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# Skin Graft for the Treatment of Crippled Hypospadias

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## Abstract

**Background:** Hypospadias is one of the most frequent birth defects, with an incidence of 1 in every 300 births. After several attempts at hypospadias surgery, the term 'crippled hypospadias' has been used to describe patients with unresolved functional problems.

**Aim of the work:** To evaluate the outcome of a two-stage skin graft for the treatment of crippled hypospadias regarding graft uptake and penile reconstruction.

**Patients and method:** This clinical study was conducted in Al-Azhar University Hospital on 15 cases presenting with crippled hypospadias from May 2021 to Oct 2022. After preoperative preparation, all patients were submitted for two-stage skin graft urethroplasty.

**Results:** At the end of the study, we found a high success rate of 86 %, with one case of glanular disruption and one case of fistula requiring reoperation.

**Conclusion:** We conclude that certain instances of repair failure have been attributed to the use of scarred skin to conceal the repaired urethra. Our current strategy for these difficult redo hypospadias surgeries is a two-stage repair if the urethral plate is extensively damaged.

**Keywords:** Crippled, Hypospadias, Skin graft

## 1. Introduction

Hypospadias is one of the most frequent birth defects, with an incidence of 1 in every 300 births.<sup>1</sup> Recently, many hypospadias repair surgeries have been described. However, some of these surgeries are unsuccessful and require reoperation.<sup>2,3</sup> Due to local penile tissue scarring and penile skin loss, hypospadias surgical failure presents difficulty in healing when it needs to be redone. Due to a lack of available local tissues, extra genital tissue is typically used to repeat hypospadias treatment, and the buccal mucosa graft (BMG) is the most prevalent tissue used.<sup>4</sup> After several attempts at hypospadias surgery, the term 'crippled hypospadias' has been used to describe patients with unresolved functional problems.<sup>5</sup> One of the most challenging aspects of surgery for crippled hypospadias is correcting

significant ventral curvatures, especially when a dorsal plication alone is not enough to straighten the penis shaft, and ventral expansion of the corpus cavernosum is needed. After a corporotomy, a variety of tissues have been used as grafts to restore the integrity of the corpora.<sup>1</sup> Buccal mucosa, genital skin, and auricular tissue have all proven viable sources of graft tissue for urethral restoration; however, each tissue source has distinct disadvantages.<sup>6</sup> Single-stage reconstruction is not feasible in some cases because there are not enough vascularized tissues to rebuild the urethra, cover it with enough skin, and make an interposing tissue layer. Curvature treatment, nonvascularized tissue removal, and vascularized tissue implantation can all be accomplished by the surgeons in two stages.<sup>7</sup> So, in this work, we evaluated the outcome of a two-stage skin graft for the treatment of crippled

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hypospadias regarding the incidence of complication, surgical outcome, and cosmetic results.

## 2. Patients and method

This prospective single-arm study was done in the Pediatric surgery Department (Al-Azhar University Hospitals) on 15 cases presenting with crippled hypospadias from May 2021 to Oct 2022. The study's protocol received approval from the Ethics Committee of Al-Azhar University. Patients' recruitment was done after taking a written consent from the parents of the patients. Inclusion criteria were: (1) age below 14 years, (2) recurrent hypospadias with absent prepuce, and (3) deficient normal penile skin and normal urethral plate. Exclusion criteria were: (1) age above 14 years and (2) primary hypospadias.

A preoperative detailed analysis was done for each case including the following: Full history taking (personal and penile surgery), medical examination (general and local penile examination), and routine preoperative investigation.

Under general anesthesia and patient poisoning in the supine position, the following steps were done: (1) Degloving. (2) Creation of the graft bed was done by fibrous tissue removal from the penis's ventral surface, the urethral plate, and the underlying Buck's fascia to expose the penis's well-vascularized tunica albuginea. (3) After erecting the penis artificially, single midline dorsal plication with 5–0 polypropylene was used to rectify the ventral curvature (VC) of  $30^\circ$  or less. Three transverse ventral corpectomies were performed on patients with a persisting VC of  $30^\circ$  or more. (4) Graft harvest: Graft dimensions should be 20 % more than the bed dimension to overcome graft shrinkage; hence, the full thickness of the groin skin was harvested. With a scalpel, the sides of the graft were incised, and then sharp scissors were used to harvest a full-thickness graft (Fig. 1). Submucosal tissues were removed by defatting the graft. Then, the graft was spread and secured to the prepared bed using interrupted sutures (6/0 Vicryl). (5) Securing the graft: the graft was surgically attached deeply to the distal end of the incised glans penis. The graft was sutured laterally

