

Dorsal inlay inner preputial graft repair versus ventral-only preputial graft repair in primary distal penile hypospadias with narrow urethral plate

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Abstract

Background: Tubularized incised plate (TIP) is the most common technique used for distal hypospadias repair with good outcome but with a high rate of urethral stricture. Inner preputial-free graft can be used as an inlay graft in the incised area of the narrow urethral plate, also can be used as an onlay graft for urethroplasty in hypospadias repair to avoid this complication.

Patients and Methods: A comparative prospective randomized study was conducted on two groups of hypospadias patients with narrow urethral plate. Group A: dorsal inlay inner preputial graft repair was performed (grafted TIP [G-TIP]) and Group B: ventral onlay preputial graft repair was performed. The assessment of outcome and hypospadias objective scoring evaluation (HOSE) score was done at 2 weeks and 6 months.

Results: Group A included 55 patients for whom dorsal inlay inner preputial graft repair was performed (G-TIP), and Group B which was planned to be conducted on 55 patients using onlay preputial graft (onlay graft) but was terminated after 15 cases due to high failure rate (33%). Group A showed better success rate 96% and better HOSE score (score 16) at 2 months and 6 months 83.6% and 88.2% versus 26.7% and 33.3% in Group B. Postoperative complications showed a statistically significant difference; glans dehiscence (3.6% vs. 40%), wound infection (1.8% vs. 33.3%), and skin sloughing (3.6% vs. 26.7%) in Groups A and B, respectively.

Conclusion: G-TIP is a good technique for the management of distal hypospadias with narrow urethral plate with good success rate, cosmetic outcome, and with less complications compared to onlay graft.

Keywords: Hypospadias, inlay, onlay, preputial graft

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INTRODUCTION

Tubularized incised plate (TIP) is the most common technique used for distal hypospadias repair with good outcome, but the incidence of meatal stenosis and neourethra stricture is high particularly in cases with narrow urethral plate.^[1]

In 2000, Kolon and Gonzales used an inner preputial-free graft in the incised area of the narrow urethral plate in hypospadias repair to decrease the incidence of meatal stenosis and neourethral stricture.^[2]

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The inner preputial graft can be used as an onlay graft for narrow urethral plate in hypospadias repair and in comparison with preputial flap; there is less penile rotation and less bulk around the urethra with easy closure of skin and glans.^[3]

In this study, we compared the outcome between the dorsal inlay inner preputial graft urethroplasty (Group A) with ventral onlay preputial graft urethroplasty (Group B) in cases of distal penile hypospadias with narrow urethral plate as regard feasibility, efficacy, and complications.

PATIENTS AND METHODS

This is a comparative prospective randomized study was conducted on children with distal penile hypospadias with narrow urethral plate. The patients are distributed into two groups using simple randomization:

- Group A: Grafted TIP (G-TIP) for whom dorsal inlay inner preputial graft repair was performed
- Group B: Onlay graft for whom ventral onlay preputial graft repair was performed.

Recurrent cases, circumcised males, cases with wide urethral plate, and penile chordee >30 degree were excluded.

Operative techniques

Both procedures were performed under general anesthesia with caudal block; a circumferential subcoronal incision was done with degloving of penile skin to penoscrotal junction, artificial erection was done to assess chordee if present. A U-shaped incision around the urethral plate and urethral meatus was done, dissection of the glandular wings from the underlying corpora cavernous to the end of the urethral plate [Figure 1a].

In Group A: Incising the urethral plate using Stevens Tenotomy Scissor from hypospadias opening to the

end of the urethral plate distally, and deep to the tunica albuginea. Measuring the row area created by this incision, an equal part was harvested from the inner aspect of the prepuce which was prepared by removing excess fascia and fenestration by fine needle [Figure 1b]. Fixation of this graft in the row area by suturing it to the inner edges of the urethral plate incision on both sides and from the urethral opening to the end of the urethral plate [Figure 2a]. Urethral closure over a suitable urethral catheter with 6/0 polyglactin sutures .

In group B: The optimal graft width was determined by measuring the circumference of the native urethra subtracting the urethral plate width and adding 2 mm for suture lines. The graft length was measured from the ventral lip of the original urethral opening to the glans tip. The graft was prepared as described before then suturing it to the edges of the urethral plate over a suitable urethral catheter with 6/0 polyglactin sutures [Figure 2b].

