Evaluation of double faced transverse preputial (onlay) island flap for hypospadias repair in pediatrics: a randomized controlled study

Mohammad Daboos1 · Khalid Hefney1 · Muhammad Abdelhafez Mahmoud1 · Ahmed Salama1 · Yousef Mohammed1 · Mohammed Hussein1 · Mohamed Abdelmaboud1 · Tharwat Hussein1 · Yasser Ashour1 · Samir Gouda1

Received: 7 January 2022 / Accepted: 15 March 2022 / Published online: 24 April 2022 © The Author(s) 2022

Abstract

Background The preputial onlay island flap technique has been popularized for hypospadias repair as a result of offering a consistent combination of acceptable functional and cosmetic results. Like other techniques, urethrocutaneous fistulae and stricture continues to be the most common complications, in addition to other complications, which could be attributed to the compromise in flaps vascularity. Some authors describe a technique that resolves some of these problems by combining the unique benefits of the double faced preputial flaps. The aim of this study:- to evaluate double faced preputial onlay island flap technique for complications rate, outcomes of surgical procedure, and cosmetic results in comparison to transverse inner preputial flap technique.

Patients and methods This was a prospective randomized controlled study that included 68 patients with anterior, mid-penile, and posterior penile hypospadias, with shallow and narrow urethral plate of size less than 6 mm, who underwent single-stage repair using preputial flaps, conducted at the department of pediatric surgery (Al-Azhar University, Cairo, Egypt), between May 2019 and October 2021, to evaluate double faced transverse preputial onlay island flap technique. Thirty-four patients underwent double faced transverse preputial onlay island flap (group A) and another 34 patients underwent inner transverse preputial onlay island flap (control group) (group B). The follow-up period ranged from 12 to 26 months.

Results The overall complication rate was 20.5% (14 of 68 children). Complications developed in 5 cases (14.7%) in group A who underwent double face onlay island flap (2 glannular dehiscence, 1 penile rotation, 1 fistula, and 1 diverticulum), as opposed to 9 patients in group B (26.4%) who underwent transverse inner preputial flap (3 developed glannular dehiscence, 2 skin flap necrosis, 3 fistulae, and 1 diverticulum). After management of the complications, all patients had good surgical outcomes with satisfactory cosmetic results.

Conclusion Double faced transverse preputial onlay island flap is an alternative option to reconstruct narrow urethral plate hypospadias. So that double faced transverse preputial onlay island flap technique appears to achieve satisfactory surgical outcomes with lower complication rate.

Keywords Double face · Onlay island flap · Inner preputial flap · Hypospadias in pediatrics

Introduction

The preputial onlay island flap technique has been popularized for hypospadias repair as a result of offering a consistent combination of acceptable functional and cosmetic results. Like other techniques, urethrocutaneous fistulae, urethral stricture, and recurrence, continue to be the common postoperative complications. All those complications can be attributed to insufficiency of flaps vascularity [1–6]. Some authors describe a technique that resolves some of these problems by combining the unique benefits of the double faced preputial flap to achieve successful repair with fewer complications and provide better cosmetic outcomes. [7–9] In this study, we aimed to evaluate double faced preputial onlay island flap in hypospadias repair for incidence of complications, outcomes of surgical procedure, and cosmetic results.
Patients and methods

This was a prospective randomized controlled study conducted at Al-Houssain and Sayed Galal University Medical Centers (department of pediatric surgery, Al-Azhar University) in the period from May 2019 to October 2021, to evaluate double faced transverse preputial onlay island flap. Sixty-eight patients fulfilled the required criteria were included in the study. The subjects were limited to the patients diagnosed as anterior, mid-penile, or posterior penile hypospadias with shallow and narrow urethral plate measuring less than 6 mm, without or with mild penile curvature of less than 30° after degloving of the penis. Patients were randomly allocated to undergo one of two surgical techniques (Group A and B) using closed sealed envelope method. Thirty-four patients underwent hypospadias repair using double faced transverse preputial onlay island flap (Group A). And the remaining 34 patients underwent inner transverse preputial onlay island flap repair (Group B).

Patients with wide urethral plate suitable for Tubularized Incised Plate (TIP) urethroplasty, other types of hypospadias as penoscrotal, scrotal, or perineal hypospadias, patients with moderate or severe penile curvature and recurrent cases were excluded from this study.

All operations were done by the same surgical team. Our institutional review board approval was obtained (IRB: 00,012,368–19-05–009) and the study was registered at ClinicalTrials.gov (ID: NCT05144659). All procedures were performed after signed written informed consent by the parents. Main outcome measurements included: postoperative complications, surgical outcomes, and cosmetic results, all were assessed by Hypospadias Objective Scoring Evaluation (HOSE) questionnaire at follow-up visits.

Surgical procedures

Under general anesthesia, after draping, a traction suture was placed in the glans and the urethral plate is defined by 2 parallel incisions, which were curved proximally to the original meatus. An incision was made circumferentially 2–3 mm. proximal to the coronal sulcus. The penile skin was degloved along Buck’s fascia proximally down to penopubic junction. All fibers bands around the corpus spongiosum were excised to correct any curvature which was present. Artificial erection test was performed to identify the site and degree of ventral penile curvature which was measured using digital goniometer. In cases with residual mild curvature, dorsal corporeal plication was done using 2 midline 5/0 silk sutures at 12 o’clock.
Results

The present study included 68 children. Their age at repair ranged from 12 months to 7 years (mean: 3.2 years) in group A, and ranged from 10 months to 7.5 years (mean: 3.3 years) in Group B. Follow-up period ranged between 12 and 26 months. Thirty-four patients underwent single-stage hypospadias repair, using double faced preputial onlay island flap (group A), included (15 anterior penile, 16 mid-penile, and 3 cases with posterior penile hypospadias), and 34 patients underwent inner preputial onlay island flap (group B), included (16 anterior penile, 16 mid-penile, and 2 cases with posterior penile hypospadias).

The overall complication rate was 20.5% (14 of 68 children). Complications developed in 5 cases (14.7%) in group A who underwent double faced onlay island flap (2 cases of glannular dehiscence, 1 case of penile rotation, 1 case of urethrocutaneous fistula, and 1 case of diverticulum), while 9 patients developed complications in group B (26.4%) who underwent transverse inner preputial onlay island flap (3 cases developed glannular dehiscence, 2 cases of skin flap necrosis, 3 cases of urethrocutaneous fistulae and 1 case of diverticulum). The difference between the complications rate in both groups was statistically significant (p-value > 0.05) Table 1.

Postoperatively, all patients were submitted to Hypospadias Objective Scoring Evaluation (HOSE) to evaluate the outcomes regarding the incidence of complications and cosmetic results Table 2.

The postoperative HOSE score in Group A ranged between 12 and 16 and the mean was (14.9 ± 1.1), while the mean postoperative HOSE score in Group B was
1474 International Urology and Nephrology (2022) 54:1471–1477

(12.4 ± 1.7), ranging between 10 and 16. The difference between two groups regarding HOSE score was statistically significant Table 3.

Four children underwent fistula repair at a second operation. The parents of the child with penile rotation refused the second operation. The children with glans dehiscence

---

**Table 1** Complication rate of double face preputial onlay island flap (Group A) and inner preputial onlay island flap (Group B)

| Complications                | Group A (n = 34) | Group B (n = 34) | $x^2$  | p-value |
|------------------------------|------------------|------------------|--------|---------|
| Urethrocutaneous fistula     | 1 (2.9%)         | 3 (8.8%)         | 3.935  | 0.047*  |
| Flap necrosis                | 0 (0.0%)         | 2 (5.8%)         | 4.201  | 0.020*  |
| Glanular dehiscence          | 2 (5.8%)         | 3 (8.8%)         | 2.207  | 0.137   |
| Penile rotation              | 1 (2.9%)         | 0 (0.0%)         | 0.986  | 0.321   |
| Urethral diverticulum        | 1 (2.9%)         | 1 (2.9%)         | 0.000  | 1.000   |
| Total complications          | 5 (14.7%)        | 9 (26.4%)        | 6.924  | <0.031* |

The difference between the complication rates in both groups was statistically significant. Using: chi-square test; $p$-value > 0.05 NS; *$p$-value < 0.05 S; **$p$-value < 0.001 HS
were treated successfully in a second repair. Two children with flap necrosis were treated successfully by tubularized urethroplasty and another 2 cases of urethral diverticulum were managed successfully by reduction urethroplasty. After management of the complications, all patients had good surgical outcomes and satisfactory cosmetic results (Fig. 3).

