

# Tubularized Incised Plate Urethroplasty Using Buccal Mucosa Graft for Repair of Penile Hypospadias

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**Purpose:** To describe the results of penile hypospadias repair using the Snodgrass method with buccal mucosa graft (BMG), supported by double dartos flap as a second layer.

**Materials and Methods:** In a prospective cohort study, 21 consecutive patients underwent hypospadias repair using the Snodgrass method and BMG as the urethral plate, with the addition of double dartos flap for covering the neourethra. Patients were followed up, and outcomes and complications were recorded.

**Results:** The mean age of the patients was  $6.57 \pm 3.69$  years (range, 2 to 15 years) and the mean follow-up period was  $8.42 \pm 2.19$  months (range, 6 to 12 months). The following minor complications, not requiring additional intervention, were recorded: 2 subjects developed slight chordee  $< 30$  degrees; 2 developed wound infection; and 1 had meatal stenosis postoperatively. Only one patient required additional surgical intervention resulting in a success rate of 95%. No urethrocutaneous fistula occurred in our subjects.

**Conclusion:** Fortifying a combination of BMG and Snodgrass method with double dartos flap decreases the rate of complication in hypospadias repair significantly.

**Keywords:** urethra, hypospadias, mouth mucosa, reconstructive surgical procedures, treatment outcome

## INTRODUCTION

**H**ypospadias is a common congenital malformation of the genitourinary system affecting one in 300 male newborns.<sup>(1)</sup> Various surgical procedures have been employed for the urethral reconstruction in hypospadias. The goals of repair is to achieve straight penis, normal position of the urethral meatus on the glans, adequate caliber of the neourethra, normal flow of urine, sufficient skin coverage of the phallus, and optimal sexual function during adulthood.

Tubularized incised plate (TIP) or Snodgrass urethroplasty is the most common technique used for correction of distal hypospadias<sup>(2)</sup> and the method of choice for treatment of many types of hypospadias.<sup>(3)</sup> Compared to other techniques, TIP has lower complication rate and one-stage surgical repair can be accomplished. Usually preputial and penile skins are used for urethral reconstruction; however, this may be insufficient in severe hypospadias or after circumcision. Consequently, the use of free buccal mucosa graft (BMG), as an alternative reconstructive option, has gained popularity in these cases.<sup>(4)</sup>

In spite of improvement in these techniques, urinary (urethrocutaneous) fistula remains the most common and serious complication of TIP, followed by urethral stenosis. In this study, we evaluated the use of double dorsal dartos flap, a well-vascularized tissue, in addition to TIP with BMG for the repair of hypospadias and their positional benefits to decrease the complications.

## MATERIALS AND METHODS

Parents of each patient were informed about the details of surgical procedure and potential outcomes and complications. Furthermore, they were asked if they would consent for the results of the surgery to be reported in medical literature with-

out patient's identification and a fully informed consent was obtained. The study design has been approved by Mashhad Center for Reconstructive Urology.

## Patients

We performed a pilot prospective cohort study on 21 patients with penile hypospadias without significant chordee, who were referred to a single reconstructive urologist from October 2008 to August 2009 in Mashhad, Iran.

All the patients underwent a buckle mucosal graft modification of traditional Snodgrass operation (Snod-graft), plus a double dartos flap as the second layer of repair. We scheduled follow-up visits every month for the first 3 months and every 3 months thereafter. To ensure completeness of follow-ups, patients were called if they failed to show up for a follow-up visit. During each visit, we evaluated patients for the development of wound infection, penile torsion, urethrocutaneous fistula, meatal stenosis, and buccal donor site complications.

Procedure was considered a success if subjects did not develop any complications or had minor complications that could be corrected with simple procedures, such as meatotomy or meatal dilatation. Complication-free success was defined when patients were completely fine after the surgery without any complications. Failure was defined as a case that needed another surgery for repair.

## Surgical Technique

Under general anesthesia, after placing stay suture, following the method of incised plate urethroplasty, a midline incision was made. Thereafter, based on the anatomy of the individual penis, this incision was either widened or deepened to create a suitable bed for the graft. To prevent ex-

cessive bleeding, we delayed the extension of the incision into the glans penis until the buccal graft harvest was obtained. The buccal mucosa graft was harvested with a width of 10 to 15 mm and a length matching with the length of penile incision. Subsequently, the buccal graft was placed on the prepared bed and fixed in place by 5.0 Monocryl sutures. Thereafter, the incision was extended into the glans penis and the graft was extended onto this area to prevent later meatal stenosis formation. Two parallel incisions were made on the ventral skin of the penis and urethral tubularization was completed in two layers using a 6 to 14 F silicone urethral catheter. To produce the dorsal dartos flap, we made a circumcisional incision completely degloving the skin. Then, the dartos flap was incised longitudinally in the middle dividing it into two. Each of the two flaps was rotated towards the ventral surface of the penis and sutured on each other onto the neourethra (Figure 1). While suturing these flaps, we visually controlled for any tension on either side and adjusted our sutures to prevent penile torsion. When pre-existing penile torsion due to previous surgeries was detected, we would adjust the tension on these flaps to correct the pre-existing torsion (Figure 2). In the next step, the skin was closed and a pressure dressing was applied. Finally, patient's catheter was fixed onto the abdominal wall to produce a slight pressure keeping the graft on its bed. We changed the dressing on the 4<sup>th</sup> postoperative day. Patients were discharged 5 to 6 days after the procedure. Urethral catheters were removed 7 to 10 days after the surgery.

### Statistical Analysis

The data were analyzed using SPSS software (the Statistical Package for the Social Sciences, Version 11.5, SPSS Inc, Chicago, Illinois, USA). We

used Fisher's Exact test to compare the prevalence of independent variables of interest between those who were successful and those who failed. Independent variables studied included age ( $\leq 6$  and  $> 6$  years), previous corrective surgery (yes or no), and type of hypospadias. *P* values less than .05 were considered significant.