For both groups: A second layer was done using dartos interposition flap, then glans wings and penile skin closure using 6/0 polyglactin sutures after circumcision. Finally, the patient was left with the urethral catheter and a compressed dressing [Figures 3 and 4]. The urethral catheter was removed on the 7th postoperative day.

Postoperative follow-up for early complications as regard wound infection, skin sloughing, fistula, glans dehiscence, and urethral stricture was recorded. Surgical outcome evaluation was done according to hypospadias objective scoring evaluation (HOSE) score at 2nd and 6th month postoperatively.

RESULTS

This study was conducted on patients with distal penile hypospadias with narrow urethral plate; candidates for

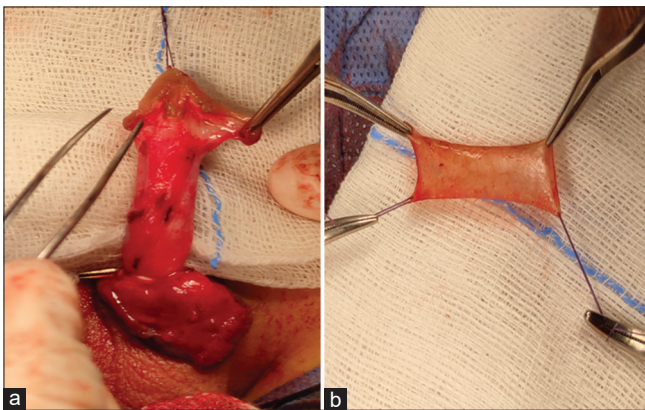


Figure 1: (a) Subcoronal degloving with paraurethral plate incision. (b) Harvesting inner preputial graft

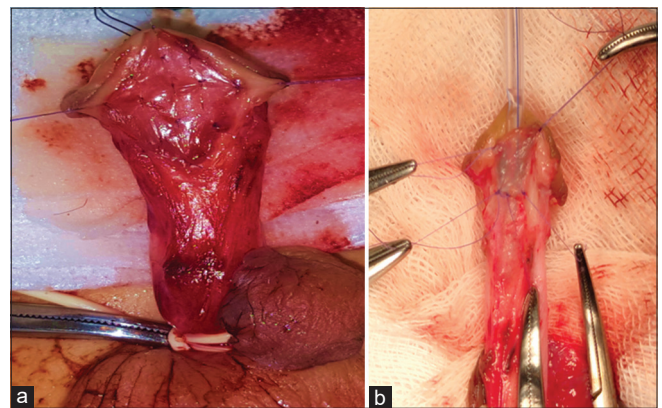


Figure 2: (a) Fixation of the inlay graft inside the urethral plate incision. (b) Fixation of the onlay graft with either side of urethral plate

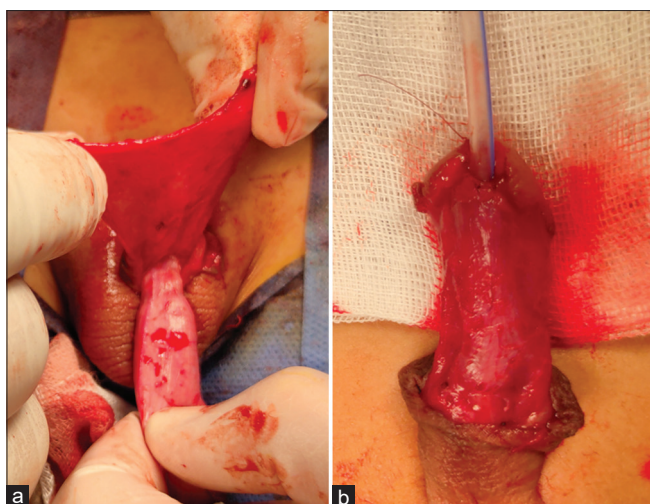


Figure 3: (a) Dorsal dartos flap dissection. (b) Dartos flap as a second layer over the neourethra

hypospadias repair from February 2021 to February 2022. Patients were divided into two groups, Group A included 55 patients for whom dorsal inlay inner preputial graft repair was performed (G-TIP), and Group B which was planned to be conducted on 55 patients using ventral onlay preputial graft (onlay graft), but this group was terminated after 15 cases due to high failure rate (33%) [Figure 5]. Data management and statistical analysis were done using SPSS version 28 (IBM, Armonk, New York, United States American).

Both groups are homogeneous as regard patient age, meatus caliber, location, transverse glans diameter, urethral plate length, urethral plate width, and presence of chordae as shown in Table 1.

