


Comparison of tubularized incised plate urethroplasty combined with a meatus-based ventral dartos flap or dorsal dartos flap in hypospadias

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Accepted: 5 January 2016 / Published online: 18 January 2016
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Abstract

Purpose Tubularized incised plate urethroplasty (TIPU) is the preferred surgical option for distal and mid-shaft hypospadias repair. Neourethra dartos flap coverage is routinely used as a protective layer with good results. We modified meatus-based ventral dartos flap (MBVDF) to TIPU by dissecting the proximal mid-ventral dartos attached urethra and leaving the subcutaneous fascia connecting the meatus, and retrospectively compared the outcomes of using MBVDF with single dorsal dartos flap (DDF) on the complication rates of TIPU.

Methods We present 2 surgeons' experiences with 356 patients with distal and mid-shaft hypospadias between January 2010 and December 2014. Patients were divided into two groups. Group DDF included 185 patients (mean age 29 months) underwent TIPU with DDF rotated laterally covering the suture lines of the neourethra. Group MBVDF included 171 patients (mean age 26 months) underwent TIPU with MBVDF covering the suture lines of the neourethra. Statistical analysis of patient basic information and complications was performed by two

independent sample *t* test and Chi square test or Fisher's exact test.

Results There were no statistical differences in age, type of hypospadias, and follow-up time between the two groups. The mean operative time in the group MBVDF (68.93 ± 8.32 min) was significantly shorter than in the group DDF (73.60 ± 9.06 min). Ventral skin necrosis (2.7 %) and penile rotation (3.8 %) in group DDF was significantly higher than group MBVDF which did not occur. The differences in other complication rates including fistula rate (2.7 vs 2.9 %) between the groups were not statistically significant.

Conclusion DDF and MBVDF with TIPU are similarly effective methods for decreasing fistula in hypospadias repair. MBVDF with TIPU may be an easier method and can avoid ventral skin necrosis and penile rotation.

Keywords Hypospadias · Tubularized incised plate · Urethroplasty · Dartos flap

Introduction

Tubularized incised plate urethroplasty (TIPU) is presently the preferred surgical option for distal and mid-shaft hypospadias repair [1]. Neourethra dartos flap coverage is routinely used as a protective layer for better results in terms of postoperative complications, especially with regard to fistula formation. Although many different types of dartos flaps have been described [1–5], two techniques have obtained wide acceptance for use in distal and mid-shaft hypospadias repair: the dorsal and the ventral dartos flap. There is still some debate about which covering flap is the most suitable technique in terms of complication rates in TIPU [6].

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The single dorsal dartos flap (DDF) has been most widely used in hypospadias repair and is considered a standard method because of its good results. However, DDF separation is difficult and may damage the blood vessels of the skin, increasing the surgical difficulty and complication rates. The ventral dartos flap has also been widely used because it is easy to harvest and well vascularized in hypospadias repair [7–9]. In this series, we made a minimal technical modification of the meatus-based ventral dartos flap (MBVDF) for use with TIPU to minimize complications. We hypothesized that the modified MBVDF would be superior to DDF for TIPU for distal and mid-shaft hypospadias repair in terms of complication rates. Therefore, the objective of this study was to retrospectively compare using MBVDF with DDF on the complication rates of TIPU in distal and mid-shaft hypospadias.

Materials and methods

Patients

Between January 2010 and December 2014, 356 male patients (12 months to 6 years) underwent TIPU for distal and mid-shaft hypospadias by two surgeons with the same procedures. The patients were divided into two groups according to treatment modality. In the group DDF, 185 consecutive patients (mean age 29 months) underwent the TIPU with DDF rotated laterally to cover the neourethra before December 2012 [1]. In January 2013, the two surgeons and team members formally discussed the modification of MBVDF for TIPU to come to an agreement. After then, in the group MBVDF, 171 consecutive patients (mean age 26 months) were repaired using the TIPU with MBVDF upturning to cover the neourethra.

The inclusion criteria were: coronal, sub-coronal or mid-shaft hypospadias in pediatric patients scheduled for TIPU repair, with minimal or no chordee. The exclusion criteria were: deficient dorsal and ventral penile skin, or thin shiny distal urethra. The institutional review board of our Medical Center approved the present study.

Surgical procedure

The penis was degloved with a U-shaped incision extending along the edges of the urethral plate. The urethral plate was widened by a midline incision, and tubularized over a 8-Fr stent using 7/0 polyglactin suture. The size of the stent was selected according to the width of the urethral plate and diameter of the glans.

For patients in group DDF (Fig. 1a–c), a single dorsal dartos flap was harvested from preputial skin, and the flap was laterally transposed to the ventral side of the penis. For

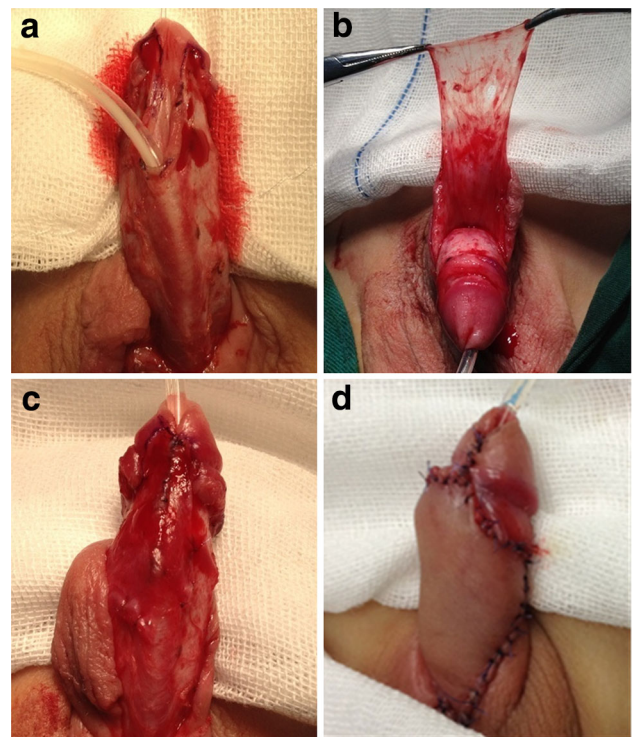


Fig. 1 a Mid-shaft meatus and urethral plate. b The harvested DDF. c Complete dorsal dartos flap laterally rotated to cover the urethroplasty. d The ventral aspect of the penis after operation

patients in group MBVDF (Fig. 2a–c), a meatus-based ventral dartos flap was harvested from dissecting the proximal mid-ventral dartos attached urethra and leaving the subcutaneous fascia connecting the meatus, and the flap was turned up. The dartos flap was sutured to the wings of the glans and corpora cavernosa, thus the neourethra became completely covered with well-vascularized tissue. Glansplasty was performed with no tension and 6/0 polyglactin suture. The excess dorsal foreskin was split and transposed ventrally from both sides to provide skin cover (Figs. 1d, 2d).

In all cases we used microsurgical instruments with a 2.5 times optical magnification. The circular compressive dressing was changed on postoperative day 4 and was removed on day 7. Urinary diversion was via a Foley catheter attached to a bag and left in place for 7 days in all patients. No suprapubic diversion was used.

Clinical data collection

Medical charts were thoroughly reviewed and analyzed. Hypospadias' type and patient's age were compared to ensure that they showed no significant difference in the type and age between the groups. Patients had regular follow-ups in the clinic at 2 weeks, 3 months, 6 months and 1 year after surgery. The authors made the assessments blinded to the dartos technique which the patients were used (Fig. 3).

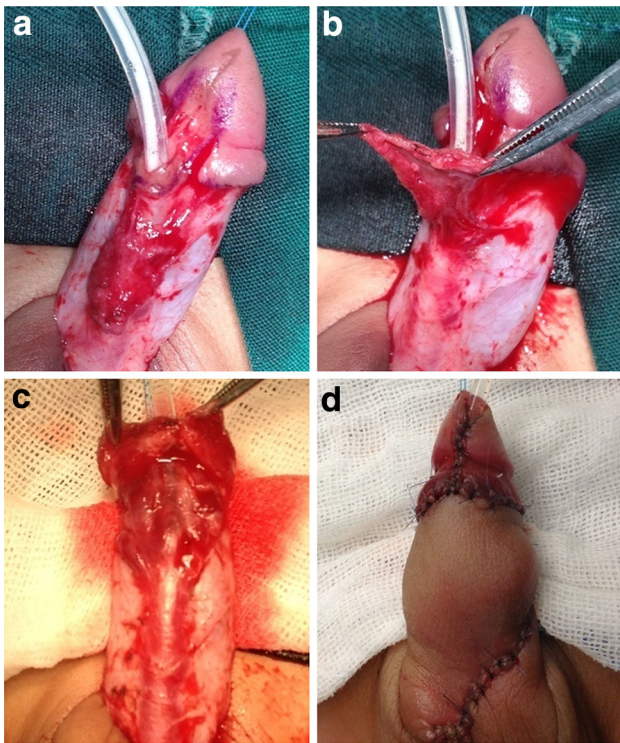


Fig. 2 **a** The harvested MBVDF. **b, c** Complete MBVDF upturning to cover the urethroplasty. **d** The ventral aspect of the penis after operation

The outcome measures were the operative time and postoperative complications. Complications, including fistula, glans dehiscence, meatal stenosis, ventral skin necrosis, penile rotation, recurrent penile curvature and mean operative time, were documented and compared.

Glans dehiscence was defined as a neourethra opening to the corona or more proximally (not glanular meatus). Ventral skin necrosis was the local covering skin darkening, slough and wound dehiscence. Penile rotation was defined as greater than 15 degrees.

Meatal stenosis was a narrowing of the opening of the urethra at the external meatus. The patients were evaluated for meatal stenosis 10 days after surgery. The size to allow sounds to pass through the neourethra was 8 F in 1-year-old children and 10 F in those aged more than 1 year. All neomeatus that required less than these sizes were evaluated as having meatal stenosis [5]. Postoperative penile curvature was assessed by parental-reported observation of the erect penis.

Statistical analysis

All data were expressed as mean ± standard deviation (SD), and all statistical analyses were performed using the statistical Software SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). The numeric variables were compared

using two independent sample *t* test if the variances of the variables in both groups were normally distributed. The count data between the two groups were compared with Chi square or Fisher’s exact test. A *P* value of less than 0.05 was considered statistically significant.

Results

Patient characteristics

356 cases of primary hypospadias with TIPU were included in this study. The patient basic information in group DDF and group MBVDF are shown in Table 1. The mean age, the type of hypospadias, and follow-up time showed no statistical difference between the two groups.

Outcomes

The mean operative time in group MBVDF was significantly less than in group DDF (*P* < 0.001). There were 24 (13.0 %) cases of complications in 21 patients for group DDF, which included glans dehiscence (2.7 %), ventral skin necrosis (2.7 %), fistula (2.7 %), meatal stenosis (1.1 %) and penile rotation (3.8 %). Penile rotation is a mild and typically not worthy of surgical intervention. There were 14 (8.2 %) cases of complications in 12 patients for group MBVDF, which included glans dehiscence (3.5 %), fistula (2.9 %) and meatal stenosis (1.8 %). There were no cases of Postoperative penile curvature in either group. Ventral skin necrosis and penile rotation did not occur in group MBDF which was significantly less than group DDF (*P* < 0.05), and the differences in other complication rates between the groups were not statistically significant (Table 1).

Discussion

In recent years, there have been some improvements in the use of neourethra dartos flap coverage that decrease the complications based on the TIPU method [7–9]. Savanelli et al. compared two randomized groups of patients with distal hypospadias treated with and without ventral dartos coverage after TIPU repair, and found better results in fistula rate [9]. Our modification of MBVDF uses the subcutaneous dartos of meatus-based ventral skin turning up to completely cover the suture lines of the neourethra. And because of the rich blood supply in the urethral meatus, so it is easier to ensure the fascia blood supply and cover the new urethra more closely. In our series, MBVDF were always available and sufficient for urethral coverage. Indeed, we should pay attention to reserve the enough

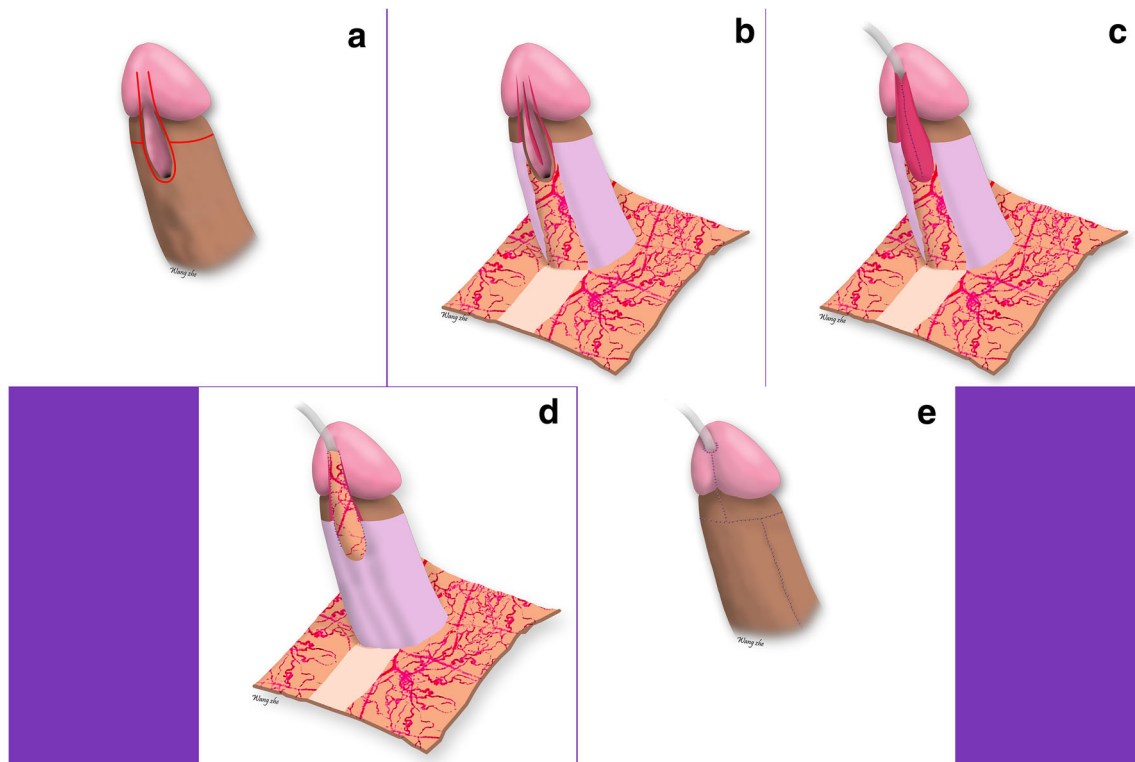


Fig. 3 Diagram depicting MBVDF with TIPU: **a** The penis was degloved with a U-shaped incision. **b, c** MBVDF was harvested from dissecting the proximal mid-ventral dartos attached urethra and

leaving the subcutaneous fascia connecting the meatus. **d** Complete MBVDF turning to cover the urethroplasty. **e** The ventral aspect of the penis after operation

Table 1 The comparison of patient basic information, operative time, and complications following TIPU with two different dartos flaps