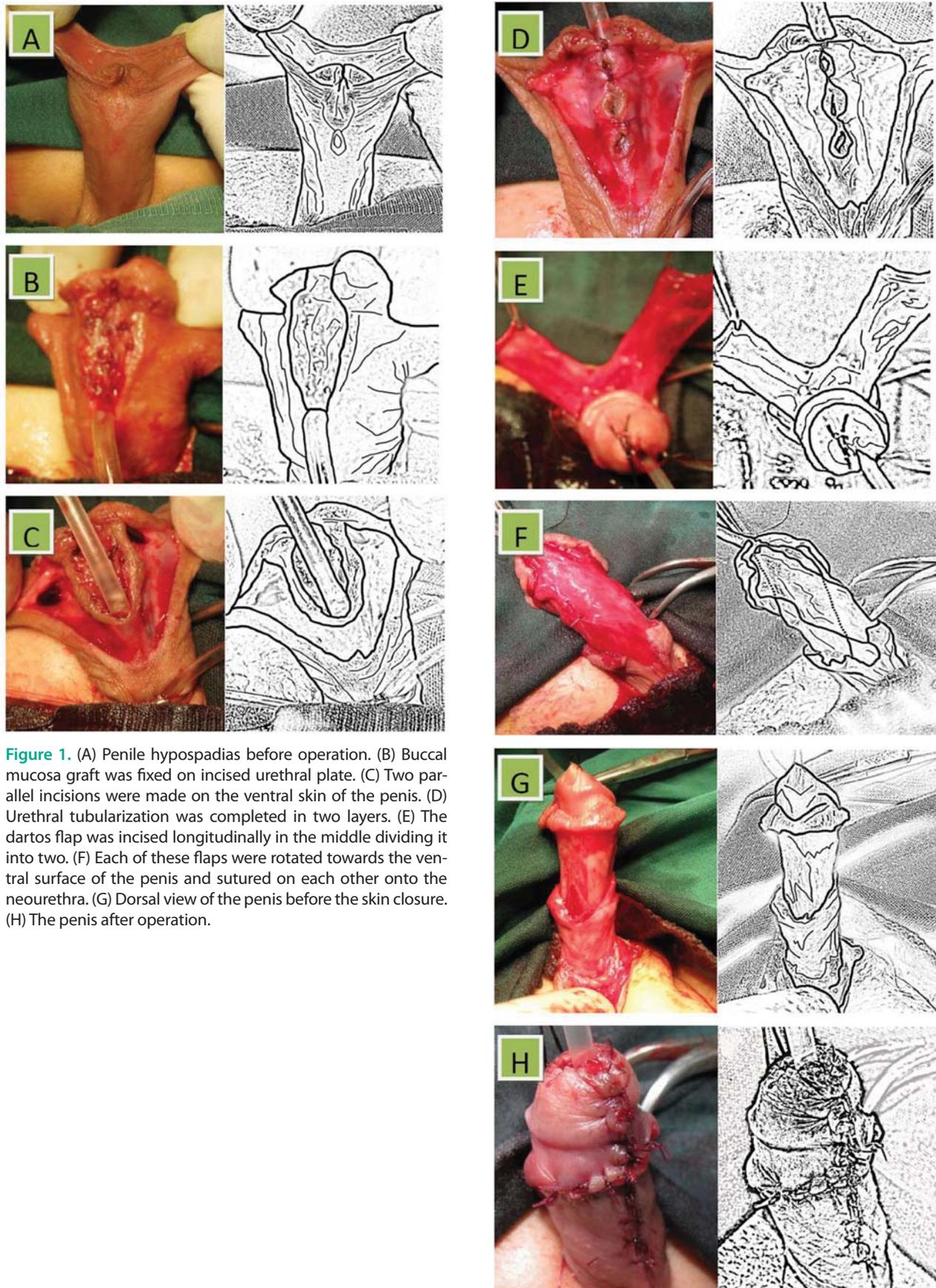
### RESULTS

Table outlines the characteristics of the patients. The mean age of the subjects was  $6.57 \pm 3.69$  years (range, 2 to 15 years) and the mean follow-up period was  $8.42 \pm 2.19$  months (range, 6 to 12 months).

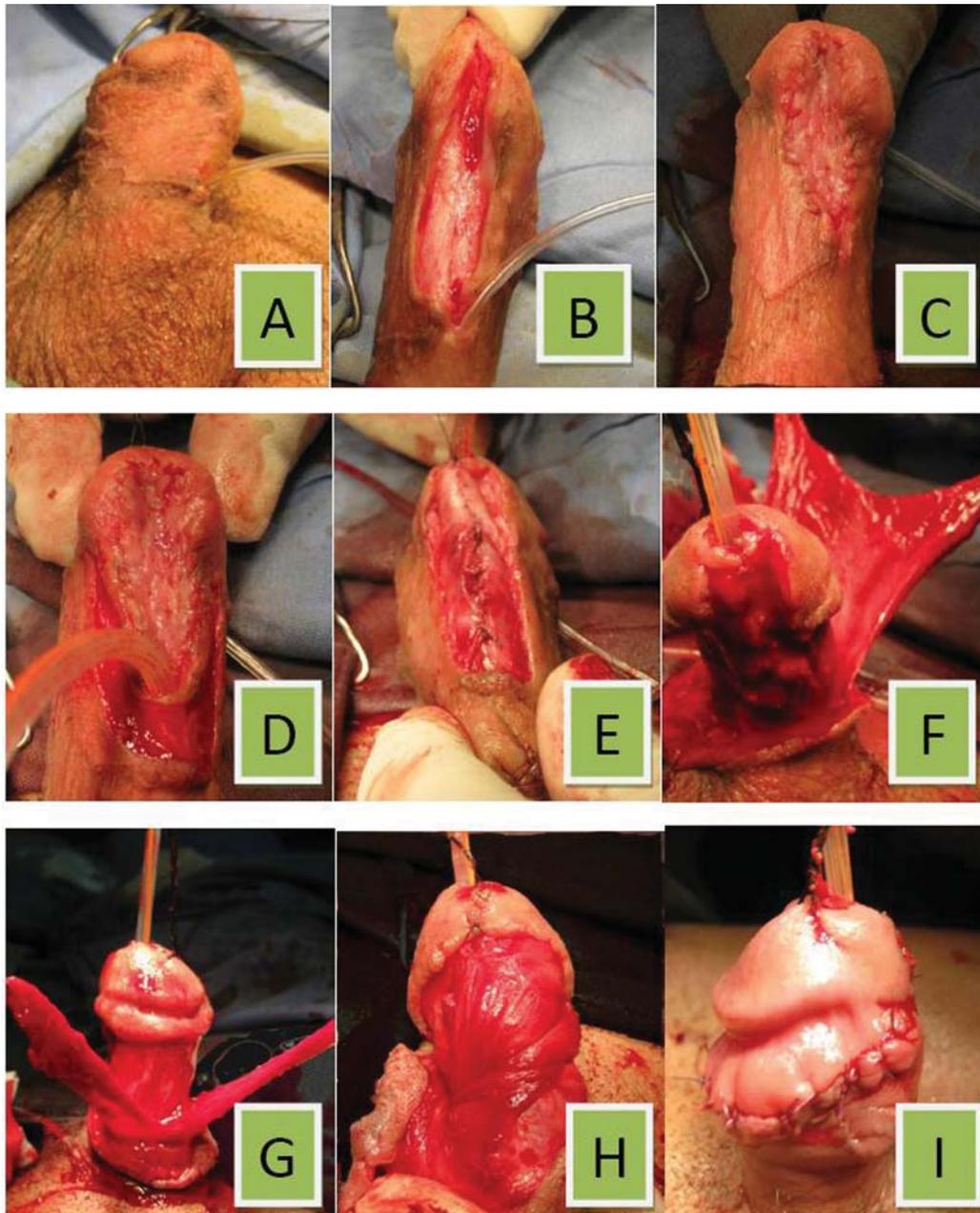
Overall success rate was 95%. Complication-free success was achieved in 16 (76.2%) subjects. Failure with a need to repeat operation occurred in one subject resulted in a failure rate of 5%. In 2 patients, there was a slight chordee ( $< 30$  degrees), which we did not make any attempts at correction because the degree of chordee was not clinically significant. One subject developed meatal stenosis, but responded to repeated urethral dilatations. Two subjects developed infection; one responded to antibiotic therapy and one did not, resulting in failure of the repair. This was the only failure and was planned for delayed surgery in 6 to 12 months. The rate of development of the urethrocutaneous fistula in our patients was zero.

