Original Article

Modified versus Classical Tubularised Incised Plate Urethroplasty in Hypospadias: A Comparative Study

Khaled S. Abdullateef, Mohamed Elbarbary, Sherif Kaddah, Belal Mosaad Elezaby, Ahmed S. Ragab[1], Wesam Mohamed

Department of Pediatric Surgery, Cairo University Children Specialized Hospital, Cairo, [1]Department of Pediatric Surgery, Port Said University, Port Fuad, Egypt

Abstract

Background: Hypospadias is a wide-world congenital malformation that accounts for 1 of 300 live male births. Many procedures were considered for its management. As the tubularised incised plate (TIP) urethroplasty, the most prevalent technique, caused many complications, several modifications were applied to the original operation to improve the outcomes and alleviate complications. The aim of this study was to compare the outcome of the ordinary TIP urethroplasty with the technique modified without dissection of the glans penis. **Materials and Methods:** A total of 82 patients with a mean age of 18.8 (±14.8) months, were randomly assigned to undergo TIP with either complete glans wings mobilisation (Group A, $n = 42$ patients) or without glans dissection (Group B, $n = 40$ patients). To evaluate the effect of modified TIP urethroplasty without glanular dissection for treatment of distal hypospadias in contrast to classical TIP repair. **Results:** Both techniques showed similar outcomes regarding functional repair, with good to excellent results between 88% and 90% after 6 months of follow-up. Most confronted post-operative complications were wound infection, oedema, urethrocutaneous fistulas and meatal stenosis. Less frequently haematoma, post-operative bleeding and glans dehiscence were encountered. The differences in complication rates between the two studied groups were statistically insignificant except for oedema ($P = 0.04$), and need for urethral dilatation ($P = 0.002$) that were more prevalent among patients who were treated with classic TIP repair with complete glans wings mobilisation. **Conclusion:** From our point of view, it seems that TIP without glanular dissection technique does not outweigh TIP with complete glans wings mobilisation regarding functional outcomes and post-operative complications.

Keywords: Glans dissection, hypospadias, tubularised incised plate

Introduction

Hypospadias is a congenital anomaly of the anterior male urethra with a proximal position of the urethral opening instead of its normal glandular site. It was considered the second-most frequent birth abnormality in males.[1] This abnormal position is due to anomalous tubularisation of the urethral plate which introduced the concept of the tubularised incised plate (TIP) urethroplasty, that over time, became the most prevalent and ideal repair technique, especially in distal hypospadias.[2]

The principle technique of TIP urethroplasty has relied on tubularisation of the urethral plate with no cutaneous flap following dorsal midline relaxing incision and subsequently coating the new urethra by glans wings to reconstruct normal anatomy and function of the penis. TIP was supposed to be easy, tolerable and appropriate for distal and to a lesser extent proximal hypospadias.[3]

Although TIP technique conserved the natural urethral plate for tubularisation, eliminated the use of skin flaps and was applied in many hypospadias types,[4] some authors reported drawbacks as urethrocutaneous fistulas (UCF), urethral strictures, meatal stenosis, wound disruption, cosmetic disfigurement and functional urethral obstruction (FUO).[4,5]

UCF and meatal stenosis rates with TIP were reported to be variable and were established to be statistically higher with a urethral plate <8 mm. Despite its rarity with TIP, wound disruption may result from challenging closure of the skin over a flap and the consequent vascular interruption. Penile torsion was added to TIP subjective outcome and mostly related

Address for correspondence: Dr. Khaled S. Abdullateef, 9A, Cairo University Street, Giza, Egypt.
E-mail: khaled.salah@kasralainy.edu.eg

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to surgeon's experience.[4] FUO was described as continuous obstructive voiding symptoms even though the apparent suitable urethral calibration after TIP procedure.[6] Several articles published many relating modifications to the novel procedure and their influence on the efficacy and complications of the technique.[2]

Herein, we will compare our modified technique depending on minimising glans dissection with the classic TIP (cTIP) repair to assess its impact on TIP complications. The main purpose of our technique is to minimise tissue handling, subsequently, reduce the risk of disruption of vascularity, fistula, meatal abnormalities, infections, haematomas and cosmetic and functional concerns.

