COMPARATIVE STUDY BETWEEN TUBULARIZED INCISED PLATE URETHROPLASTY AND TRANSVERSE PREPUCEAL ONLY ISLAND FLAP URETHROPLASTY FOR THE MANAGEMENT OF DISTAL PENILE HYPOSPADIAS

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Abstract:

Introduction: *The optimal treatment of hypospadias remains controversial. Several techniques have been described, but the best approach remains unsettled.*

Objective: *To compare the outcomes of two popular methods, Tubularized incised plate urethroplasty (TIPU) and Transverse preputial onlay island flap (TPOIF) for the correction of distal penile hypospadias.*

Materials and method: *This prospective interventional study was conducted in the Department of Urology, Dhaka Medical College Hospital, during the period of September 2015 to March 2017. 40 patients with distal hypospadias with minimum or no chordee and no previous history of circumcision or hypospadias surgery were allocated into two groups by simple random sampling with equal number of distribution. In Group-A, patients were subjected to correct the defect by TIPU procedure while in Group-B, they were operated by TPOIF urethroplasty technique. In this study, the outcomes of the aforementioned procedures were compared in terms of operative time, surgical complications and cosmetic outcome.*

Result: *Mean age and meatal position of the patients in Group-A and Group-B were comparable. The mean operation time of Group-B (100.78 ±16.66 min) was higher than Group-A (89.98 ±19.80 min). Complications in terms of UCF and meatal stenosis were higher in Group-A than in Group-B, 26.31% vs. 16.67% and 36.84% vs. 5.56% respectively, but were lower for wound disruption, 0% vs. 11.11%. Although difference between the groups was not statistically significant in case of UCF and wound disruption (p value >0.05), it was significant in meatal stenosis (p value <0.05). Cosmetic outcome of most of the cases in Group-A was good (61.11%), whereas it was poor in Group-B (78.77%).*

Conclusion: *It seems that both techniques can be used for the correction of distal penile hypospadias with apparently similar outcomes. However well controlled randomized study with adequate sample size may reveal more divergent outcomes for the two techniques.*

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Introduction:

Hypospadias is one of the most common congenital anomalies occurring in approximately 1 in every 300 male children [1]. Although many techniques to repair hypospadias have been reported, no consensus has yet been made on the best repair. Of all these

methods, one-stage repair has become the accepted procedure of choice. Nowadays, particular importance has been attached to urethral plate preservation which is well vascularised, has a rich nerve supply and muscular backing [2]. Transverse preputial onlay island flap (TPOIF) urethroplasty and Tubularized incised plate urethroplasty (TIPU) are two preferred techniques where urethral plate is preserved. According to two different surveys on current hypospadias surgery practices conducted in North America and in Europe respectively, TIP urethroplasty and TPOIF urethroplasty have also emerged as the favoured techniques [3, 4].

Surgical correction of hypospadias should not be taken lightly or casually by any surgeons, as first attempt of surgery is the best chance to get the highest outcome. This study was aimed to compare the outcome of two most preferred surgical techniques for correction of distal penile hypospadias that would comply with level of our surgical expertise. We hypothesised that Transverse preputial onlay island flap urethroplasty (TPOIF) is better technique than Tubularized incised plate urethroplasty (TIPU) for the management of distal penile hypospadias.

Materials and method:

This prospective interventional study was conducted in the Department of Urology, Dhaka Medical College Hospital, during the period of September 2015 to March 2017. 40 patients with distal penile hypospadias with minimum or no chordee and no previous history of circumcision or hypospadias surgery were selected for the surgery. When external urethral meatus was located in the glans, corona glandis or in the distal third of the shaft of penis, the case was regarded as distal penile hypospadias. Using closed envelopes, patients were randomly allocated into two equal groups. In Group-A, patients were subjected to correct the defect by TIPU procedure while in Group-B, they were operated by TPOIF urethroplasty technique.

Surgical technique:

After obtaining detailed history of each patient, they were thoroughly examined. Special attention was given on location of urethral meatus and chordee. Operative steps were as described by the originator.

Steps of TPOIF repair

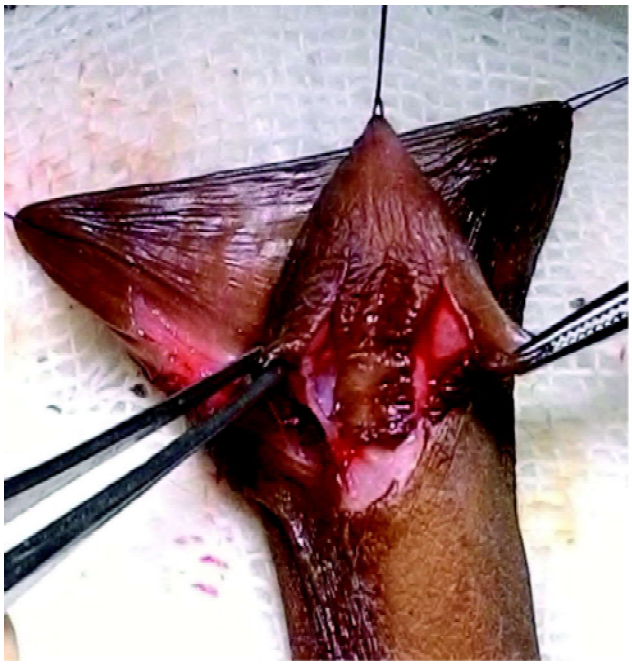

Fig- 1A: *Creation of glans wings and u-shaped incision around urethral plate*

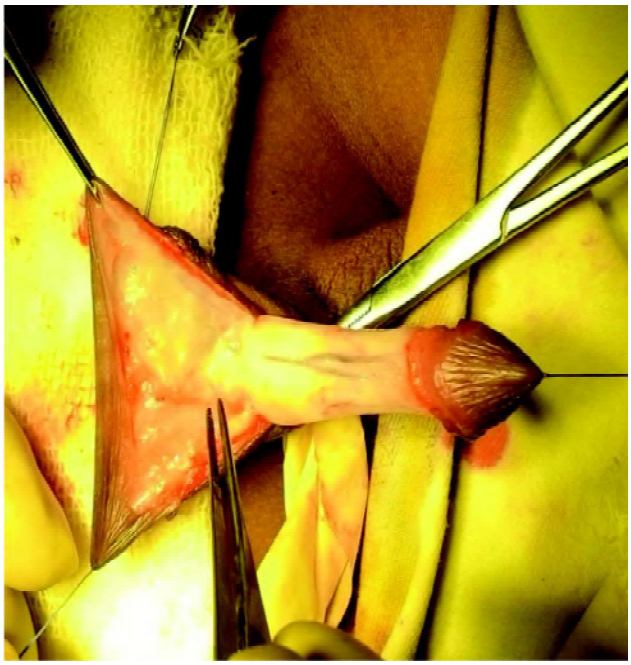

Fig- 1B: *Degloving of penis after circumferential incision around glans.*

Fig- 1C: *Testing for chordee*

Fig- 1D: Outline of preputial flap

Fig- 1E: *Dissection of prepucial flap*

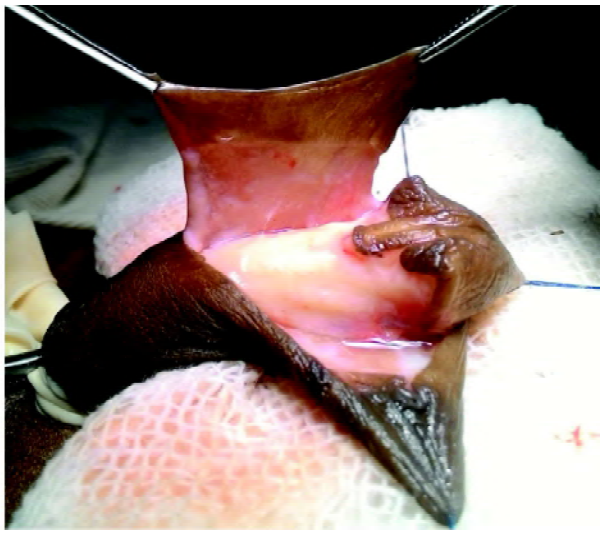

Fig- 1F: *Mobilization of prepucial flap*

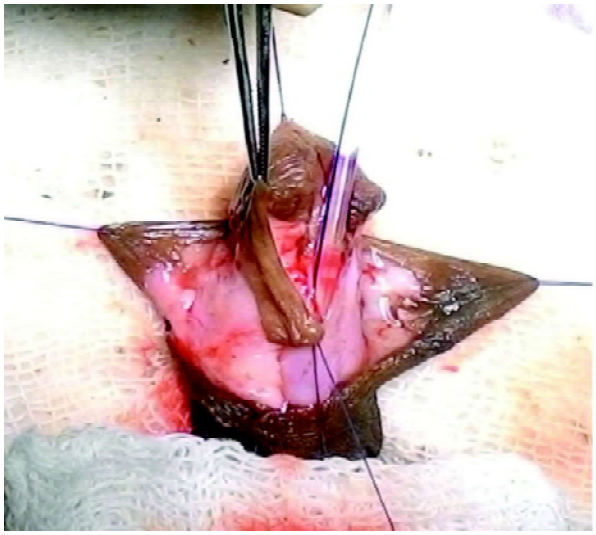

Fig- 1G: *Flap is being fixed to urethral plate.*

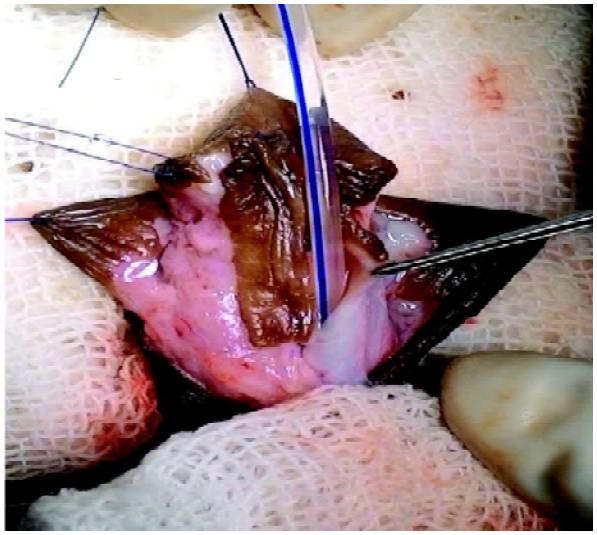

Fig- 1H: *Flap has been fixed to one side of urethral plate.*

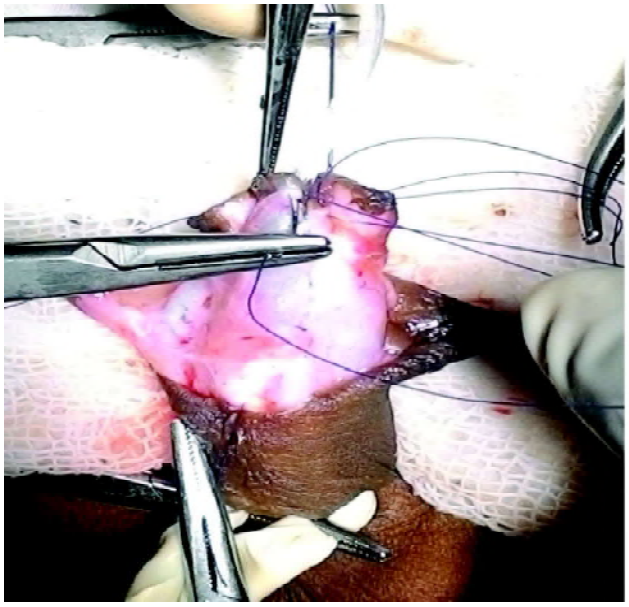

Fig- 1I: *Flap is being fixed to other side of urethral plate.*

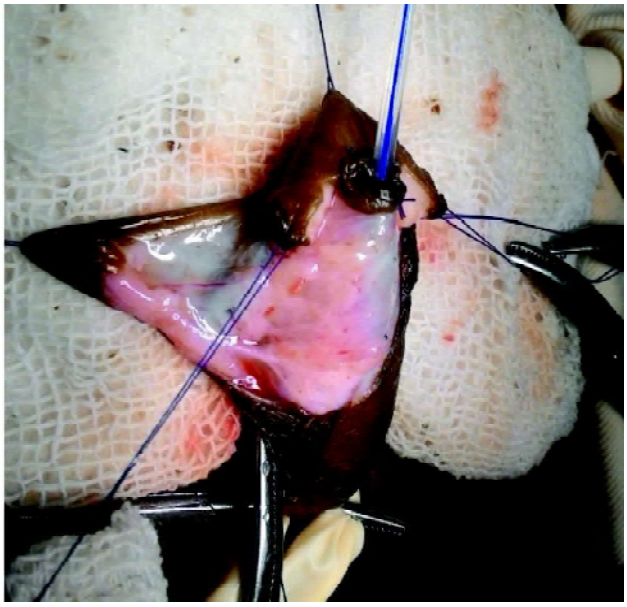

Fig- 1J: *Urethroplasty has been completed.*

Fig- 1K: *After glansplasty and skin closure*

Fig- 1L: *After dressing.*

Postoperative care and follow up:

In the postoperative ward patients were observed for adequate pain control, hemorrhage and urinary retention. All patients were followed up daily till discharge for fever, bleeding, stent blockage, control of pain and other complications. Dressing was checked on 5th POD. Details of healing pattern and other findings like wound disruption was noted. Wound disruption was defined as partial or full thickness skin necrosis or complete breakdown of skin suture line. Patients were discharged on the same day or following day if no complication occurred. Catheter was removed at 03 week after which voiding information about calibre of the urinary stream with direction and UCF was recorded. At the same time cosmetic appearance was noted. Cosmetic outcome was evaluated by shape of the meatus and penile torsion. A vertical slit like meatus was desirable and penile torsion was defined when the

penis appeared rotated on its axis (either the corporal bodies or just the glans). Cosmetic outcome was graded as good when there was a vertical slit like meatus and absence of any penile torsion, acceptable when either abnormal meatal shape or penile torsion was present and poor with presence of both abnormal meatal shape and penile torsion.

All patients were followed up at 6th and 12th week when meatal stenosis and urethrocutaneous fistula were evaluated. While the age specific BMI feeding tube was failed to be introduced through meatus or any tightness was felt, the meatus was labelled as stenosed. The meatus of a boy under 1 year should accept a feeding tube of 6 Fr, between 1 to 3 years below 8Fr, 4 to 10 years 8Fr and 11 to 12 years of age 10Fr [5].

Statistical analysis of data and ethical consideration:
The study was approved by Ethical Clearance Committee of Dhaka Medical College. Quantitative data were expressed as mean and standard deviation and compared by Student "t" test. Qualitative data were expressed as frequency and percentage, compared by Fisher's exact test. A probability value (p) of less than 0.05 was considered to indicate statistical significance. Statistical analyses of the results were obtained by using Microsoft Xcel, 2010 (Microsoft Corporation, Washington, U.S.) and web based computer software – Graph Pad Software, 2017 (Graph Pad Software, Inc, USA).

Result:

Out of the forty study subjects, one patient from Group-A and two from Group-B were lost from follow up. Mean age of the patients in Group-A and Group-B was 65.68 (±23.77) months and 72.22 (±24.33) months respectively (p>0.05). Meatal position of most of the patients in both groups was distal penile (63.16% Vs 83.33%, p>0.05). The difference between the groups in respect of age and meatal position was statistically not significant, thus reflecting similarity and allowing potentially meaningful comparisons between the groups. The mean operation time of Group-B (100.78 ±16.66 min) was higher than Group-A (89.98 ±19.80 min), although the difference was not statistically significant (p>0.05). Complications in terms of UCF and meatal stenosis were higher in Group-A than in Group-B, 26.31% vs. 16.67% (p>0.05) and 36.84% vs. 5.56% (p<0.05) respectively, but were lower for wound disruption, 0% vs. 11.11%. The meatal shape are vertical slit, rounded and stenosed in 57.90%, 5.26% and 36.84% cases of Group-A and in 22.22%, 72.22% and 5.56% cases of Group-B respectively, whereas penile torsion after hypospadias repair was observed in 89.11% cases in Group-B, but this condition was absent in Group-A. Cosmetic outcome was assessed upon the presence of these two parameters and it was graded as good in most of the cases of Group-A (61.11%), whereas it was poor in Group-B (78.77%). Acceptable cosmetic outcome was observed in 08 (38.89%) and 14 (77.78%) patients in Group-A and Group-B respectively.

Table-I

Preoperative patient data, operative duration and postoperative data

Mean (± SD), percentage of variable		Group		
		Group-A (TIPU) N=19	Group-B (TPOIF) N=18	P value
Age (mean ±SD) (months)		65.68 ± 23.77	72.22± 24.33	0.436
Site of EUM	Subcoronal	07 (36.84%)	03 (16.67%)	0.269
	Distal penile	12 (63.16%)	15 (83.33%)	
Operative time (mean ±SD) (min)		89.98 ±19.80	100.78 ±16.66	0.080
Complications	Meatal stenosis	07 (36.84%)	01 (5.56%)	0.042
	UCF	05 (26.31%)	03 (16.67%)	0.692
	Wound disruption	00 (0%)	02 (11.11%)	0.230
Shape of meatus	Vertical slit	11 (57.90%)	04 (22.22%)	0.044
	Rounded	01 (05.26%)	13 (72.22%)	0.0001
	Stenosed	07 (36.84%)	01 (05.56%)	0.0001
	Penile torsion	00	16 (89.11%)	
Cosmetic outcome.	Good	11 (61.11%)	02 (11.11%)	0.005
	Acceptable	08 (38.89%)	02 (11.11%)	0.062
	Poor	00 (0%)	14 (77.78%)	

Discussion:

Hypospadias has challenged generations of reconstructive surgeons to restore as much normal function and appearance of phallus as possible. The advantages of the TIP repair include in situ tubularization using native urethral plate, elimination of skin flaps and its applicability to many different variants of hypospadias, although the technique is not free from significant complication. Snodgrass himself found overall complication rate and urethrocutaneous fistula (UCF) rate 8% and 4% in an earlier series and later on 4% and 2% , respectively following distal hypospadias repair in his own city, Dallas, in Texas, USA [6, 7]. But the fact is not the same when the procedure was performed in other parts of the world. It showed extreme geographical variations as evidenced by an editorial comment of Hadidi "A standard question I encounter in hypospadias workshops is % I have read the TIP technique and I have carefully watched Dr. Snodgrass operating live. How come I have 25%–30% complication rate after TIP repair and Dr. Snodgrass reports only a 2% complication rate" [8]. The findings of Pfistermuller et al. also support the above statement, where they found in a meta-analysis that the UCF rate was 7.1% (range 3.6-13.4%), 7% (range 4.2-11.6%) and 9% (range 6.8-11.7%) in North America, Europe and the rest of the world respectively [9]. We tried to discover the performance of the procedure in our perspective and to compare it with another time-proven technique, TPOIF repair.

The fistula rate has historically been used as the gold standard tool for assessing success of hypospadias repair. In our series, we found UCF rate of 26.31% and 16.67% in Group-A and Group-B respectively. Although it can be as high as 45% described in the literature [10], it seems that fistula rate was quite high in our study. Recently a meta-analysis reported the same complication as 5.7% following TIP repair of distal penile hypospadias [9]. On the other hand, Ghali et al. reported no fistula formation in his 15 OIF repairs for anterior hypospadias cases [11]. In another study of 40 hypospadias cases, 20 patients underwent TPOIF technique and urethrocutaneous fistula occurred in only 1 case [12]. Singh et al. found UCF rate 5% with some modifications in original OIF repair in their consecutive 200 hypospadias patients [13]. So there is space of criticism in our series regarding fistula rate.

In OIF and TIP repairs, careful protection of the vasculature of the flap and prevention of overlapping suture lines, as we have tried in our cases, generate a waterproof closure with minimum risk of postoperative fistula. But some features of the urethral plate, especially a flat and narrow plate, potentially increase the risk of complications, i.e. meatal stenosis and UCF [14]. A prospective randomized study showed a significant relation of complication rate with urethral plate width ($p = 0.048$) on uvivariate analysis [15]. Aboutaleb concluded that patients with urethral plate <8 mm had a statistically significant higher fistula rate ($P = 0.004$) and meatal stenosis ($P = 0.01$) compared to the patients with urethral plate >8 mm [16]. These technical factors were not taken into account in our cases and might be the cause of relatively higher UCF and meatal stenosis rate following TIPU repair.

There are different modifications of TIPU procedure to reduce the complication rate like single or double layered dartos flap, dartos flap from prepucial, ventral or dorsal skin, spongioplasty, tunica vaginalis flap reinforcement with original TIPU repair [17]. Researchers also tried different modifications with OIF repair like longitudinal oriented flap, double layered flap, prepucial flap buttonholing to the ventrum and distal folding of flap. These modifications were done to optimize the different characters of the defects found in hypospadias, like – chordee, narrow/wide or shallow native urethral plate, small or conical glans, presence, absence or level of divergence of spongiosum etc. But in our study, we only used inner preputial skin/dartos flap which was buttonholed in case of TIPU and twisted laterally in case of TPOIF to the ventrum whatever the character of the defect was. Lacking of above mentioned technical optimization may be another cause of relatively higher fistula rate of our series. Moreover, surgeries in our series were performed by different surgeons having different level of learning curve.

Wound disruption is not an uncommon complication following hypospadias surgery especially after a flap repair. It can be technically difficult to close the skin over the bulk of pedicle of the flap, which may predispose to wound disruption due to loss of vascularity of the overlying skin. In our series we encountered 3 (16.67%) patients of OIF group who developed wound disruption; however no patients sustained this complication in TIPU group. The key to prevent wound disruption as well as overall complication is minimal tissue handling, proper mobilization of flap, tension-free reconstruction and appropriate case selection [18].

We observed relatively higher mean operative time in group-B than in group-A (100.78 vs. 89.98 min). TPOIF is a technically more demanding procedure that may be the cause of higher operative time in Group-B cases.

Metal stenosis is one of the complications seen with urethroplasty. Meatal problems can be the cause of unsatisfactory cosmetic appearance and can also cause fistula. In our series 07 (36.84%) patients of TIPU group developed meatal stenosis, while 01 (5.56%) patient of OIF group experienced such type of complication and the difference between the groups was statistically significant ($p < 0.05$). However, we encountered meatal problem in OIF group as patulous meatus; in case of our two cases we found it. It may be due to larger width of the flap.

Cosmetic appearance is one of the important primary outcomes of hypospadias surgery and usually assessed by the surgeon. This is thought to be prone to bias, inaccuracy, and subjectiveness [19]. Hadidi first proposed a scoring system to assess cosmetic and functional outcome and complications [20]. Later on some different other objective scoring systems have been described by different researchers like - Hypospadias objective scoring evaluation (HOSE) [21], Penile Perception Score (PPPS) [22], Hypospadias Objective Penile Evaluation Score (HOPE) [23]. These are yet to be validated as a measurement tool devised for cosmetic outcome assessment and evaluation is still subjective, i.e. surgeon dependent. We have assessed cosmetic outcome in our series as good, satisfactory and poor, keeping in mind the shape of the neomeatus, whether it was vertically slit or rounded and presence or absence of penile torsion. Our assessment was that in most of the OIF cases cosmetic outcome was poor (77.78% Vs 0% in TIPU, p value <0.05), while in TIPU cases it was good (61.11% Vs 11.11% in OIF, p value <0.05). In our OIF cases the increased frequency of rounded fish-mouth shaped neomeatus and penile torsion turned the outcome poor. In current study we achieved satisfactory cosmetic outcome in a significant proportion of TIPU cases (38.89% Vs 11.11% in OIF, p>0.05). It would also be good if meatal stenosis would not have occurred in 7 patients of Group-A. It could be attained by Snodgrass's suggestion while performing distal part of urethroplasty.

Functional status of the neourethra after hypospadias repair is now a great concern. Uroflowmetry is a validated tool to assess it. We did not try to assess this due to time constrain. Very recently, in an editorial comment, González and Ludwikowski warned about chance of development of obstructive flow pattern in about 25% of boys following TIPU procedure, that they observed in a meta analysis done by them [24]. Hadidi also described a new entity, the FUO (Functional Urethral Obstruction), defined by him as persistent obstructive voiding signs and symptoms in spite of apparently successful calibration or dilatation of urethra that occurs following TIP repair [25].

Conclusion: It seems that both techniques can be used for the correction of distal penile hypospadias with apparently similar outcomes. So when question arises regarding choice of urethroplasty procedure aiming a good functional and cosmetic phallus for distal penile hypospadias, TIPU is not the only answer. We like to cite the comment of Keating, who was the co-author of the original report describing incising the urethral plate first to hypospadias repair [26] in this regard —

"I choose to ask of the TIP what it can provide. The technique is an ideal choice for some distal hypospadias — no more, no less. It performs as well as any other contemporary urethroplasty when properly constructed and applied — no better, no worse. It is not the universal panacea for the anomaly, at least not in my hands. That is the best 'tip' I could ever offer" [27].

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