The location of hypospadias, proximal, mid-shaft, and distal, was not significantly associated with development of complications ( $P = .877$ ). Seven subjects had distal penile hypospadias, of whom 2 (28.6%) developed complications. Eight and 6 patients suffered from mid-shaft and proximal hypospadias, of whom 2 (25.0%) and 1 (16.7%) developed complications, respectively.

Subjects with a history of previously failed op-



**Figure 1.** (A) Penile hypospadias before operation. (B) Buccal mucosa graft was fixed on incised urethral plate. (C) Two parallel incisions were made on the ventral skin of the penis. (D) Urethral tubularization was completed in two layers. (E) The dartos flap was incised longitudinally in the middle dividing it into two. (F) Each of these flaps were rotated towards the ventral surface of the penis and sutured on each other onto the neourethra. (G) Dorsal view of the penis before the skin closure. (H) The penis after operation.



**Figure 2.** (A) Penile torsion before operation. (B) Making midline incision. (C) Fixing buccal mucosa graft to underlying tissues. (D) Two parallel incisions were made on the ventral skin of the penis. (E) Urethral tubularization was completed in two layers. (F) The dorsal dartos flap was created. (G and H) Adjusting the tension of the dorsal dartos flaps to correct pre-existing penile torsion. (I) Final view after the operation.

eration had higher complication rates; 3/10 (30%) versus 2/11 (18%), but the difference was not statistically significant ( $P = .623$ ). The complications in 10 patients with history of previous failed surgery included meatal stenosis in one, chordee in one, and infection in one subject. Prepuce was present in 7 subjects, of whom 2

(28.6%) had complications. Among the 14 subjects without existing prepuce, 3 (21.4%) suffered from complications after the repair surgery. There was no significant correlation between age and the development of complications ( $P = .49$ ). We did not find any other independent variable that was significantly predictive of the develop-

Patients' characteristics.					
Patient No.	Age, y	Types of hypospadias	Previous operations	Follow-up, month	Complications
1	11	Proximal penile	Yes	9	
2	15	Distal penile	Yes	9	
3	3	Mid penile	No	9	chordee
4	4	Proximal penile	Yes	9	
5	7	Distal penile	Yes	6	chordee
6	11	Mid penile	No	6	infection
7	9	Mid penile	No	6	
8	3	Proximal penile	No	6	
9	4	Distal penile	Yes	6	
10	2	Mid penile	No	6	
11	8	Distal penile	No	6	infection
12	5	Mid penile	Yes	6	
13	2	Mid penile	No	6	
14	6	Mid penile	Yes	3	
15	9	Proximal penile	Yes	3	meatal stenosis
16	12	Distal penile	Yes	3	
17	2	Mid penile	No	3	
18	7	Distal penile	No	3	
19	3	Distal penile	No	3	
20	8	Proximal penile	Yes	3	
21	7	Proximal penile	Yes	3	

ment of complications ( $P > .05$ ).

We were able to eliminate penile torsion in 3 patients who had a pre-existing penile torsion as a result of previous surgical interventions. The discomfort at the buccal donor site was mild in all of our subjects in the 1<sup>st</sup> to 2<sup>nd</sup> postoperative days, and normal diet was started on the 2<sup>nd</sup> postoperative day. There were no aesthetic or functional complications at the oral donor site during our follow-up period.

## DISCUSSION

In this study, we demonstrated high success rate and low complication rate with the combination of Snodgrass method and BMG and used double dorsal flaps for the repair of hypospadias irre-

spective of patients' age, location of hypospadias, history of previously failed surgery, and presence or absence of the prepuce.

Since the introduction of TIP in 1994, it has gained widespread acceptance and has become the treatment of choice for many types of hypospadias.<sup>(3,5,6)</sup> Tubularized incised plate is relatively simple, has a low complication rate, and attains superior cosmetic and functional results.<sup>(7)</sup> The superiority of TIP is the result of the incision that widens the urethral plate in order to create a tension-free neourethra.<sup>(8)</sup> Subsequent modifications to the technique have resulted in reduced risk of complications.<sup>(9)</sup> However, in other studies, especially in patients with history of previous surgery, higher incidences of urethral stricture and fibrosis were

reported.<sup>(10-13)</sup>

Buccal mucosa graft has several advantages over other grafts; hence, it has become the graft of choice in hypospadias repair.<sup>(14)</sup> The tissue is tough and resilient, which allows for manipulation, the process of harvesting is simple and does not create a visible donor site scar,<sup>(4)</sup> and it is compatible with the wet environment of the urethra. Furthermore, the tendency of fluid collection, hematoma formation, and lifting the graft from the bed as the result of shear forces can be decreased by quilting of BMG well onto its bed.<sup>(15)</sup>

Snodgrass and Elmore reported a two-stage operation, in which dorsal BMG replaced the plate or scarred skin. Using this method, they demonstrated improved vascularization and an initial graft healing rate of 88%, with the overall success rate of 65%.<sup>(15)</sup> We used Snodgrass method and BMG as a dorsal inlay with careful fixation to the corpus cavernosum, which resulted in low complication rate both at the area of graft removal and outcome of the repair.

The most common complication in hypospadias repair is the formation of urethrocutaneous fistula. Several surgical techniques have been used to ameliorate the rate of this complication. Retik and Borer used a subcutaneous dartos flap to cover the neourethra.<sup>(16)</sup> Yerkes and colleagues used the Y-to-V procedure to wrap the corpus spongiosum and reinforce the neourethra.<sup>(9)</sup> Shanberg and associates used a laterally-based de-epithelialized flap when trying to repair hypospadias with previous repair failure.<sup>(17)</sup> However, these methods may result in other complications. Rotated asymmetric flaps harvested from subcutaneous tissue may cause rotation in the penis. Spongy tissue has limited application in mid-shaft hypospadias. Sozubir and Snodgrass used dorsal dartos pedicle flap harvested from the dorsal prepuce and

rotated it to the ventral side with a button whole maneuver,<sup>(18)</sup> which addressed the issue of fistula formation, with less risk of rotation.<sup>(19)</sup> Mustafa and coworkers reported the advantages of double dorsal dartos flap in TIP in 38 patients with a mean follow-up period of 4.19 months.<sup>(8)</sup> In our study, we divided dartos to two parts, as Mustafa and colleagues did. Each part of the flap was rotated laterally and symmetrically to cover the neourethra; hence, reduced the risk of the penile rotation. Furthermore, by adjusting the tension of flaps, we were able to correct the pre-existing penile rotations as well. By creating double barrier, we reduced the risk of fistula formation. Therefore, none of our subjects developed urinary fistula. In comparison, Mustafa and associates reported 2 cases of fistula formation in their patients; however, not in subjects who underwent primary reconstruction.<sup>(8)</sup>

In our study, we believe in the use of BMG contributed to the low rate of fistula formation as well as a decreased rate of meatal stenosis because we extended the BMG to the glans. This in return allowed us to avoid creation of high pressure voiding, which could lead to higher rates of fistula formation.

The use of BMG in fistula repair has been previously reported by Hosseini and colleagues.<sup>(20)</sup> Ye and associates combined TIP with BMG in 53 patients. The outcome was especially acceptable in patients with prior failed hypospadias repair. The overall complication rate, after an average follow-up period of 22.6 months, was 15.1%. This included 5 cases of fistula and 3 cases of stricture formation.<sup>(7)</sup> Additional use of double dorsal dartos as a second layer to cover the neourethra probably accounted for the lower rate of fistula formation in our study. On the other hand, it could be argued that the lower complication rate

in our study may be due to the shorter duration of follow-up period. However, usually, the majority of complications are evident in the first 6 months after the operation.<sup>(21)</sup> Furthermore, 5 out of the 8 reported complications in Ye's series occurred when the surgeon was in learning curve period,<sup>(7)</sup> which may improve as the surgical technique is mastered.

Our study is not without limitations. First, the follow-up period is short. Second, we compared our complex method with other techniques.

## CONCLUSION

Combining BMG with double dorsal dartos flap is an acceptable technique for the urethral reconstruction in penile hypospadias. Further studies are needed to confirm our results.

## CONFLICT OF INTEREST

None declared.

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