to the patient's penile skin. The graft was stitched to the bed using a number of quilted 6/0 Vicryl sutures to ensure excellent graft uptake. Hematomas can be prevented by making small incisions in the graft. A Foley catheter with an 8 Fr diameter was put in, and then a roll of petroleum gauze was wrapped around the graft and held in place with a tie-over bandage (Fig. 2). (6) Postoperative care: 6–7 days after surgery, when the sutures were removed, the catheter and bandage were taken off, and the graft was evaluated. The graft was treated with an antibiotic cream twice a day for 7 days. The child was followed in an outpatient clinic once a month for the next 6 months, and was scheduled for a complete operation 6 months after the initial surgery (Fig. 3). (7) Second-stage urethroplasty: The urethral stent was sized appropriately for the patient according to his age, and the graft was tabularized over it. To avoid the formation of a ventral pouch, a U-shaped incision was made, with the base of the U resting on the urethral meatus. We performed the urethroplasty by interrupted subcuticular inverting sutures (6/0 polydioxanone). (8) Glansplasty: Three interrupted subepithelial 6–0 polyglactin stitches were used to approximate the Glans wings over the neourethra. (9) Effective penile skin closure using 4–0 polyglactin sutures, hemostasis, and catheter drainage was applied for 10 days. A sterile dressing was applied to the penis (Fig. 4).

All data analysis was done using the SPSS (IBM Corp., Armonk, NY., USA). Quantitative data were described as mean and SD. Categorical data were described as absolute frequencies (N) with percentages (%).

## 3. Results

In the present study, 15 patients with crippled hypospadias were aged between 1.5 and 8 years with a mean age of about  $3.55 \pm 1.6$ . And all cases included in the study were proximal crippled cases with failed repeated attempts of repair, the 0 deficient urethral plate length ranged between 2.8 and 5.2 cm, and the mean was  $3.2 \pm 1.7$ . A significant penile curvature  $>30^\circ$  was present in three cases



Fig. 1. (a, b) Graft site from inguinal and (c) graft defatting.

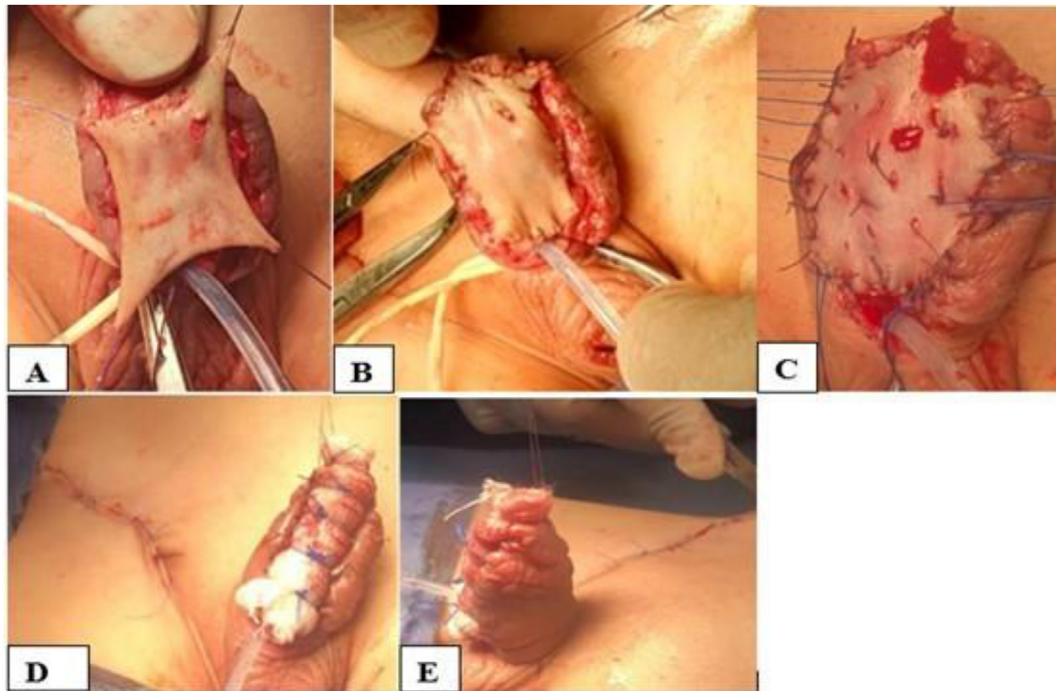


Fig. 2. (a, b) Graft fixation, (c) graft fenestration, (d,e) tie-over bandage on graft.