Discussion

The concept of a vascularized preputial island flap was introduced by Hook in 1896 [10]. Asopa and colleagues developed the first very effective use of inner preputial skin for a substitution urethroplasty [8]. Duckett developed this by describing a transverse island tube repair in 1980. By 1980s gradually, it became recognized that most penile curvatures in hypospadias is due to the skin and subcutaneous tissue asymmetry. So that after correction of the curvature, the urethral plate could be safely incorporated into a hypospadias repair [11–13].

Many authors suggested that the dissection of the vascularized pedicle flaps from dorsal preputial tissue may affect the vascularity and increase the complication rate and also showed that transferring the flap with its skin covering appears to achieve better results [7–9, 14].

Penoscrotal and the most proximal hypospadias are usually associated with moderate or severe penile curvature in about 68–70%, so only 11–24% of surgeons preferred to do onlay island flap in such cases, On the other hand, more than 50% of hypospadias surgeons preferred to do staged repair [15, 16]. Braga et al. in their study submitted 40 patients with proximal hypospadias for onlay island flap urethroplasty. As a result, complications occurred in 45% of patients, and they reported that recurrent ventral penile curvature was more frequent. So, in this study, we preferred to exclude the cases with penoscrotal or the most proximal

| Variable of HOSE | HOSE score | No of patients in Group A (n = 34) | No of patients in Group B (n = 34) |
|------------------|------------|-----------------------------------|-----------------------------------|
| **Meatal location** |            |                                   |                                   |
| Distal glanular   | 4          | 32                                | 29                                |
| Proximal glanular | 3          | 2                                 | 2                                 |
| Coronal           | 2          | 0                                 | 1                                 |
| Penile shaft      | 1          | 0                                 | 2                                 |
| **Meatal shape**  |            |                                   |                                   |
| Vertical slit     | 2          | 11                                | 13                                |
| Circular          | 1          | 23                                | 21                                |
| **Urinary stream**|            |                                   |                                   |
| Single stream     | 2          | 31                                | 29                                |
| Sprayed           | 1          | 3                                 | 5                                 |
| **Erection**      |            |                                   |                                   |
| Straight          | 4          | 34                                | 34                                |
| Mild angulation   | 3          | –                                 | –                                 |
| Moderate angulation| 2         | –                                 | –                                 |
| Sever angulation  | 1          | –                                 | –                                 |
| **Fistula**       |            |                                   |                                   |
| None              | 4          | 33                                | 31                                |
| Single distal     | 3          | 1                                 | 1                                 |
| Single proximal   | 2          | 2                                 | 2                                 |
| Multiple or complex| 1         | –                                 | –                                 |

In group A, the score ranged between 12 and 16, while in group B, the score ranged between 10 and 16.

HOSE score, defined by Holland et al. in 2001

Table 3 The difference between HOSE score for both groups was statistically significant

| Mean HOSE score | Group A (n = 34) | Group B (n = 34) | P-value |
|-----------------|------------------|------------------|---------|
| Mean ± SD       | 14.9 ± 1.1       | 12.4 ± 1.7       | <0.001**|

Using: independent sample t-test; p-value < 0.001 HS

Fig. 3 Late pictures of double faced onlay island preputial flap technique
hypospadias and cases with moderate or severe penile curvature, to provide better surgical outcomes and avoid recurrence of penile curvature. [17].

In this study, we agreed with Gonzalez et al. 1996 in their series, emphasizing that double faced onlay preputial flap technique has resulted in satisfactory functional, cosmetic outcomes, and low complication rates [7].

Abdelhaset al. 2017 and Daboos et al. 2020 suggested that the dissection of the vascularized pedicle flap from dorsal preputial tissue may affect the vascularity and increase the complication rate, and also showed that transferring the tube or flap with its skin covering appears to achieve better results [9, 14].

In the present study, we performed a one-stage procedure using two well-established techniques to repair anterior and mid-penile hypospadias in 68 cases without or with mild penile chordee, categorized into two groups. The first group (group A) underwent double face preputial onlay island flap procedure. While second group (group B) underwent inner transverse preputial onlay island flap procedure. Five cases (14.7%) developed Complications in (group A), while 9 patients (26.4%) developed complications in (group B), with statistically significant difference of complications between two groups. Barroso et al. 2000 reported that complications requiring reoperation occurred in 12 patients (25%) in 47 children who underwent double faced onlay island flap repair. In their series, they have higher incidence of urethrococutaneous fistulae (8 cases i.e. about 17%), while in our series, we have one case of urethrococutaneous fistula (2.9%). The lower rate of fistulae in our study may be due to meticulous dissection of preputial flap with preservation of its vascularity, adequate and integrated closure, in addition to the dorsal non dissected skin flap covering, provided more protection and securing for the suture lines. Also, they have higher rate of urethral diverticulum (about 4 cases). So, proper measuring of the flaps width and length leads to lower incidence of diverticulum in our series [18].

