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https://doi.org/10.21608/zumj.2025.379115.3926 Manuscript ID:ZUMJ-2504-3926 DOI:10.21608/ZUMJ.2025.379115.3926 ORIGINAL ARTICLE

Outcomes of Onlay Island Flap (OIF) Versus Dorsal Inlay Graft (DIG) for Repair of Anterior and Middle Hypospadias with Narrow Urethral Plate: A Comparative Study

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ABSTRACT

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Submit Date:28-04-2025 **Accept Date**:13-05-2025 Background: Hypospadias is a common congenital anomaly of the male urethra that often necessitates surgical repair, particularly when a narrow urethral plate is present. Various techniques, including the Dorsal Inlay Graft (DIG) and Onlay Island Flap (OIF), have been developed to optimize outcomes. This study compares the efficacy and outcomes of the DIG and OIF techniques in repairing anterior and middle hypospadias with narrow urethral plates. Methods: A retrospective review was conducted on 48 male patients with anterior and middle hypospadias and narrow urethral plates who underwent surgery between 2018 and 2022. Patients were divided into two groups: 22 underwent the OIF technique and 26 underwent the DIG technique. Clinical characteristics, surgical details, and postoperative complications were collected from medical records. Outcomes were assessed using the Hypospadias Objective Scoring Evaluation (HOSE) score after at least six months of follow-up. Parental satisfaction was evaluated using the Pediatric Penile Perception Score (PPPS). Results:No significant differences were found between the two groups regarding age, hypospadias type, or degree of chordee. Postoperative complications occurred in 13.5% of the OIF group and 15% of the DIG group, with no statistically significant difference. Functional and cosmetic outcomes, based on HOSE scores and parental satisfaction, were comparable between groups. Conclusions: Both the Dorsal Inlay Graft and Onlay Island Flap techniques are safe and effective for repairing anterior and middle hypospadias with narrow urethral plates, offering favorable outcomes with low complication rates.

Keywords: Hypospadias; Urethral Plate; Onlay Island Flap; Dorsal Inlay Graft; Pediatric Urology.

INTRODUCTION

Hypospadias represents one of the most common congenital anomalies of the genitourinary system, second only to cryptorchidism, with a reported incidence of approximately 1 in 200 to 1 in 300 live births [1,2].Over 300 surgical techniques and modifications have been described for its correction, reflecting the complexity and variability of the condition [3].

In 1994, Snodgrass introduced the tubularized incised plate (TIP) urethroplasty, which has since become the most widely adopted technique for hypospadias repair

due to its favorable cosmetic and functional outcomes [4,5]. However, the TIP technique is associated with a higher rate of complications when applied to patients with a narrow urethral plate (<8 mm), often resulting in a stenotic and inelastic neourethra [6-8].In such cases, alternative techniques that preserve and augment the urethral plate are preferred. Among these, the dorsal inlay graft (DIG) and onlay island (OIF) procedures have gained flap popularity [9–12]. Both techniques aim to widen and reinforce the urethral plate, facilitating the formation of a functionally

and cosmetically acceptable neourethra. The choice between DIG and OIF is typically influenced by the operating surgeon's expertise and preference. The present study aims to evaluate and compare the surgical outcomes and postoperative complications of DIG versus OIF techniques in the repair of anterior and middle hypospadias with narrow urethral plates, based on the experience of our department over the past five years.

METHODS

This retrospective comparative study included male patients diagnosed with anterior and middle hypospadias, classified according to the 2020 European Association of Urology (EAU) guidelines [13], who were operated on between January 2018 and December 2022 at our pediatric surgery unit.

Ethical Approval:

This study was conducted in accordance with the ethical guidelines of Zagazig University and received institutional review board approval. IRB#(838/13-11- 2024).

patients included in the study All demonstrated a urethral plate width of less than 8 mm, in association with variable degrees of ventral penile curvature (chordee).Surgical correction was performed using either the Onlay Island Flap (OIF) or Dorsal Inlay Graft (DIG) techniques.