Spongioplasty was done in 18 cases of Group A (32.7%) but not could not be done in Group B (0%) due to onlay graft. The operative time of both groups was nearly the same, the mean operative time for Group A was 119 min and for Group B was 117 min, and dorsal plication was needed in 4 cases in Group A (7.3%) and in 1 case in Group B (6.7%) with no statistically difference [Table 2].

HOSE score at 2 weeks postoperative: The meatal location was significantly different between the studies groups; distal glandular location (success rate) was higher in Group A (96.4%) than in Group B (60%), while the coronal location (failure rate) was higher in Group B (33.3%) than in Group A (3.6%). Regarding the meatal shape, the vertical slit was significantly high in Group A (87.3%) than in Group B (33.3%), whereas the total score of 16 was significantly higher in Group A (83.6%) than in Group B (26.7%) [Table 3].

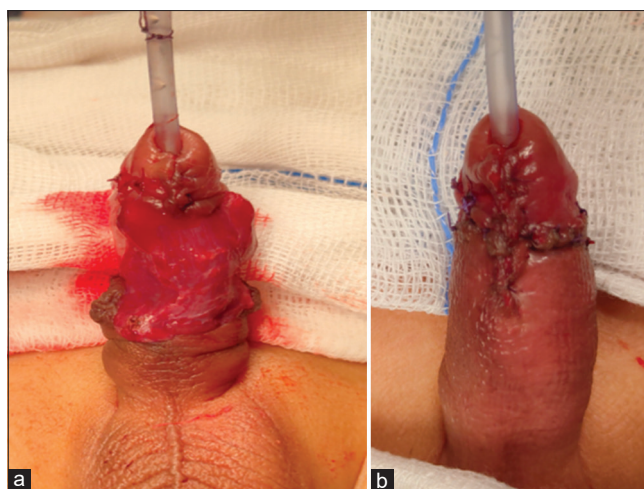


Figure 4: (a) Glans closure. (b) Penile skin closure

Table 1: General characteristics and preoperative assessment

	Grafted TIP (n=55), n (%)	Onlay graft (n=15), n (%)	P
Age (month)	22 (7-55)	30 (10-56)	0.171
Meatus caliber			
Stenotic	41 (74.5)	10 (66.7)	0.543
Wide	14 (25.5)	5 (33.3)	
TGD (mm)	11±1	12±2	0.102
Meatal location			
Distal penile	12 (21.8)	3 (20.0)	0.875
Subcoronal	35 (63.6)	9 (60.0)	
Coronal	8 (14.5)	3 (20.0)	
Urethral plate length (mm)	8±1	9±2	0.198
Urethral plate width (mm)	5±1	4±1	0.486
Chordae	4 (7.3)	1 (6.7)	1.0

Data were presented as mean±SD, median (minimum–maximum), or n (%). TGD: Transverse glans diameter, TIP: Tubularized incised plate, SD: Standard deviation

Table 2: Intraoperative characteristics of the study groups

	Grafted TIP (n=55), n (%)	Onlay graft (n=15), n (%)	P
Operative time (min)	119±5	117±5	0.119
Spongioplasty	18 (32.7)	0	0.01*
Dorsal plication	4 (7.3)	1 (6.7)	1.0

*Significant. Data were presented as mean±SD or n (%). TIP: Tubularized incised plate, SD: Standard deviation

The early postoperative complications (at 2 weeks) were significantly higher in Group B than in Group A as regards glans dehiscence (3.6% in Group A vs. 40% in Group B), wound infection (1.8% in Group A vs. 33.3% in Group B), and skin sloughing (3.6% in Group A vs. 26.7% in Group B) as shown in Table 4.

HOSE score at 6 months' postoperative: Four patients had lost follow-up in Group A and three patients had lost follow-up in Group B. The meatal location was significantly different between studied groups; distal glandular location (success rate) was higher in Group A (96.1%) than in Group B (58.3%), while the coronal location (failure rate)

was higher in Group B (33.3%) than in Group A (3.9%). Regarding meatal shape, the vertical slit was significantly higher in Group A (90.2%) than in Group B (33.3%), and the total score of 16 was significantly higher in Group A (88.2%) than in Group B (33.3%) as shown in Table 5.

