15/194 patients (7.7%), with 8 (8.4%), 4 (7%) and 3 (7.5%) of them in the TIP group, OIF group and two-stage group, respectively. There was no statistically significant difference in the fistula rate between the three techniques, but a significantly higher fistula rate was encountered in patients with scrotal hypospadias (5/30 patients, 16.7%) and perineal hypospadias (1/2 patients, 50%) (Table 4). Complications were encountered in 2 out of 6 patients (33.3%) with penoscrotal transposition and 4 out of 17 patients (23.5%) with bifid scrotum, with an overall complication rate of 26.1% in patients with associated scrotal lesion versus 12.1% in patients with normal scrotum ($P = 0.01$).

The complications were repaired in a single re-operation by meatoplasty, glanuloplasty and fistula closure for patients with meatal stenosis, glans dehiscence and fistula,

respectively. Repair breakdown [2] was successfully repaired by buccal mucosal graft. Repair was successful in 25/27 patients. However, the meatus could not be achieved to the tip of the glans in 2 patients with glans dehiscence. After correction of all complications, 182/194 (94.8%) patients showed normal cosmetic and functional outcomes, with 91/96 (95%), 54/57 (95%) and 37/41 (90%) of them in the TIP group, OIF group and two-stage group, respectively, and with no statistically significant difference between the three techniques ($P = 0.26$).

Cosmetic dissatisfaction was reported in 12 patients with extra skin [5], unsatisfactory meatal appearance [3] and abnormal scar tissue [4]. Success was defined as having a functional urethra with normal stream, without fistula, diverticulum or stricture, and having a normal looking straight penis with a conically shaped glans and a slit-like meatus at its tip.

Discussion

Despite the recent great advances in hypospadias surgery, the optimal management of proximal hypospadias has not

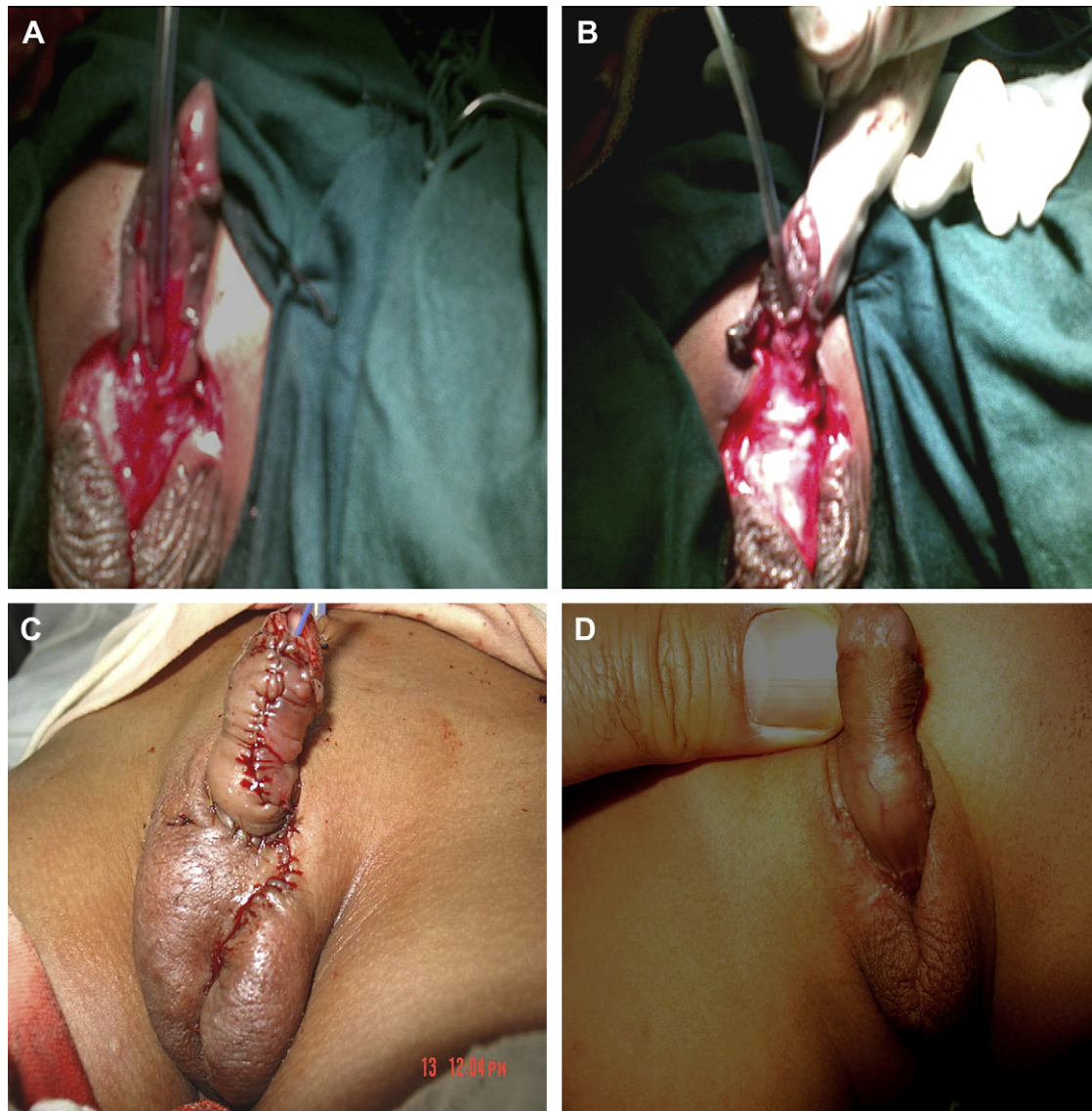


Figure 5 Two-stage technique (second stage). (A) The neourethral plate is dissected from the surrounding skin. (B) Neourethral plate is longitudinally incised and tubularized over a 10-Ch urethral stent. (C) Immediate second stage postoperative view. (D) Late postoperative view (3 months postoperatively).

been standardized. Repair can be performed as an either single or multi-stage procedure with much debate regarding operation for repair. In this series, single-stage repair was performed whenever plate preservation was possible using TIP urethroplasty or OIF urethroplasty, while two-stage repair was preferred when plate transection was necessary. Most OIF repairs were performed in the initial 24 months of

the study period, but the treatment strategy was changed thereafter towards more TIP urethroplasty repairs, based upon the recently reported encouraging results [5–7]. However, OIF was still preferred if the urethral plate did not have a supple appearance. Snodgrass and Lorenzo reported the outcome of 33 TIP urethroplasty patients with a supple plate appearance in all but two cases.

Table 2 Mean age and follow-up period.

	TIP	OIF	Two-stage repair	Total
No. of patients	96	57	41	294
Mean age at presentation in months (range) \pm SD	14.9 (6–31) \pm 5.306	15.3 (6–30) \pm 6.035	13.1 (6–22) \pm 4.652	14.43 (6–31) \pm 5.322
Mean follow-up in months (range) \pm SD	33.9 (12–54) \pm 9.91	33.6 (13–50) \pm 8.703	32 (11–48) \pm 8.854	33.2 (11–54) \pm 9.156

Table 3 Types and percentage of complications.

	Meatal stenosis	Fistula		Glans dehiscence	Repair breakdown	Total	P value
		Temporary	Permanent				
TIP (96)	3 (3.1%)	2 (2.1%)	6 (6.3%)	2 (2.1%)	—	13 (13.6%)	0.9
OIF (57)	1 (1.75%)	1 (1.75%)	3 (5.25%)	1 (1.75%)	2 (3.5%)	8 (14%)	
Two-stage (41)	2 (5%)	—	3 (7.5%)	1 (2.5%)	—	6 (15%)	
Total (194)	6 (3.1%)	3 (1.5%)	12 (6.2%)	4 (2.1%)	2 (1%)	27 (13.9%)	

Table 4 Complications and meatal site.

	Meatal stenosis	Fistula	Glans dehiscence	Repair breakdown	Total	P value
Proximal shaft (98)	2 (2%)	5 (5%)	1 (1%)	1 (1%)	9 (9%)	<0.05
Penoscrotal (64)	3 (4.7%)	4 (6.3%)	2 (3.1%)	—	9 (14.1%)	
Scrotal (30)	1 (3.3%)	5 (16.7%)	—	1 (3.3%)	7 (23.3%)	
Perineal (2)	—	1 (50%)	1 (50%)	—	2 (100%)	
Total (194)	6 (3.1%)	15 (7.7%)	4 (2.1%)	2 (1%)	27 (13.9%)	

Postoperatively, these two patients had repair dehiscence and neourethral contracture with recurrent penile curvature, respectively [23].