Exclusion Criteria:

Patients were not included in the study if they met any of the following exclusion criteria:

- Urethral plate width greater than 8 • mm
- History of previous failed • hypospadias repair with a scarred or unhealthy urethral plate
- Prior circumcision

Surgical Techniques:

All procedures were conducted as singlestage repairs by experienced pediatric surgeons. The OIF technique was performed following the standard approach described

by John P. et al. [14] and later adapted by Ricardo G. et al. [12]. In this technique, a preputial flap was transposed onto the urethral plate to augment and tubularize the neourethra.

The DIG technique was based on the Snodgraft modification [9,10], with a dorsal midline incision of the urethral plate followed by graft augmentation extending to the glans tip, as described by Cherian A. et al. [11] and Ahsen A. et al. [15]. In both techniques, neourethral coverage was achieved using a vascularized flap derived from the prepuce or dartos fascia.

Data Collection:

Eligible cases were grouped based on the surgical technique used (OIF vs. DIG). Data were retrospectively extracted from medical records and included patient age. hypospadias type, urethral plate width (measured at the widest point), chordee severity (measured intraoperatively with a goniometer), operative time, details of the catheter procedure, duration. and postoperative complications.

Postoperative Evaluation and Follow-Up:

Families were contacted by phone and invited for follow-up in the outpatient clinic at least six months postoperatively. Outcome assessment was performed using the validated Hypospadias Objective Scoring Evaluation (HOSE) system, which includes parameters such as meatal location and shape, urinary stream, penile straightness, and fistula presence [16]. (See Table 3)

Parental satisfaction was assessed using the Pediatric Penile Perception Score (PPPS), which evaluates cosmetic aspects including meatal appearance, glans configuration, and overall aesthetic penile shape, impression [17]. Responses were obtained structured through а questionnaire completed by the parents during follow-up. (See Table 4).

Statistical Analysis

Data were analyzed using SPSS software version 20. Continuous variables were expressed as mean \pm standard deviation (SD), and comparisons between the two groups were performed using the independent Student's t-test. A p-value <0.05 was considered statistically significant, with a 95% confidence interval.

RESULTS

A total of 48 boys with anterior or middle hypospadias and a narrow urethral plate underwent surgical reconstruction during the study period. The cohort was divided into two groups: 22 patients (45.8%) received the Onlay Island Flap (OIF) repair, while 26 patients (54.2%) underwent the Dorsal Inlay Graft (DIG) procedure. Table 1 summarizes the baseline demographic and clinical profiles of the study population. The median age at surgery was 3.3 ± 1.5 years in the OIF group and 3.8 ± 1.8 years in the DIG group, with no statistically significant difference observed. Among the OIF group, 13 patients (59%) had anterior hypospadias and 9 (41%) had middle-type. Similarly, within the DIG group, anterior hypospadias was observed in 16 patients (61.5%), whereas 10 patients (38.5%) had middle hypospadias. The severity of chordee differed between the two groups, with moderate curvature being the most common presentation-observed in 45.4% of patients in the OIF group and 46.1% in the DIG group. Mild curvature was seen in 31.8% (OIF) and 34.6% (DIG), while severe chordee was reported in approximately 22% of each group. The width of the urethral plate ranged from 4.2 to 7 mm in the OIF group and from 5.1 to 7 mm in the DIG group. Postoperative complication rates were comparable between the two groups, recorded at 13.5% for OIF and 15% for DIG, with no statistically significant difference. The most frequently encountered complication was urethrocutaneous fistula. Only one case of urethral stricture was reported in the DIG group, while no such complications occurred in the OIF group.

Meatal retraction was reported in one case within the OIF group. Full details of complications are presented in Table 2.Follow-up evaluations were conducted at least six months postoperatively. Using the Hypospadias Objective Scoring Evaluation (HOSE) system (Table 3), both groups demonstrated similar penile axis outcomes, with straight alignment achieved in 86% (OIF) and 88% (DIG) of cases. Mild residual curvature was noted in the remaining patients, while no cases of moderate or severe angulation were recorded in either group. Notable differences were observed in the evaluation of the external urethral meatus between the groups. The DIG group showed superior results in terms of meatal location and contour. statistically However. significant no difference was observed in the overall HOSE score between the two techniques. Parental satisfaction, assessed via the Pediatric Penile Perception Score (PPPS) (Table 4), revealed no significant differences in cosmetic satisfaction regarding glans shape, penile shaft appearance, or overall penile aesthetics. However, parents in the DIG group reported higher satisfaction with the position and shape of the external meatus compared to those in the OIF group.

Variable	(OIF) group	(DIG) group	P- value
Number	n= 22	n= 26	
Age	3.3±1.5	3.8±1.8	0.42
Type of hypospadias :		16 (61.5%)	
Anterior	13 (59%)		
Middle	9 (41%)	10 (38.5%)	
Chordee:			
No – Mild	7 (31.8%)	9 (34.6%)	
Moderate	10 (45.4%)	12 (46.1%)	0.95
Severe	5 (22.7%)	5 (19.2%)	
Plate width:	5.2±1.65	5.9±1.73	0.63

Table. 1 : Subjective patients characteristics

No significant difference or association founded between groups

 Table 2: Post-operative Complications

Complications	OIF Group $(n = 22)$	DIG Group $(n = 26)$	p-value
Fistula	1 (4.5%)	2 (7.6%)	0.37
Stricture	0	1 (3.8%)	0.15
Glans dehiscence	0	1 (3.8%)	0.15
Tissue loss (Failure)	1 (4.5%)	0	0.09
Meatal retraction	1 (4.5%)	0	0.09
Total Complications	3 (13.5%)	4 (15%)	0.77

 Table 3 : HOSE Score

HOSE variable	HOSE	(OIF) group	(DIG) group 26 Ptn	P-value
	5010	22 1 011.	20 1 011	
Meatal Location :		N= (%)	N= (%)	
Tip of glans	4	20 (91%)	25 (96%)	
Proximal glans	3	2 (9%)	1 (4%)	0.45
Coronal	2	0	0	
Penile shaft	1	0	0	
Meatal shape				
Vertical slit	2	18 (82%)	24 (92%)	0.27
circular	1	4 (18%)	2 (8%)	
Urinary stream				
Single stream	2	20 (91%)	25 (96%)	0.45
spray	1	2 (9%)	1 (4%)	
Penile axis				
Straight	4	19 (86%)	23 (88%)	
Mild angulation	3	3 (14%)	3 (12%)	0.82
Moderate angulation	2	0	0	
Severe angulation	1	0	0	
Fistula				
None	4	0	0	

HOSE variable	HOSE score	(OIF) group 22 Ptn.	(DIG) group 26 Ptn.	P-value
Single proximal	3	1 (4.5%)	1 (4%)	
Single distal	2	0	1 (4%)	0.38
Multiple or complex	1	0	0	

(Minimum total score is 5 Maximum total score is 16),No significant difference or association founded between groups

 Table. 4 : PPPS score (for parent's satisfaction)

Outcome Variable	(OIF)group	(DIG)group	P -value
	22 ptn.	26 ptn.	
Patient Satisfaction	n= (%)	n= (%)	
Meatal Shape &position			
Very dissatisfied	0	0	
Dissatisfied	4 (18%)	3 (11.5%)	0.81
Satisfied	14 (63.5%)	18 (69%)	
Very satisfied	4 (18%)	5 (19%)	
Glans Shape			
Very dissatisfied	0	0	
Dissatisfied	2 (9%)	2 (7.5%)	
Satisfied	14 (63.5%)	19 (73%)	0.77
Very satisfied	6 (27%)	5 (19%)	
Penile Skin Shape			
Very dissatisfied	0	0	
Dissatisfied	2 (9%)	2 (7.5%)	
Satisfied	17 (77%)	20 (77%)	0.97
Very satisfied	3 (13.5%)	4 (15%)	
General Cosmetic			
Appearance	0	0	
Very dissatisfied	3 (13.5%)	3 (11.5%)	
Dissatisfied	15 (68%)	19 (73%)	0.93
Satisfied	4 (18%)	4 (15%)	
Very satisfied		× , , , , , , , , , , , , , , , , , , ,	

Overall, the median PPPS score was $(11.9\pm3.58 \& 13.2\pm4.7)$ with no significant difference between groups .

Table.5 : