Modified double face preputial flap urethroplasty for single-stage repair of proximal hypospadias

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Abstract

Background: There is an ongoing pursuit to decrease complications of hypospadias surgery. We studied a modification to the double onlay preputial island flap, whereby an additional tunica vaginalis layer was used.

Aims: We aim to study the efficacy, complication rates and outcomes of the modified double onlay urethroplasty technique.

Materials and Methods: This study adopts an observational consecutive study design. From 2014 to 2019 the modified preputial double onlay urethroplasty technique was used in 30 patients. Selection criteria was severe hypospadias operated on using the technique studied in a single stage procedure. We excluded perineal hypospadias, cripple hypospadias, and combined procedures. The operative technique used involved a layer of preputial flap for the neourethra followed by a layer of tunica vaginalis followed by another preputial flap layer over the ventral penile skin defect.

Results: Patients were followed up for a mean of 2.04 years. There were 11 (36.67%) complications. Urethrocutaneous fistulas occurred in 3 patients (10%). There were 3 cases (10%) of glanular dehiscence and 1 (3.3%) diverticulum. No correlation was found between operative age, hypospadias type, or chordee approach and complications. Short second surgeries were needed in 7 patients (23.3%).

Conclusion: The modified technique used in this study yielded good cosmetic and functional results. Complication rates were in line with the lower ranges reported by the literature for the standard double onlay preputial flap technique.

Keywords: Onlay, preputial flap, proximal hypospadias, severe hypospadias, single-stage repair, transverse preputial island flap

BACKGROUND

Hypospadias is a congenital anomaly of deficient ventral penile tissue formation. Clinical features associated include the ectopic placement of the urethral meatus in a ventral position, a curvature of the penis (chordee), and a defect in the ventral prepuce. Severe forms of hypospadias can be defined as “those with a proximal division of corpus spongiosum (below the midshaft)”[1].

The surgical correction of hypospadias aims to straighten the penis, reconstruct the missing parts of the urethra.
allowing a urethral meatus placement at the tip of the glans. Ultimate goals are long-term cosmetic and functional outcomes (micturition and sexual function). However, the repair of hypospadias presents with challenges to the reconstructive surgery field and there have been many approaches to it. One of the surgical techniques well suited for cases of proximal hypospadias is the preputial flap.\(^2\) The initial technique utilized a transverse free preputial graft from the dorsal skin. However, the procedure was found to have a high rate of complications, mainly urethrocutaneous fistulas, strictures, and glans dehiscence.\(^3\) A potential cause for this was vascular insufficiency in relation to the large length of urethroplasty. To improve vascular supply and reduce complication rates, the surgical intervention was modified to the current mainstay of intervention: A double-faced preputial flap approach.\(^4\) The modified approach allowed the transfer of the preputial flap along with its vascular supply. It provided improved cosmetic and functional outcomes and less complication in comparison to the single preputial flap technique.\(^5\) The modified double-faced preputial flap technique for repair of proximal hypospadias was defined as those found to have proximal divisions of the corpus spongiosum following degloving of the penis, associated with a concurrent penile curvature above 15 degrees and a glans defect. Only patients operated on by a single surgical team within the defined time were studied. The exclusion criteria included less severe forms of hypospadias, perineal hypospadias variant, cripple hypospadias, multistage surgeries, and those who had surgeries combined with procedures other than cosmetic scrotoplasty.

The operative technique used was the modified double-faced preputial flap technique in which, adds the use of an additional tunica vaginalis flap to the traditional double onlay preputial flap.

Patients were kept in a supine position and general and caudal anesthesia was given. The surgical field was outlined and sterilized. Initially, a stay suture is placed in the glans using a 5-0 prolene stitch. Then, a circumferential incision is made slightly proximal to the corona and the penile skin is degloved and fibers attached to the corpus spongiosum are excised. The urethral plate is outlined by making two paramedian parallel incisions which extend to the glanular tip. This is followed by using an artificial erection test to assess the degree of penile curvature (chordee). If the chordee was >15 degrees, a chordectomy was performed to straighten the penis; a second erection test was done following chordectomy and if there was no improvement, then a dorsal plication of the tunica albuginea was done using 5-0 prolene sutures. Then, a preputial island flap is created by transecting a rectangular area from between the inner prepuce and penile shaft. The pedicle is dissected to mobilize the flap and ventral placement is achieved by passing the flap in front of the penis by lateral rotation. The outer flap surface is then aligned with the urethral plate along its longitudinal axis. The flap is then sutured to the urethral plate using interrupted sutures with a 7-0 Polydioxanone suture (PDS) over a 8 French urethral stent. Glans wings are re-approximated using a 7-0 PDS. Then, the modification commences, whereby a tunica vaginalis flap is created through performing a right-sided scrotopasty. The tunica vaginalis situated on the anterior testis is incised creating a rectangular-shaped flap, which is then mobilized away from the testis and nearby cord structures. The tunica vaginalis flap is used as a second cover of the first preputial flap onlay. We then continue with the traditional approach, in which the remaining preputial skin flap is used as another onlay layer to cover the ventral skin defect using 5-0 rapid vicryl suture. Following the surgery, the urinary bladder is filled, and suprapubic catheter is placed for urinary drainage.
Postoperative protocol focused on optimizing patient health. A simple dressing was placed around the penis consisting of gauze and an adhesive covering. Dressings were removed 4 days following surgery, while urethral stents were removed on the 5–7 days after surgery.

Antibiotic prophylaxis was given for a total of 14 days, the duration the suprapubic catheter remained indwelling (suprapubic catheters were removed 14 days postoperatively). Patients were given intravenous cephalosporins for the duration of their hospital stay, which ranged from 3 to 8 days, followed by oral trimethoprim-sulfamethoxazole for the remaining days. Analgesia was given as required.

Patients were followed up for variable durations between 1.5 and 3 years (mean: 2.08). If complications requiring surgical correction occurred, patients had a second surgery as outpatients 6 months following the initial surgery. Furthermore, histories and examinations were taken during follow-up appointments, and observations were taken regarding the cosmetic and functional results (micturition time, central urinary stream).

Data collected concerned demographics, operative parameters, and postoperative care. This included operative age, type of hypospadias (proximal penile, penoscrotal, or scrotal positions), operative time, chordee approach used, the use of a cosmetic scrotoplasty, complications, hospital stay, days of suprapubic catheter placement, days of urethral stent placement, days before dressings were removed, the need for a second surgery, antibiotics, and follow-up duration. The data were plotted in an excel spreadsheet.

Statistical analysis was conducted using the SPSS statistics software, version 27 (IBM Corp., Chicago, IL, USA). Descriptive analyses were presented as frequencies, central tendencies (means), and dispersion indices (ranges and standard deviations). Correlations between categorical variables and outcomes were assessed using Chi-squares and the ANOVA logistic regression modality. P ≤ 0.05 rendered significant correlations.

Operative parameters, the necessary medical attention, postoperative care, and outcomes were recorded. Outcomes were assessed in terms of complication rates and cosmetic and functional outcomes.

Ethical approval was obtained from the responsible organization: “Ministry of Health Healthcare Research Committee.”

RESULTS

We analyzed the outcomes of 30 cases of severe hypospadias, excluding perineal hypospadias, who underwent the modified double-faced preputial flap urethroplasty at a single institution in Bahrain between January 2014 and December 2019. The operations were done by a single surgical team at the institution.

Patients’ characteristics overall in terms of operative age, type of hypospadias (penoscrotal or scrotal), and follow-up durations are outlined in Table 1.

The mean operative time was 2.65 h. Chordee was corrected by chordectomy or if unsuccessful by dorsal plication. Chordectomy was done for 14 (46.7%) chordee cases and dorsal plication for 16 (53.3%). Scrotoplasty was only done for cosmetic purposes when indicated due to the presence of scrotal hypoplasia; it was done for five patients (16.7%).