In the current study, we have results nearly similar to those of Chin et al. 2001, regarding the urethrococutaneous fistula and glannular disruption, after hypospadias repair using a double faced onlay island flap performed in 15 patients with middle and posterior penile hypospadias. Postoperative complications with Chin et al. occurred in 2 patients: 1 developed a subcoronal fistula and 1 had dorsal skin necrosis and suture disruption of the glannular wings. The overall complication rate was 13% and they reported that method provides a well-vascularized ventral skin cover and reduces the area of avascular dorsal skin [19].

El dahshoury et al. 2013 adopted the technique of double faced onlay island flap in 160 cases of distal and mid-shaft hypospadias and they had similar incidence of urethral diverticulum, penile rotation, and one case of glannular dehiscence in spite of they had harvested the outer preputial layer as a triangular flap sutured to the ventral aspect of the proximal non-approximated glannular wings, to avoid closure of the glannular wings under tension. In this study, we also agree with El dahshoury et al., in that penile torsion was recorded in only one case due to insufficient dissection of penile skin down to the penopubic angle [20].

Outcomes of hypospadias repair can be analyzed using both objective and subjective criteria. Objective criteria include functional evaluation of micturition by uroflowmetry, which is difficult to interpret in children as its profile is often abnormal even if reconstruction is satisfactory, may be due to child cooperation difficulties. [9] Objective evaluation of urinary function using uroflowmetry could not be done in this study due to difficulty in cooperation, as most of cases were before toilet training age.

By reviewing the literature, few studies had adopted HOSE score for assessment of postoperative outcome after onlay island flap procedure. In spite of HOSE score has been validated as a pediatric objective scoring system for evaluating the outcomes of hypospadias repair, as it incorporates the outcomes of meatal location, shape, urinary stream, the straightness of erection, and any urethral fistula [21].

In their original series for application of HOSE score, Holland et al. 2001, had used HOSE score for assessment of postoperative outcomes of different hypospadias repair techniques (including onlay island flap for 11 patients from a total of 20 patients) for repair of anterior and middle hypospadias. The HOSE assessment gave a total score of 12–16 [21]. Seibold et al. 2010 showed that the mean HOSE score was 15 (range 12–16) out of a maximum score of 16, with a score of 14 or greater defined as excellent. Ninety-three patients (94%) reached the maximum of 16 points. Six patients (6%) reached 12–15 points. Hence, 96 patients (97%) had an excellent surgical outcome [22].

A score of 14 or more (maximum score of 16) was suggested by Liu MM et al. 2015 in their series on different techniques to infer an acceptable outcome [23]. We came from the same way as the previous studies; because we found 29 cases (about 85%) in group A and 25 cases (about 74%) in group B achieved more than 14 points. And the least score ranged between 10 and 12 points were reported in both groups. At the end of this study, we can say that our series is the only one that applied HOSE score for assessment of Double Faced Onlay Island Flap.

Limitations of this study included: relatively small number of cases, due to COVID-19 pandemic restriction, and relatively short follow-up period, so a larger number of cases with a longer follow-up period is recommended by the authors.
Conclusion

Double faced transverse preputial onlay island flap is an alternative option to reconstruct narrow urethral plate hypospadias. So that double faced transverse preputial onlay island flap technique appears to achieve satisfactory surgical outcomes with lower complication rate.

Funding  Open access funding provided by The Science, Technology & Innovation Funding Authority (STDF) in cooperation with The Egyptian Knowledge Bank (EKB). None.

Declarations

Conflict of interest  No conflict of interest and no financial disclosures.

Ethical statements  The study protocol was approved by our Hospital’s IRB and Ethics Committee.

Patient consent  Written informed consent was obtained from parents. The consents were approved by our Hospital’s Ethics Committee.