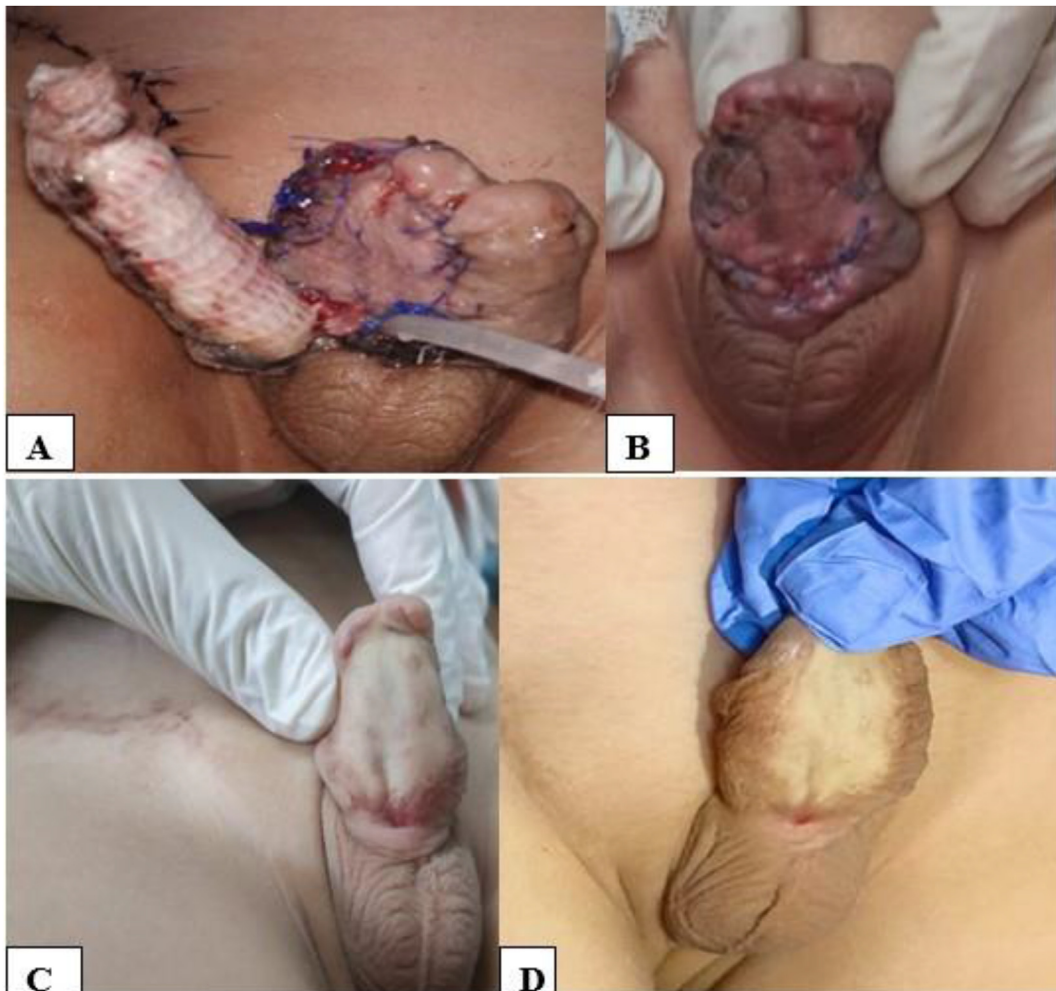


Fig. 3. (a) Fist dressing and removal of the tie-over bandage, (b) 2 weeks postoperatively, (c) 4 months postoperatively, (d) 6 months postoperatively.