A total of 11 complications occurred [detailed in Table 2]. Proximal urethrocutaneous fistulas occurred in 10% of the patients. Penile edema was defined as significant swelling of the penis that lasted for more than 7 days and occurred in 13.3% of the patients in this study. Glanular dehiscence occurred in 10% of patients. Moreover, diverticula only occurred in 3.3% of cases (n = 1). There were no episodes of urethral strictures or penile rotation [Table 2]. The

### Table 1: Patient characteristics

| Variable                        | Modified technique |
|---------------------------------|--------------------|
| Total number of patients (n)    | 30                 |
| Mean age at surgery (years)     | 1.4, 1.4 (1-2)     |
| Type of hypospadias, n (%)      |                    |
| Penoscrotal                     | 19 (63.3)          |
| Scrotal                          | 22 (36.7)          |
| Mean follow-up duration (years) | 2.08, 2 (1.5-3)    |

### Table 2: Operative parameters

| Operative parameters                     | Modified technique (n=30) |
|------------------------------------------|----------------------------|
| Operative time (h), median (range)       | 2.65±0.46 (2.2-3.5)       |
| Chordee approach, n (%)                  | 14 (46.7)                 |
| Dorsal plication                          | 16 (53.3)                 |
| Scrotoplasty done, n (%)                 | 5 (16.7)                  |
| Complications (between groups P=0.16), n (%) |               |
| Total                                     | 11 (36.67)               |
| Diverticula                                | 1 (3.3)                   |
| Glanular dehiscence                       | 3 (10)                    |
| Penile edema                               | 4 (13.3)                  |
| Proximal urethrocutaneous fistula         | 3 (10)                    |
| Urethral stricture                         | 0                         |
| Penile rotation                            | 0                         |
| Second surgery - frequency (%)            | 7 (23.3)                  |
| Range – months from the time of the initial surgery to the second surgery (months) | 6-12 |

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Al Hindi and Khalaf: Modified double face preputial flap urethroplasty for repair of proximal hypospadias

Table 3: Complications in relation to other variables

| Variables assessed in relation to complication type | Complications |
|----------------------------------------------------|--------------|
| Type of hypospadias (P=0.47)                        |              |
| Penoscrotal                                         | n=6          |
| Penile edema                                        | 4            |
| Proximal urethrococutaneous fistula                 | 1            |
| Diverticula                                         | 1            |
| Glans dehiscence                                   | 0            |
| Scrotal                                             | n=5          |
| Penile edema                                        | 0            |
| Proximal urethrococutaneous fistula                 | 2            |
| Diverticula                                         | 0            |
| Glans dehiscence                                   | 3            |
| Chordee approach (P=0.41)                           |              |
| Chordectomy                                         | n=4          |
| Penile edema                                        | 3            |
| Proximal urethrococutaneous fistula                 | 1            |
| Diverticula                                         | 0            |
| Glans dehiscence                                   | 0            |
| Dorsal plication                                    | n=7          |
| Penile edema                                        | 1            |
| Proximal urethrococutaneous fistula                 | 2            |
| Diverticula                                         | 1            |
| Glans dehiscence                                   | 3            |
| Operative age (years) (P=0.87)                      |              |
| <1.5                                                | n=6          |
| Penile edema                                        | 3            |
| Proximal urethrococutaneous fistula                 | 2            |
| Diverticula                                         | 1            |
| Glans dehiscence                                   | 0            |
| ≥1.5                                                | n=5          |
| Penile edema                                        | 1            |
| Proximal urethrococutaneous fistula                 | 1            |
| Diverticula                                         | 0            |
| Glans dehiscence                                   | 3            |

The single-stage use of transverse tabularized double island preputial flap method for severe hypospadias was by Duckett.[9,14] Originally, the technique involved attaching the preputial flap tube to the dorsal prepuce while the urethral plate was excised. Subsequent studies urged to preserve the urethral plate, emphasizing that penile curvatures were not associated with the urethral plate mostly. Moreover, the technique was modified to a double preputial onlay flap which involved a layer attached to the preserved urethral plate (the neourethra) and the use of the remaining dorsa prepuce to cover the ventral penile skin defect. This modification was made to improve vascularity, which was hypothesized to reduce complications associated with suboptimal blood supply.[7,9,10] The double onlay technique showed reductions in complication rates in comparison to other surgical approaches.[14]

However, although complications were reduced with the double onlay method, there is still a percentage of patients who experience urethrococutaneous fistulas, glans dehiscence, and other complications. Urethrococutaneous fistulas are one of the most common complications associated with the surgical repair of hypospadias and many of patients who develop this complication may require second surgeries to repair the fistula. One of the procedures used to correct urethrococutaneous fistulas that follow hypospadias repair are distant flaps (including those from the tunica vaginalis). The modification we present in this study proposes an additional tunica vaginalis layer between the traditional double onlay, to provide an additional overlying layer of support and assess whether this extra layer can contribute to decreasing the rate of complications.