Open Access  This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

1. Hollowell JG, Keating MA, Snyder HM, Duckett JW (1990) Preservation of the urethral plate in hypospadias repair: extended applications and further experience with the onlay island flap urethroplasty. J Urol 143:98
2. Mollard P, Castagnola C (1994) Hypospadias: the release of chordae without dividing the urethral plate and onlay island flap (92 cases). J Urol 152:1238
3. Xiao D, Nie X, Wang W et al (2014) Comparison of transverse island flap onlay and tubularized incised-plate urethroplasties for primary proximal hypospadias: a systematic review and meta-analysis. PLoS ONE 9(9):e106917
4. Baskin LS, Duckett JW, Ueoka K et al (1994) Changing concepts of hypospadias curvature lead to more onlay island flap procedures. J Urol 151:191
5. Wiener JS, Sutherland RW, Roth DR et al (1997) Comparison of onlay and tubularized island flaps of inner preputial skin for the repair of proximal hypospadias. J Urol 158:1172
6. Aritonang J, Rodjani A, Wahyudi I, Situmorang GR (2020) Comparison of outcome and success rate of onlay island flap and dorsal inlay graft in hypospadias reconstruction: a prospective study. Rep Urol 16(12):487–494
7. Gonzalez R, Smith C, Denes ED (1996) Double onlay preputial flap for proximal hypospadias repair. J Urol 156:832–835
8. Asopa R, Asopa HS (2013) One stage repair of hypospadias using double island onlay preputial skin tube. Indian J Urol Rev J 1(41):1984
9. Elemam A, Taha SM, Gismalla MD (2017) Transverse Ventral Island Preputial Tube Versus Double Face Preputial Tube in the Repair of Penoscrotal Hypospadias: Does the Dissection of the Tube from Dorsal Preputial Skin Affect the Outcome of Repair? Global Journal of Medical Research: I Surgeries and Cardiovascular System, vol 17, no 1, Version 1.0
10. Horton CE, Devine CI Jr, Barcat N (1973) Pictorial history of hypospadias repair techniques. In: Horton CE (ed) Plastic and reconstructive surgery of the genital area. Little Brown, Boston, pp 237–248
11. Duckett JW (1980) Transverse preputial island flap technique for repair of severe hypospadias. Urol Clin North Am 7:423
12. Avellan L, Knuttson F (1980) Microscopic studies of curvature causing structures in hypospadias. Scand J Plast Reconstr Surg 14:249–258
13. Snodgrass WT, Patterson K, Plaire JG et al (2000) Histology of the urethral plate: implications for hypospadias repair. J Urol 164:988
14. Daboos M, Helal AA, Salama A (2020) Five years’ experience of double faced tubularized preputial flap for penoscrotal hypospadias repair in pediatrics. J Pediatr Urol 16(5):673.1–7
15. Hayashi Y, Kojima Y (2008) Current concepts in hypospadias surgery. Int J Urol 15(8):651–664
16. Cook A, Khoury AE, Neville C, Bagli DJ, Farhat WA, Pippi Salle JL (2005) A multicenter evaluation of technical preferences for primary hypospadias repair. J Urol 174(6):2354–2357
17. Braga LH, Pippi Salle JL, Lorenzo AJ, Skeldon S, Dave S, Farhat WA, Khoury AE, Bagli DJ (2007) Comparative analysis of tubularized incised plate versus onlay island flap urethroplasty for penoscrotal hypospadias. J Urol 178(1):1451–1456
18. Barroso U Jr, Jednak R, Spencer Barthold J, González R (2000) Further experience with the double onlay preputial flap for hypospadias repair. J Urol 164(3):998–1001
19. Chin TW, Liu CS, Wei CF (2001) Hypospadias repair using a double onlay preputial flap. Pediatr Surg Int 17(5–6):496–498
20. El Dahshoury ZM, Gamal W, Hammady A, Hussein M, Salem E (2013) Modified double face onlay island preputial skin flap with augmented glanuloplasty for hypospadias repair. J Pediatr Urol 9(6):745–749
21. Holland AJ, Smith GH, Ross FI, Cass DT (2001) HOSE: an objective scoring system for evaluating the results of hypospadias surgery. BJU Int 88(3):255–258
22. Seibold J, Werther M, Alloussi S, Gakis G, Schilling D, Colleselli D, Stenzl A, Schwentner C (2010) Objective long-term evaluation after distal hypospadias repair using the meatal mobilization technique. Scand J Urol Nephrol 44(5):298–303
23. Liu MM, Holland AJ, Cass DT (2015) Assessment of postoperative outcomes of hypospadias repair with validated questionnaires. J Pediatr Surg 50(12):2071–2074

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.