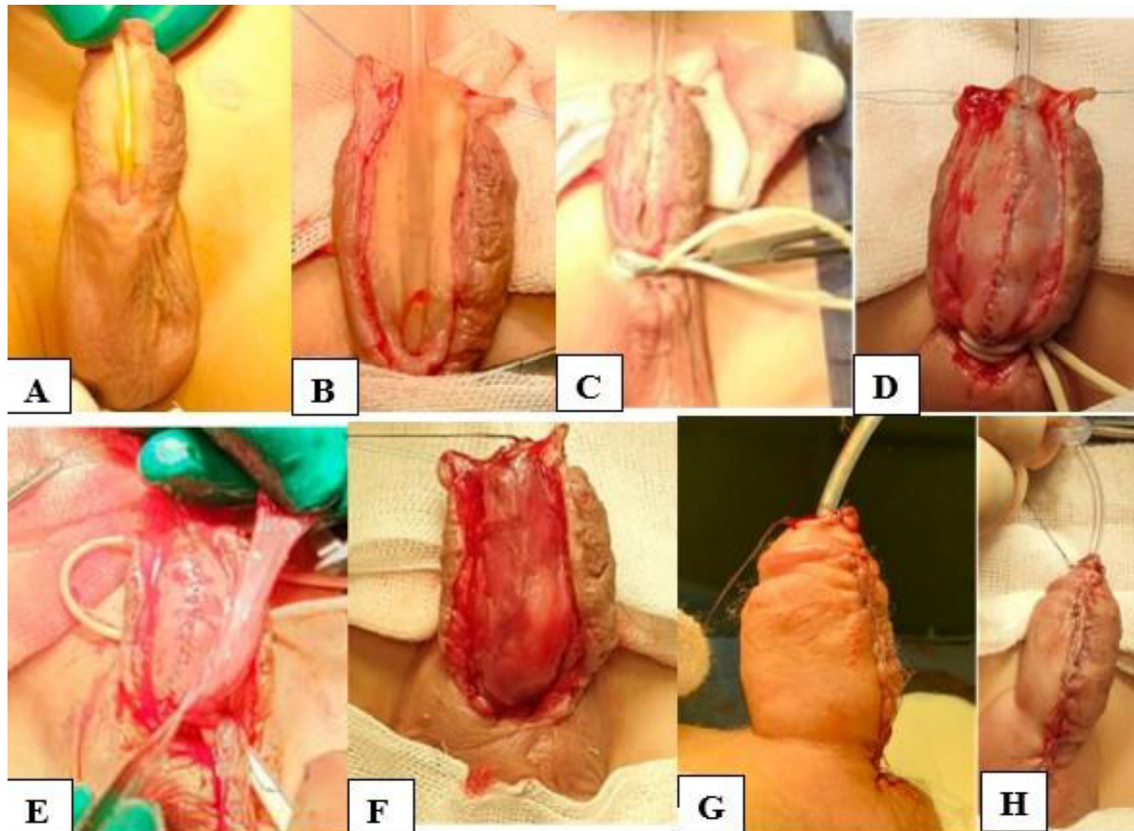


Fig. 4. (a) Assessment of the urethral plate, (b) U-shaped incision, (c, d) first interrupted sutures and second continuous layer, (e, f) tunica vaginal flap, (g, h) skin closure.

that required ventral corporotomies, while two cases have mild penile curvature, less than  $30^\circ$ , and dorsal plication was enough, and the remaining 10 cases were straight, without ventral chordee. The glans width was good  $>15$  mm in 13 cases of our study, while in two cases their glans width was relatively small  $<15$  mm. Most cases did not have other anomalies except one case associated with unilateral cryptorchidism, and another case suffered from a right inguinal hernia (Table 1). Intraoperatively, the width of the neourethral plate ranged between 10 and 20 and the mean was  $14.0 \pm 2$  mm, and its length ranged between 2.8 and 5.2 mm with a mean length of  $32 \pm 1.7$  mm (Table 2). The overall complications in the first stage were observed in one case, in the form of graft contraction of 6.6 % as shown in the figure; the cases of graft contraction mildly affect the length and width of the graft and were safely fit for the second stage. So there was no hematoma, infection, or graft rejection (Table 3). The child was followed in the outpatient clinic monthly for 6 months postoperatively and scheduled for completion surgery ensuring at least 6 months have elapsed between stages. The operative

Table 1. Demographic data of the studied patients.