This modification also allows the incorporation of the tunica vaginalis layer in the initial hypospadias repair stage, as opposed to following the occurrence of a urethrococutaneous fistula after the hypospadias correction, which would necessitate another surgery which may involve the addition of a tunica vaginalis layer. The single-stage hypospadias surgical approach was selected due to the surgeons’ preference, as it was the technique the surgeon was most experienced with and the requirement for a single surgery and hence, a single exposure to general anesthesia. In this study, we assess efficacy in terms of functionality and outcomes as well as the implication on the rate of complications.

DISCUSSION

Severe hypospadias mandates surgical reconstruction of the missing parts of the urethra, covering penile skin deficiencies, and eliminating associated chordee. Moreover, severe hypospadias has been linked to a higher complication incidence in comparison to less severe forms, with rates ranging from 33% to 53.8%.[11-13]

To date, there is no consensus on the best way to surgically approach severe hypospadias, although various techniques have been implored to correct the defects associated. The preputial onlay island flap in particular has been associated with lower complication rates in comparison to other techniques such as the use of the buccal mucosa graft and the Koyanagi method. It has been praised by some surgeons for severe hypospadias in conditions where a healthy urethral plate and inner prepuce are available.[9,14]
In the literature, cumulative complication rates using the onlay island preputial flap method ranged from 28.5% to 45%.[14,16‑18] Our study reports a complication rate of 36.67% using the modified double onlay preputial flap technique, which falls within the range reported by the literature. Moreover, fistulas still pose a problem with the modified double onlay technique, although the rates have been lower than those reported with the preceding techniques described.[10] Baskin et al., Wallis et al., de Mattos e Silva et al., and Barroso et al. reported fistula rates ranging from 6% to 20% using the onlay procedure.[14,17,18] Our study found that the incidence of urethrocutoaneous fistulas using the modified method was only 10% (n = 3) which is in line with the lower ranges reported by the literature. Moreover, our study had a 10% rate of glanular dehiscence, and a 3.3% rate of diverticula following surgery. Furthermore, in Barroso et al.’s study related complication rates to other variables and found that complications occurred in more proximal hypospadias; yet in our study, there was no statistically significant correlation between the incidence of correlations in penoscrotal versus scrotal hypospadias (P = 0.47).[19] Moreover, our study found no significant correlations between age of intervention or chordee approach used (chordectomy or dorsal plication) and complications.

Finally, similar to other studies’ findings, we found good long-term functional and cosmetic outcomes using the modified double onlay technique.[7,9,20] These assessments were made using parents’ reports of central urinary output and good and uninterrupted urinary stream as well as physicians’ assessments during follow-up visits.

Limitations of this study include the lack of objective measures of urinary function such as uroflowmetry, partially due to the young participant age which meant some were not toilet trained. Moreover, short follow-up durations limit the assessment of further complications and long-term outcomes such as psychosocial implications and sexual function. In addition, the small number of patients included as well as the absence of a comparison group limits the ability to assess differences in outcomes compared to the standard onlay method. A second study would be needed to show whether the modified technique results in fewer complications.

CONCLUSION

The modified double onlay preputial flap urethroplasty led to good cosmetic and functional outcomes in severe hypospadias. The correction of the penile curvature was achieved mostly by dorsal plication. The modified surgical approach led to complication rates in line with the lower complication rates in the literature, however, a second study which compares outcomes to those in a control group would be needed to establish whether the modification has a significant impact on complication rates. There were no significant associations between the type of hypospadias, chordee approach and operative age and the rates of complications.

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Conflicts of interest

There are no conflicts of interest.

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