When plate transection was necessary (41 patients), two-stage repair was preferred aiming at a better cosmetic and functional outcomes. Duckett Jr. [13], Hodgson [14], and Asopa et al. [15] all reported single-stage repair using tubularized preputial island flaps, but unfortunately with a high complication rate of 20–50% that may necessitate secondary procedures. Johal et al. proposed that the delay between grafting and closure allows for all scarring and contractions to occur around the meatus before the second stage, providing the best chance of success [17].

Our two-stage technique entails laying down an inner preputial pedicle flap as a neourethral plate that is tubularized in the second stage. This flap provides a hairless neourethral plate of adequate width, length and vascularity, leaving abundant vascularized skin to cover the raw area created after release of chordee. Incising this neourethral plate during the second stage allows additional widening of the plate and minimizes the incidence of stricture urethra.

Powell et al. compared the outcomes of urethral construction using flaps and grafts for the single-stage treatment of proximal hypospadias, and concluded that the use of vascularized flaps offered no advantages as regards the complication rate [24]. However, we believe that graft harvest increases morbidity depending on the donor site.

Moreover, a vascularized flap is a stronger guarantee against neourethral plate shrinkage or sloughing. With the introduction of buccal mucosa as a urethral substitute, many authors reported its application to repair proximal and complex hypospadias cases, but the overall complication rates range from 24% to 57% [25,26]. Hensle et al. reported the long-term results of buccal mucosa grafts for hypospadias surgery and stated that urethral construction for primary hypospadias is most effectively done with inner preputial skin [25].

In 6 patients, penoscrotal transposition was found and repaired in the first stage of the two-stage procedure giving the chance to reassess the penile shaft skin status before urethroplasty. Bifid scrotum was repaired as a single stage in 10 patients (6 TIP cases and 4 OIF cases) with incorporation of the midline smooth hairless scrotal epithelium in the neourethra, while it was repaired in the first stage of the two-stage procedure in 7 patients. The complication rate for TIP and OIF urethroplasty patients was 13.6% and 14%, respectively, which is comparable to the outcomes reported in other series (Tables 5 and 6). With the two-stage technique, the first stage was successful in all patients, but a complication rate of 15% was reported in the second stage which is comparable to that reported by Bracka in his group of patients after two-staged repair [16].

In agreement with the findings of Braga et al., there was no statistically significant difference in the complication rate in relation to the performed technique [27]. However,

Table 5 Complications of TIP urethroplasty for proximal hypospadias repair.

	Technique	No. of patients	Hypospadias location	% Complications
Chen et al. [5]	TIP	40	Mid shaft, perineal	9/40 (22.5%)
Snodgrass et al. [6]	TIP	27	Mid shaft, penoscrotal	3/27 (11%)
Palmer et al. [7]	TIP	21	Penoscrotal	2/21 (10%)
Cheng et al. [8]	TIP	100	Mid shaft, proximal	4/100 (4%)
Present series	TIP	96	Proximal shaft penoscrotal, scrotal	13/96 (13.6%)

Table 6 Complications of OIF urethroplasty for proximal hypospadias repair.

	Technique	No. of patients	Hypospadias location	% Complications
Gearhart and Borland [9]	OIF	61	Not mentioned	6
Biosca et al. [10]	OIF	67	Mid, post shaft and scrotal	12
Hollowell et al. [11]	OIF	31	Mid and post shaft	10
Silva et al. [12]	OIF	126	Not mentioned	27
Present series	OIF	57	Proximal shaft penoscrotal, scrotal	14

a significantly higher complication rate was encountered in patients with scrotal (23.3%) and perineal (100%) hypospadias and in patients requiring scrotoplasty (26.1% versus 12.1% in patients with normal scrotum). A more extensive procedure and a longer suture line with increasing tissue trauma and ischemia may be behind this outcome. This also reflects the thoughts of authors who suggest that the more complicated or extensive the procedure, the more complications will develop [28,29].

Conclusion

A single-stage urethroplasty using TIP or OIF can be successfully used to repair proximal hypospadias when plate preservation is possible, while a two-stage technique is applicable when plate transection is necessary. Short-term outcome is excellent but long-term assessment is still needed, especially for stricture urethra, diverticulum formation and cosmetic outcome.

Conflict of interest

The authors have no conflict of interest.

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