| Parameter                       | Total number = 15                |
|---------------------------------|----------------------------------|
| <b>Age (years)</b>              |                                  |
| Mean $\pm$ SD                   | 3.5 $\pm$ 1.6                    |
| Range                           | (1.5–8)                          |
| <b>Hypospadias type</b>         |                                  |
| Proximal                        | 15 (100.0 %)                     |
| <b>Urethral plate condition</b> |                                  |
| Deficient (length)              | 3.2 $\pm$ 1.7<br>Range (2.8–5.2) |
| <b>Penile curvature</b>         |                                  |
| $>30^\circ$                     | 3 (20 %)                         |
| $<30^\circ$                     | 2 (13 %)                         |
| <b>Glans condition</b>          |                                  |
| Maximum width                   | 13 $>$ 15 mm<br>2 $<$ 15 mm      |
| <b>Associated anomalies</b>     |                                  |
| No                              | 13 (86.6 %)                      |
| Yes                             | 2 (13.4 %)                       |
| <b>Graft site</b>               |                                  |
| Inguinal skin                   | 15 (100.0 %)                     |

time of the second stage was 90 min. The period of catheterization after tubularization of the neourethral plate was 10 days, all cases have uneventful events on postoperative days (Table 4). The

Table 2. Intraoperative and postoperative data of the first stage.

| Second-stage data                | Total number = 15 |
|----------------------------------|-------------------|
| <b>Operative time in minutes</b> |                   |
| Mean                             | 90 ± 15           |
| <b>Cath. Period</b>              |                   |
| Mean                             | 10 ± 3 days       |
| <b>First dressing (hrs.)</b>     |                   |
| Mean ± SD                        | 72.00 ± 0.00      |
| Range                            | 48–96             |

Table 3. Postoperative complications after the first stage.

| First stage complications | Total number = 15 |
|---------------------------|-------------------|
| <b>Graft Rejection</b>    |                   |
| No                        | 15 (100.0 %)      |
| Yes                       | 0 (0.0 %)         |
| <b>Hematoma</b>           |                   |
| No                        | 15 (100.0 %)      |
| Yes                       | 0 (0.0 %)         |
| <b>Infection</b>          |                   |
| No                        | 15 (100.0 %)      |
| Yes                       | 0 (0.0 %)         |
| <b>Graft contraction</b>  |                   |
| No                        | 14 (86.7 %)       |
| Yes                       | 1 (6.6 %)         |

complications of the second stage urethroplasty were reported in five cases about 33 % (2 cases of urethrocutaneous fistula, 1 case of glanular dehiscence, and 2 cases of urethral stricture (Table 5). During the follow-up period, which ranged from 2 to 4 months, several cases were observed. One case of urethrocutaneous fistula closed spontaneously with the application of silver nitrate, while another case required surgical closure. The case of glanular dehiscence underwent a second repair procedure known as glanuloplasty. In addition, the cases of urethral stricture initially responded well to urethral dilatation. Finally 13 of 15 cases (about 86 %) have successful surgical results and satisfied surgical outcomes. During the follow-up visits, all cases were evaluated by Hypospadias Objective Penile Evaluation (HOPE-score) (Table 6) for cosmetic results and revealed that 13 cases have 10 points at the meatal position, 10 points at the metal shape, 10 points at skin conditions, 10 points at torsion (no torsion), and 10 points at straightness (no curvature,

Table 4. Intraoperative and postoperative data of the second stage.

| Second-stage data                | Total number = 15 |
|----------------------------------|-------------------|
| <b>Operative time in minutes</b> |                   |
| Mean                             | 90 ± 15           |
| <b>Cath. Period</b>              |                   |
| Mean                             | 10 ± 3 days       |
| <b>First dressing (hrs.)</b>     |                   |
| Mean ± SD                        | 72.00 ± 0.00      |
| Range                            | 48–96             |

Table 5. Postoperative complications for the second stage.