Materials and Methods

Study design

This comparative study included 82 patients, with distal-to-mid penile hypospadias, who were collected randomly and categorised into two groups: Group A comprising 42 patients managed through cTIP and Group B comprising 40 patients managed through modified TIP without glans dissection (mTIP). They were gathered in the period between December 2020 and June 2021. The study was approved by the research ethics board.

All patients' parents had provided informed written consent.

Study population

Patients aged 6 months–12 years were included in our study. They had hypospadiac meatus at glanular, coronal, subcoronal and mid penile sites. All patients had a straight penis with chordee <30°. Simultaneously, we excluded children with recurrent or proximal hypospadias. Patients who had considerable penile ventral curvature (chordee >30) and other associated anomalies were eliminated from our study sample.

Study interventions

All patients were subjected to pre-operative evaluation through detailed history taking, general examination to exclude related anomalies, local examination for testicles, penis, glans penis and perineum and finally routine laboratory investigations.

All patients received general anaesthesia with caudal blockage. They were either placed near the table edge or its midline.

Regarding group (A) 'cTIP', the following steps were done: (1) 6/0 vicryl stay suture was taken from the glans penis tip [Figure 1a], (2) Penile degloving up to spongiosal tissue after circumferential incision 1–2 mm proximal to the abnormal meatus, (3) To rule out chordee, artificial erection was performed and mild chordee was handled by degloving the shaft and cutting off attachments of skin and dartos layer, (4) Longitudinal parallel incisions were performed on the identified urethral plate edges with deep lateral dissection of the glanular wings [Figure 1b], (5) After gentle elevation and lateral retraction of the urethral plate, incision is made in midline from meatus till the glans penis tip entirely, to expose the underlying corporeal bodies, (6) Tubularisation of the urethral plate over a urinary catheter (6F), using a needle (11–13 mm) with a rounded or spatulated tip for continuous passage of 7/0 or 6/0 vicryl and close the plate over the catheter to preserve the urinary flow for 5–7 days, (7) Spongioplasty is done followed by dissection of vascularised dartos flap from the dorsal preputial and either rotating it laterally or as a button hole centrally to shield the new urethra, finally approximation of the glandular wings at the midline with 6/0 vicryl subcuticular sutures with skin closure [Figure 1c].

Concerning the second group (B) 'mTIP' (modified TIP without dissection of glans penis): (1) 6/0 vicryl traction suture for the glans which must be central, horizontal and just back to the new meatus site, (2) Circumferential subcoronal incision was done [Figure 2a], (3) Penile degloving up to spongiosal tissue after circumferential incision 1–2 mm proximal to the abnormal meatus [Figure 2b], (4) Mild chordee was corrected by degloving the shaft and cutting off attachments of skin and dartos layer, (5) To expose the edges of the urethral plate, depithelization of a triangle of glanular skin near the urethral plate to the ventral end of the future meatus [Figure 2c], (6) Incision is made in midline from meatus till the glans penis tip entirely, to expose the underlying corporeal bodies, (7) The distal margin of the urethra is evaluated by estimating the collocation points around a 6-Fr catheter, later, urethroplasty followed by spongioplasty was stitched using a vicryl 6/0 with a 13-mm needle [Figure 2d], (8) To end the operation, subcuticular glanuloplasty using vicryl 6/0 was done [Figure 2e] without usage of any dartos flap.

Post-operative care was performed for all patients in the form of dressing, urinary catheter, analgesia and antibiotics administration. The dressing was removed after 2 days postoperatively while the urinary catheter was maintained for only 7 days. Follow-up visits were scheduled at 1, 3 and 6 months to rule out wound infection, fistula, meatal stenosis and urinary flow.

Statistical analysis

Data analysis was done by utilising the Statistical Package for the Social Sciences (SPSS) version 24 for windows. Normality of data was tested using Kolmogorov–Smirnov test.

Results

Eighty-two patients were studied. In Group A (n = 42), patients underwent complete glans wings mobilisation urethroplasty (cTIP), whereas in Group B (n = 40), patients underwent modified TIP without glans dissection urethroplasty (mTIP). Both groups were age matched with a mean age of 18.8 ± 14.8 months. Table 1 shows the sociodemographic features of the studied cases.