DISCUSSION

The surgical repair of hypospadias includes orthoplasty, urethroplasty with meatoplasty, glanuloplasty, and skin covering of the phallus with or without scrotoplasty.^[4] TIP was first reported in 1994 by Snodgrass and became the surgical procedure of choice because it is simple and give good results and suitable for most distal and some proximal hypospadias cases.^[5] One of the complications of TIP procedure is urethral stricture due to inflammatory reaction and granulation tissue formation at the incision site, so in 2000, dorsal inlay urethroplasty has been described by Kolon and Gonzales using an inner preputial graft which was fixed in the row area created by urethral plate incision to avoid this complication.^[2]

A narrow urethral plate and shallow glans are the main indications of using grafts, measuring the ratio of the urethra before and after urethral plate incision helps to decide whether to graft or not; if the ratio is <0.5, proceed to put a graft because the row area will form a greater part of urethral circumference which is more liable for stricture.^[6]

Another method of grafting is using the inner prepuce as a free onlay graft over the narrow urethral plate without incision, so no row area or scar tissue formation. The advantage of using a graft over a flap is decreasing the incidence of penile torsion and providing less tissue bulk facilitating skin and glans closure.^[3]

In this study, we compared two procedures of hypospadias repair using grafts on cases of primary distal hypospadias divided into two groups. Group A included 55 patients in whom G-TIP repair was performed. Group B included 55 patients in whom ventral onlay preputial graft repair was planned to be performed. The Group B which was planned to be conducted on 55 patients had been terminated only by 15 patients due to high failure rate (40% glans dehiscence). Both groups were comparable as regards to the patient's age, meatal location, length, width, and depth of urethral plate and glans width.

There are different age groups among the study groups of G-TIP, for example, in Asanuma *et al.*, the mean age at surgery was 21 months (14 months–4.6 years).^[7] In Silay *et al.*, the

Table 3: Postoperative cosmetic assessment hypospadias objective scoring evaluation score at 2 weeks

	Grafted TIP (n=55), n (%)	Onlay graft (n=15), n (%)	P
Meatal location			
Penile shaft	0	1 (6.7)	<0.001*
Coronal	2 (3.6)	5 (33.3)	
Distal glanular	53 (96.4)	9 (60.0)	
Meatal shape			
Circular	7 (12.7)	10 (66.7)	<0.001*
Vertical slit	48 (87.3)	5 (33.3)	
Urinary stream			
Spray	4 (7.3)	3 (20.0)	0.145
Single stream	51 (92.7)	12 (80.0)	
Erection			
Straight	15 (100.0)	15 (100.0)	-
Fistula			
Single-subcoronal or more distal	3.8	11.1	0.521
None	2 (3.6)	1 (6.7)	
Total score			
Less than sixteen	53 (96.4)	14 (93.3)	
Sixteen	9 (16.4)	4 (26.7)	<0.001*

*Significant. Data were presented as n (%). TIP: Tubularized incised plate

Table 4: Early postoperative complications in the study groups

	Grafted TIP (n=55), n (%)	Onlay graft (n=15), n (%)	P
Glans dehiscence	2 (3.6)	6 (40.0)	<0.001*
Wound infection	1 (1.8)	5 (33.3)	0.001*
Skin sloughing	2 (3.6)	4 (26.7)	0.017*
Catheter slippage	2 (3.6)	1 (6.7)	0.521
Detrusor irritability	2 (3.6)	1 (6.7)	0.521

*Significant. Data were presented as n (%). TIP: Tubularized incised plate

Table 5: Postoperative cosmetic assessment (hypospadias objective scoring evaluation score) at 6 months

	Grafted TIP (n=51), n (%)	Onlay graft (n=12), n (%)	P
Meatal location			
Penile shaft	0	1 (8.3)	0.002*
Coronal	2 (3.9)	4 (33.3)	
Distal glanular	49 (96.1)	7 (58.3)	
Meatal shape			
Circular	5 (9.8)	8 (66.7)	<0.001*
Vertical slit	46 (90.2)	4 (33.3)	
Urinary stream			
Spray	2 (3.9)	1 (8.3)	0.476
Single stream	49 (96.1)	11 (91.7)	
Erection			
Straight	51 (100.0)	12 (100.0)	-
Fistula			
Single-subcoronal or more distal	1 (2.0)	0	1.0
None	50 (98.0)	12 (100.0)	
Total score			
Less than sixteen	6 (11.8)	8 (66.7)	<0.001*
Sixteen	45 (88.2)	4 (33.3)	

*Significant. Data we're presented as n (%). TIP: Tubularized incised plate

mean patient age was 7.26 years (1–17 years)^[8] and Mouravas *et al.* reported that it was 3.5 years (10 months–9.4 years).^[9]