| Second-stage complications      | Total number = 15 |
|---------------------------------|-------------------|
| <b>Urethrocutaneous Fistula</b> |                   |
| No                              | 13 (87.7 %)       |
| Yes                             | 2 (13.3 %)        |
| <b>Glans dehiscence</b>         |                   |
| No                              | 14 (93.33 %)      |
| Yes                             | 1 (6.65 %)        |
| <b>Stricture</b>                |                   |
| No                              | 13 (87.7 %)       |
| Yes                             | 2 (13.3 %)        |
| <b>Infection</b>                |                   |
| No                              | 15 (100.0 %)      |
| Yes                             | 0 (0.0 %)         |
| <b>Rotation</b>                 |                   |
| No                              | 15 (100.0 %)      |
| Yes                             | 0 (0.0 %)         |
| <b>Residual chordee</b>         |                   |
| No                              | 15 (100.0 %)      |
| Yes                             | 0 (0.0 %)         |

while 2 cases have 8 points in the term of meatal position, 7 points at the metal shape, 7 points at skin shape, 7 points at torsion (slight torsion), and 10 points at straightness (no curvature). So, there were about 86 % of cases with good cosmetic results regarding the HOPE score.

#### 4. Discussion

A common genital deformity known as hypospadias affects 0.2–0.6 % of boys.<sup>8</sup> Historically, the urethral plate or local skin flaps and tubes were used to reconstruct failed hypospadias; however, children who have undergone multiple operations may have plates that are too scared to use and an extreme lack of skin that could be used for onlay or tube reconstruction of the urethra.<sup>9</sup> The use of grafts for reconstruction after unsuccessful hypospadias surgery is the focus of this study. In this study, we enrolled 15 children for skin graft repair of crippled hypospadias. Most of them had previous two or three trials of hypospadias repair. And meatus was mainly located at the posterior penile. Primary and redo hypospadias were compared using an onlay island flap by Emir et al.<sup>10</sup> Redo patients were found to have a greater fistula rate than initial patients (42.4 % vs. 11.7 % for primary cases). They concluded that prior numerous repairs had a significant impact on the prognosis, particularly for patients with a penoscrotal meatus.<sup>10</sup> The number of prior procedures may have an impact on the results of redo hypospadias, which is brought on by increasing tissue scarring and a lack of healthy tissue nearby. Also, the loss of preputial tissue from several prior procedures necessitates additional surgical intervention.<sup>7</sup> Aivar Bracka introduced a

Table 6. Hypospadias Objective Penile Evaluation (HOPE) score.

|   |
|---|
| <p><b>1. Position meatus: assess the position of the meatus?</b><br/>See HOPE-score reference pictures</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Position 1 (10 points)</li> <li><input type="checkbox"/> Position 2 (8 points)</li> <li><input type="checkbox"/> Position 3 (5 points)</li> <li><input type="checkbox"/> Position 4 (3 points)</li> <li><input type="checkbox"/> Position 5 (1 point)</li> </ul> <p><b>2. Shape meatus: what is the shape of the meatus?</b><br/>See HOPE-score reference pictures</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Normal (10 points)</li> <li><input type="checkbox"/> Slightly abnormal (7 points)</li> <li><input type="checkbox"/> Moderately abnormal (4 points)</li> <li><input type="checkbox"/> Severely abnormal (1 point)</li> </ul> <p><b>3. Shape glans: what is the shape of the glans?</b><br/>See HOPE-score reference pictures</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Normal (10 points)</li> <li><input type="checkbox"/> Slightly abnormal (7 points)</li> <li><input type="checkbox"/> Moderately abnormal (4 points)</li> <li><input type="checkbox"/> Severely abnormal (1 point)</li> </ul> <p><b>4. Shape Skin: what is the shape of the penile skin?</b><br/>See HOPE-score reference pictures</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Normal (10 points)</li> <li><input type="checkbox"/> Slightly abnormal (7 points)</li> <li><input type="checkbox"/> Moderately abnormal (4 points)</li> <li><input type="checkbox"/> Severely abnormal (1 points)</li> </ul> <p><b>5.1 Torsion: is there a torsion of the penis?</b><br/>See HOPE-score reference pictures</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> 0–30° (10 points)</li> <li><input type="checkbox"/> 30–50° (7 points)</li> <li><input type="checkbox"/> 50–70° (4 points)</li> <li><input type="checkbox"/> &gt;70° (1 points)</li> </ul> <p><b>5.2 Curvature in penile erection: is there a curvature of the penis in erection?</b><br/>See HOPE-score reference</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> No erection observed (5.2 does not account for the HOPE-score)</li> <li><input type="checkbox"/> 0–30° (10 points)</li> <li><input type="checkbox"/> 30–50° (7 points)</li> <li><input type="checkbox"/> 50–70° (4 points)</li> <li><input type="checkbox"/> &gt;70° (1 point)</li> </ul> |
| <p>Hypospadias Objective Penile Evaluation (HOPE)-score = mean number of points question 1–5.</p>   |