During following up of both groups, some post-operative complications were encountered as shown in Table 2. After cTIP, 11 (26.8%) patients developed urethrocutaneous fistula, nine of them needed another operation after



Figure 1: (a) 6-0 Vicryl traction suture is placed through glans, (b) Midline relaxing incision of the urethral plate. (a) Transverse section of the mid glans level demonstrated a good volume of connective tissue underlying the flat urethral plate and so the incision should be deep enough to reach near the surface of the corpora cavernosa (b) A plate with a natural groove extending near the corpora which need a more superficial relaxing incision. (c) Show urethral catheterisation, meatoplasty, glanuloplasty and circumcision

6 months for correction. While 10 (25%) patients developed urethrocutaneous fistula in the mTIP group, four of them had spontaneous closure, whereas the other six required operative correction. Fourteen patients had metal stenosis following cTIP, i.e. 33.3% among those nine patients needed urethral dilatation under sedation. On the other hand, metal stenosis occurred in 6 (15%) patients after mTIP who were treated conservatively. Wound infection incidence was the highest among both studied groups; 24 (57%) and 18 (45%) patients in cTIP and mTIP, respectively, developed post-operative wound infection. Sixteen patients (38%) had oedema after cTIP, in contrast with 7 (17%) patients in the mTIP group. Nineteen patients (45%) had dysuria after cTIP and 15 (37.5%) patients experienced the same complication after mTIP.

Other less frequent complications such as post-operative haematoma occurred in three patients in each of the cTIP and mTIP (7.1% and 7.5%, respectively). One patient (2.4%) had bleeding after cTIP repair. On the other hand, 1 (2.5%) patient belonging to the mTIP group had glans dehiscence,

Table 1: Sociodemographic characteristics of the included patients (*n*=82 patients)

Variable	*n* (%)
Group, *n* (%)	
Classic TIP	42 (51.2)
Modified TIP	40 (48.8)
Age (months)	18.8±14.8*
Operative time (h)	1.34±0.22*
Type of hypospadias, *n* (%)	
Coronal	21 (25.6)
Sub coronal	43 (52.4)
Mid penile	18 (22)
Catheter type 6 F	82 (100)
Catheter duration (days)	5.9±1.6*
Dressing duration (days)	2.87±0.68*

*Mean±SD. TIP: Tubularized incised plate, SD: Standard deviation

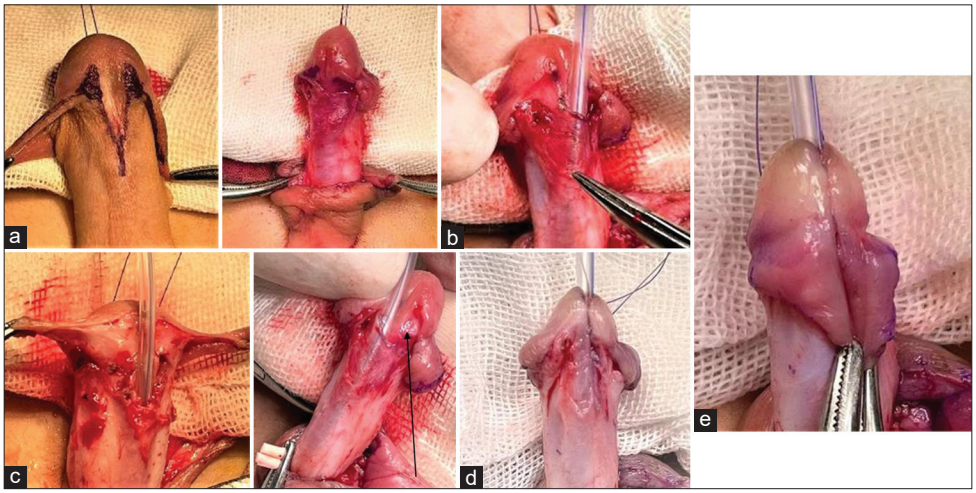


Figure 2: (a) Circumferential subcoronal incision and site of triangular glans de-epithelialization. (b) Degloving of the penis. (c) De-epithelization of the triangular area of glandular skin. (d) Determining the point of apposition around an 6-Fr catheter. (e) Glansplasty and Firlit collars

Table 2: Post-operative complications among both groups (*n*=82)

Variable	Group (A) classic TIP (*n*=42), *n* (%)	Group (B) modified TIP (*n*=40), *n* (%)	*P*
Hematoma	3 (7.1)	3 (7.5)	1.00 F
Edema	16 (38.1)	7 (17.5)	0.04 C
Bleeding	1 (2.4)	0	1.00 F
Wound infection	24 (57.1)	18 (45)	0.377 C
Glans dehiscence	0	1 (2.5)	0.488 F
Meatal stenosis	14 (33.3)	6 (15)	0.053 C
Urethral dilatation	9 (21.4)	0	0.002 F
UCF	11 (26.8)	10 (25)	1.00 C
Dysuria	19 (45.2)	15 (37.5)	0.51 C
Stream 1 week			
Weak	2 (4.8)	2 (5)	0.813 F
Good	36 (85.7)	32 (80)	
Excellent	4 (9.5)	6 (15)	
Stream 1 month			
Weak	6 (14.3)	4 (10)	0.818 C
Good	22 (52.4)	24 (60)	
Excellent	14 (33.3)	12 (30)	
Stream 6 months			
Weak	5 (11.9)	4 (10)	0.95 F
Good	14 (33.3)	15 (37.5)	
Excellent	23 (54.8)	21 (52.5)	
Recurrence	4 (9.5)	2 (5)	0.676 F

TIP: Tubularized incised plate, C: Chi-square test, F: Fisher's exact test, UCF: Urethrocutaneous fistula

whereas none of the cTIP patients had this complication post-operatively. Moreover, 4 (9.5%) patients had recurrence after cTIP, whereas 2 (5%) patients had recurrence following mTIP urethroplasty.

Regarding the functional outcomes at the end of a 6-month follow-up period, achieving good-to-excellent urine stream after cTIP correction was obtained in 14 and 23 (33.3 and 54.7%) patients, respectively, versus 15 and 21 (37.5 and 52.5%) patients, respectively, after mTIP correction. Unfortunately, 5 (11.9%) patients and 4 (10%) patients had weak urine stream following cTIP and mTIP, respectively.

Mention worthy, despite the differences between both studied groups, these differences were statistically insignificant. Except for post-operative oedema and the need for urethral dilatation for urethral stenosis correction following cTIP ($P = 0.04$ and $P = 0.002$), respectively.

Discussion

Surgical correction of hypospadias is challenging in the terms of restoring the function and the normal appearance of the penis, also the first attempt of surgery is the best chance to get the best outcome.[7]

TIP urethroplasty gained worldwide popularity since its publication in 1994, it utilises a midline relaxing incision in the urethral plate that widens the plate, ensuring the creation of a vertically oriented slit-like neomeatus and making tubularisation of shallow and narrow plates feasible.[8] Although TIP urethroplasty is a successful and reliable method for treating hypospadias, yet it has some significant complications.[7]

Globally, post-operative fistula rate has been used to assess the success of hypospadias repair,[7] in our study, it came into third place among overall complications. The rates were 26.8% versus 25% in cTIP and mTIP, respectively. Although the differences between both techniques in our study were insignificant ($P = 1$), these rates are considerably high compared to other published reports, such as Snodgrass *et al*. who reported 2% fistula rates after TIP.[8] Singh reported as low as 5% fistula rate with some modification of TIP.[9] On the other hand, Hadidi also had high rates of urethrocutaneous fistula following TIP urethroplasty, he stated complications rates of 25%–30% after TIP repair although he claimed that he strictly followed Snodgrass steps.[10] Another author with similarly high rates for fistula was Hasan *et al*. who reported a rate of 26.31% after TIP.[7] Snodgrass *et al*. stresses on the importance of wide glanular wings dissection in cTIP repair performed at 3 and 9 o'clock positions, particularly in cases with small glans size to allow a tension-free glansplasty. In mTIP, we never mobilise the glans wings and this has the advantage of less trauma and rough handling of the glanular tissue with consequent less intraoperative bleeding and post-operative oedema, moreover a tension-free glanuloplasty is feasible.