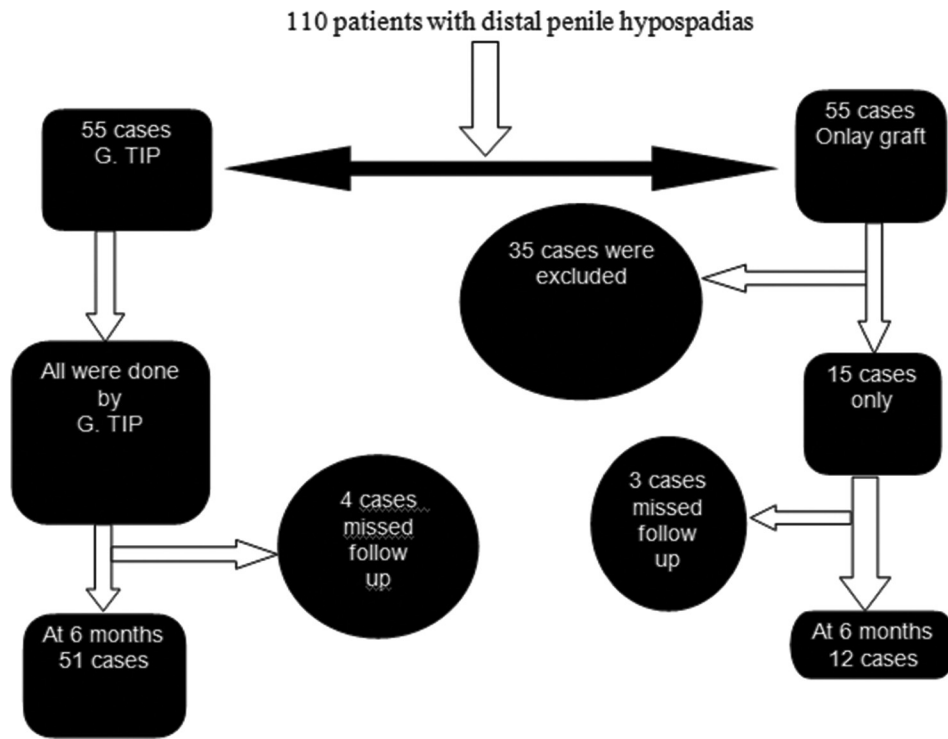


Figure 5: Flowchart

In Gupta *et al.*, the median age of repair was 15 months (11–72 months).^[10] In Shuzhu *et al.*, the median age was 1.2 years (6 months–3 years).^[5] In Helmy *et al.*, the mean age was 40 ± 15 months.^[11] In our study group, the median age of the patient was 22 months (10–56 months).

As regard G-TIP, the mean operative time in Asanuma *et al.* was 200 min (154–249 min),^[7] In Helmy *et al.*, was 106 ± 12 min,^[11] and in the present study, the mean operative time of the G-TIP was 119 ± 5 min.

As regard, success rate which was assessed in most of papers by the presence of the external meatus at the tip of the glans penis, Kolon and Gonzales performed G-TIP in 32 patients with success rate of 93.8%.^[2] Asanuma *et al.* reported that success rate was 96.4%.^[7] Silay *et al.* reported success rate in 102 patients with distal penile hypospadias was 90.2%.^[8] Mouravas *et al.* reported that the success rate in 24 patients with distal penile hypospadias was 91.7%.^[9] Gupta *et al.* performed G-TIP in 263 patients with primary hypospadias ranging from glandular to proximal types with success rate of 96%.^[10] Shuzhu *et al.* reported success rate of 92.5%.^[5] Helmy *et al.* reported success rate of G-TIP 93.3%.^[11] In our study, our success rate of Group A (G-TIP) was 96.1%.

Kolon and Gonzales,^[2] Asanuma *et al.*,^[7] Silay *et al.*,^[8] Mouravas *et al.*,^[9] and Helmy *et al.*^[11] reported no cases of

meatal stenosis in their studies, but Gupta *et al.* reported that only seven cases of 160 (4.4%) repaired by G-TIP developed meatal stenosis.^[11] In our study, meatal stenosis occurred only in two cases in G-TIP group (one of them responded to frequent dilatation and the other underwent meatotomy).

Kolon and Gonzales reported no cases of urethrocutaneous fistula,^[2] Asanuma *et al.* reported that urethrocutaneous fistula developed in one patient with proximal hypospadias (3.6%) who required surgical repair after 6 months.^[7] While detected in ten patients (9.8%) in Silay *et al.*^[8] and in one patient (4.16%) in Mouravas *et al.*,^[9] and the incidence of fistula was 3.7% in Gupta *et al.*,^[10] and 3.1% in Shuzhu *et al.*^[5] We encountered in G-TIP Group 2 cases of urethrocutaneous fistula (3.6%); one associated with distal meatal stenosis that responded to frequent meatal dilatation and closed spontaneously after 1 month, the other one required surgical repair after 6 months.

Kolon and Gonzales reported two cases (6.2%) had glans dehiscence and ventral skin breakdown,^[2] Mouravas *et al.* reported one case of G-TIP (4.16%) developed glans dehiscence,^[9] Helmy *et al.* reported two cases (6.7%) developed partial glans dehiscence,^[11] and in the present study, 2 cases developed glans dehiscence in G-TIP group with no statistically significant difference between previous studies. Hence, G-TIP is a good option for distal penile hypospadias.

Gangopadhyay *et al.* studied 33 patients with distal and mid-shaft hypospadias repaired by full-thickness free onlay preputial graft urethroplasty with success rate of 84.8%.^[12] Cambareri *et al.* retrospectively studied 62 cases of primary hypospadias (one case was distal, 19 cases were midshaft, and 42 cases were proximal) to evaluate the long-term outcomes of hypospadias repair using onlay preputial graft. They reported that success rate was 64.5%.^[3] In the present study, the overall success rate was 58.3% (7 cases out of 15), for this reason, and from ethical point of view, we terminated this arm of the study at 15 cases only because of high failure rate.

In Cambareri *et al.*, the mean and median age at the time of surgery was 15.2 (16.4) and 11 months, respectively.^[3] In Gangopadhyay *et al.*, the mean patient age at surgery was (5.98 ± 2.29) years.^[12] In our study, the median age of the patient was 30 months ranging from 10 to 56 months.

Gangopadhyay *et al.* reported that one case (3.3%) of the group repaired by onlay graft developed meatal stenosis,^[12] whereas Cambareri *et al.* reported that three cases (4.8%) developed meatal stenosis and three cases (4.8%) developed urethral stricture.^[3] While meatal stenosis was reported in one case (8.3%) in our study (1 case of successful and 7 cases means 14%).

Gangopadhyay *et al.* reported that four cases (12%) of the group repaired by onlay graft developed urethrocutaneous fistulae,^[12] whereas Cambareri *et al.* reported that seven cases (no cases of distal, but seven cases of 19 mid-shaft hypospadias) (36.8%) developed urethrocutaneous fistula,^[3] whereas reported in one case (6.7%) in our study group repaired by onlay graft (14% of successful cases) (this case did not follow-up).

In our study, six cases (40%) repaired by onlay graft was complicated by glans dehiscence and the urethral meatus reverted to its native location. We noticed that onlay graft repair was associated with high incidence of infection that occurred in 5 of 15 patients (33%) and skin sloughing that occurred in four patients (26.7%) despite advice of proper postoperative antibiotics in both groups. We think that this may be due to failure of graft take followed by devitalization, infection, and necrosis of the graft.

In our study, we found that the percentage of cosmetic outcomes assessed by HOSE score was 88.2% success rate in G-TIP group (45 cases of total 51 cases at 6th month follow-up were scored 16 in HOSE score) compared with 33.3% success rate in the onlay graft group (4 cases

of total 12 cases at 6th month follow-up were scored 16 in HOSE score). We found that the postoperative complications in the onlay graft group demonstrated significantly higher glans dehiscence (40%) versus (3.6%) in G-TIP group and wound infection (33.3%) versus (1.8%) in G-TIP group. Skin sloughing (26.7%) versus (3.6%) in G-TIP group. Hence, early failure and high complication rate of the onlay graft group made us to abort this technique at this number of cases. At 6-month follow-up, we found that meatal location was significantly difference between the studied groups; distal glanular location was higher in the G-TIP group (96.1%) than in onlay graft (58.3%). Regarding meatal shape, the vertical slit was significantly higher in the G-TIP group (90.2%) than in the onlay graft group (33.3%). In addition, the total score of 16 was significantly higher in the G-TIP group (88.2%) than in the onlay graft (33.3%).

CONCLUSION

G-TIP is a good technique used for distal hypospadias repair, especially with narrow urethral plate with good success rate, cosmetic outcome, and with less complications compared to onlay graft.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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