two-stage penile skin-graft technique in 1995 to address complications resulting from unsuccessful hypospadias surgery. The study included 600 patients, out of which 121 patients underwent this procedure. Bracka claimed that this technique is highly versatile and can produce excellent outcomes for any level of deformity.<sup>11</sup> One-stage procedures for correcting severe hypospadias have been suggested to involve the use of flaps and grafts. Although many studies have reported positive outcomes using alternative procedures, two-stage repairs remain the preferred method for treating the most severe cases of hypospadias.<sup>12</sup> After unsuccessful hypospadias surgery, Snodgrass and Elmore

reported 25 instances of staged urethroplasty in 2004. Twenty of the 25 instances had stage II completed, and one patient (or 5 % of them) had a fistula form. None of the patients exhibited meatal stenosis, neourethral stricture, or diverticulum, and they all had a neomeatus that resembled a slit.<sup>9</sup> Obara et al.<sup>13</sup> reported that it was thought that grafts had several benefits over flaps, including the ease with which they could be harvested and the fact that a thin graft produced less tissue volume than a flap and did not twist. Grafting facilitates skin and glans closure and enhances aesthetic appeal. In our study, we agree with Obara et al. as we have few incidences of complication, successful surgical

outcomes, and good cosmetic results. Staging the surgery provides the option to remove non-vascularized tissues, correct curvature, and lay down vascularized tissue (usually a graft) for urethral reconstruction in the second stage. Grafts are frequently obtained from genital or nongenital areas, including postauricular skin grafts, oral mucosa grafts, and inner preputial grafts if the kid is not circumcised.<sup>7</sup> Fistula formation is the most prevalent complication following hypospadias surgery, according to a survey of hypospadias consequences. The failure rate of fistula repair is higher in cases of hypospadias cripples and reoperative cases due to the poor healing properties of scarred and ischemic fibrotic tissues.<sup>14</sup> The current study used inguinal skin as a graft to reconstruct the neourethral plate. The overall fistula rate of 6.7 % is a commendable achievement, especially considering the unfavorable patient profile. After 6 months of postoperative follow-up, we found one case (6.7 %) of urethral fistula, meatal prolapse, meatal stenosis, stricture, and donor site infection that responded to local antibiotics and dressing. The overall fistula rate reported by Obaidullah and Aslam,<sup>15</sup> who performed the two-stage Bracka procedure on 1206 patients (189 re-operative cases), was 5.9 %. However, the specific fistula rate for the reoperative cases was not reported. Gill and Hameed<sup>16</sup> compared the preputial skin transplant, postauricular graft, and buccal mucosal graft, and they found that the fistula rate was 3.12 %, 5 %, and 5.8 %, respectively. In the study of Badawy et al.,<sup>7</sup> four (16 %) children had a fistula and glanular dehiscence in six (24 %) children but zero stricture urethra. The total success rate in our investigation was 86 % and two (about 14 %) of the cases with fistula and urethral stenosis did not need further intervention, while one case of fistula and the other case of glanular disruption required redo operation. Our finding was comparable with the study of Badawy et al.<sup>7</sup> The total success rate discovered was 72 %, 24 % of children with glanular dehiscence did not need further surgeries and one patient with complete disruption was scheduled for further surgery. Also, Snodgrass et al.<sup>9</sup> reported a high success rate of 88 % complete, similar to our study and they reported complete graft uptake and successful surgical outcome in their two-stage repair. Fam and Hanna<sup>17</sup> determined that full-thickness grafts produced better aesthetic outcomes because of their enhanced feeling, improved capacity to stretch during erection, and less secondary contraction, and these results come in the same way as the HOPE-score results obtained in our study.

#### 4.1. Conclusion

In the patient with crippled hypospadias using two stages of skin graft urethroplasty is a good alternative option for repair because it has fewer incidences of complication, acceptable surgical outcome, and good cosmetic results.

#### Author's contributions

All authors contributed to all steps of the study (conception, design of the study, acquisition of data, analysis and interpretation of data, drafting the article, and final approval of the version).

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None to declare.

#### Conflicts of interest

None to declare.

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