	Group DDF ($n = 185$)	Group MBVDF ($n = 171$)	P value
Type of hypospadias			
Coronal	73 (39.4 %)	56 (32.7 %)	0.367 (NS)
Sub-coronal	46 (24.9 %)	52 (30.4 %)	0.378 (NS)
Mid-shaft	66 (35.7 %)	63 (36.9 %)	0.876 (NS)
Mean age, months	25.02 \pm 7.72	23.39 \pm 6.17	0.075 (NS)
Mean operative time, min	73.60 \pm 9.06	68.93 \pm 8.32	<0.001 (S)
Follow-up time, months	27.31 \pm 2.12	26.10 \pm 17.90	0.483 (NS)
Complications			
Glans dehiscence	5 (2.7 %)	6 (3.5 %)	0.670 (NS)
Ventral skin necrosis	5 (2.7 %)	0 (0.0 %)	0.039 (S)
Fistula	5 (2.7 %)	5 (2.9 %)	0.902 (NS)
Meatal stenosis	2 (1.1 %)	3 (1.8 %)	0.675 (NS)
Postoperative penile rotation	7 (3.8 %)	0 (0 %)	0.016 (S)
Total	24 (13.0 %)	14 (8.2 %)	0.189 (NS)

Group DDF (TIPU with a single dorsal dartos flap); Group MBVDF (TIPU with meatus-based ventral dartos flap)

$P < 0.05$, S significant, NS not significant

subcutaneous fascia in the course of anatomy, and sometimes connect some penoscrotal fascia in some cases. The step of creating the MBVDF is simultaneously performed with correcting the penile curvature and it is also simpler to be harvested compared with the DDF. There was a

statistical decrease in mean operative time in group MBVDF. This method decreases the surgeon's learning curve and operative time, so it is easily accepted.

In our present study, we compared the outcomes of using MBVDF and DDF on the complication rates of TIPU in

distal and mid-shaft hypospadias. Fistula in group MBVDF and DDF was the most-common complication, but their rates are comparable with other similar studies from around the world [10, 11]. So, these two coverage techniques used with TIPU are effective methods to decrease fistula in hypospadias repair. Our findings reveal that the differences in rates of glans dehiscence, fistula and meatal stenosis of the two groups were not statistically significant, MBVDF could completely avoid the complications of ventral skin necrosis and penile rotation which were statistically less than in DDF.

DDF has the advantage of being sufficiently available and relatively convenient, but the moderate penile rotation rate is 5 to 10 % [2, 12]. In our series, the penile rotation rate of group DDF was 3.8 % comparable with the literature, but no cases occurred in group MBVDF. The lateral transposition of DDF with asymmetric and insufficient flap formation is the key factor, especially in mid-shaft hypospadias. MBVDF as a upturning middle flap can avoid penile rotation.

Kamal first reported the double dorsal dartos flap technique that could eliminate penile rotation and reduce the fistula formation [12, 13]. Nevertheless, the complete mobilization of a single or double flap may sacrifice some of the blood supply to the skin that will eventually be used for ventral skin coverage. There was a 2.7 % rate of ventral skin necrosis in the group DDF, which was not observed in the group MBVDF, because the untouched dorsal skin has a full blood supply and is not easily necrotized [14]. Another drawback of the double flap makes approximation of the glans wings difficult and can lead to dehiscence [15, 16].

There are other methods of using a healthy DDF that avoid these risks, including buttonholing, splitting flap, and lateral de-epithelialization flap. However, the buttonholing or splitting flap method practically requires that the dorsal skin is sufficient and thick enough, which is not always the case, especially mid-shaft. Lateral de-epithelialization flap method could influence the transfer of lateral skin in some cases.

This study has some limitations. This was a single center study that allowed comparison of the two groups, but a larger sample study in multiple centers might reveal statistically significant differences in the complication rates. As a retrospective study the patients were not randomly allocated into groups so this may have introduced some bias into the study despite their being no statistical significance between the groups in terms of baseline characteristics. Besides, we stipulated over 15° as a measurement of the complication of penile rotation but this level of rotation only affects the penile appearance and it does not need a corrective procedure; therefore, this value increased the reporting rate of postoperative complications.

In conclusion, DDF and MBVDF with TIPU are similarly effective methods to decrease fistula in hypospadias repair. MBVDF with TIPU may be the easier method and can avoid ventral skin necrosis and penile rotation complications.

Compliance with ethical standards

Conflict of interest/funding The authors declare that they received no financial support for this study, and they have no conflict of interests.

Ethical approval For this type of study formal consent is not required.

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