In the current study, post-operative meatal stenosis was more prevalent following cTIP compared to the other groups with rates of 33.3% and 15%, respectively. It was obvious that the nine cases with stenosis who failed to be treated conservatively and needed dilations under sedation were exclusively belonging

to the cTIP repair group, whereas those in the mTIP group were treated conservatively. In a recently published study that compared the outcomes of TIP and transverse preputial onlay island flap for distal hypospadias repair, they reported that 36.84% of the patients who underwent TIP had meatal stenosis compared to the 5.56% with the other techniques.[7] Sarhan *et al*. reported 14 (2.8%) cases of meatal stenosis out of 500 studied patients who underwent TIP urethroplasty.[11] Baccala *et al*. also reported lower rates of meatal stenosis (3 out of 101 cases) following modified TIP in comparison to ours.[12]

Our high rates of fistula and meatal stenosis carry some critics to our study and could be attributed to patient's characteristics such as flat and narrow urethral plates, these criteria were suggested by Sarhan *et al*. and Aboutaleb, respectively, to be accompanied by higher complications in the terms of fistulas and meatal stenosis following TIP repair.[12-14] These aforementioned factors might be overlooked in our series.

Concerning other acute complications, wound infection was the most prevalent in our study, it occurred in 57% and 45% of the cases in cTIP and mTIP groups, respectively, it was a mild infection and did not result in serious complications. This could be attributed to environmental factors such as humidity, high temperature and also the nearness of the wound to a potentially contaminated area.[15] Post-operative oedema had a significantly higher rate after cTIP in comparison with mTIP ($P = 0.04$). A literature review by Bhat and Mandal[16] mentioned that oedema after TIP urethroplasty has an incidence of 11.11% and that it usually worsened after removal of the dressing pressure between the 2nd and the 5th day of surgery which was the situation in the current study. One patient had glans dehiscence following mTIP repair, such complication was not encountered in the other studied groups. This complication is very rare and may happen secondary to sepsis, oedema, haematoma, erections, reduced blood supply, the tension on sutures and some of these were encountered in our cases.[17] Moreover, the latter complication was reported more commonly with TIP compared to Mathieu repair.[18] Although we do not mobilise the glans, glanuloplasty can be easily carried out with no impact on glans dehiscence rate.

Although there were some differences between both studied groups concerning the post-operative haematoma, post-operative bleeding, recurrence and dysuria, these all were of no statistical significance. Haematoma could be of concern if significant as it may lead to infection, devascularisation of the flap and subsequently surgical failure,[19] fortunately, none of the patients had such serious complications. Moreover, the only case that experienced post-operative bleeding after cTIP repair was controlled by compression.

Besides achieving the best cosmetically acceptable appearance, the functional outcomes of hypospadias surgery are the cardinal goals that must be evaluated post-operatively.[8] For this, we followed up our cases for 6 months after hypospadias repair for detection of flow obstruction.

At the end of the 6-month follow-up visits, the urinary stream of the studied cases in both groups was good to excellent in about 88%–90% in the cTIP and the mTIP group, respectively ($P = 0.95$). These results were consistent with Gürdal *et al*. reported that 95% of 70 studied cases who underwent TIP urethroplasty showed normal urine flow.[20] Kaya reported similar results with a 78.5% normal urinary flow rate following TIP.[21] Furthermore, Andersson followed 126 cases for years after TIP repair in their childhood and found that there is a great chance for normalisation of urinary flow at puberty, therefore unless obstructive symptoms showed up, they should be followed conservatively.[22] On the other hand, Scarpa reported obstructed uroflowmetry in 42% of his cases after cTIP urethroplasty.[23] Holmdahl also reported that 49% of his studied cases showed abnormal uroflowmetry results 2 months after TIP urethroplasty.[24] Many causes may attribute to such contradictory results, as that the uroflowmetry might not reflect the actual urethral function in the presence of abnormal bladder functions and whether the abnormal flow is due to the original malformation or a result of the corrective surgery.[25] And finally, the degree of obstruction is relative to the length of the reconstructed urethra.[26]

Conclusion

In this series, the overall functional results, as well as the post-operative complications rate, were similar. Apart from post-operative oedema and the need for urethral dilatation; being more common in the patients treated with TIP repair with complete glans wings mobilisation. It also seemed that modified TIP technique without glanular dissection did not outweigh TIP with complete glans wings mobilisation repair. Yet, more comprehensive studies are necessary to validate the presented outcomes.

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Conflicts of interest

There are no conflicts of interest.

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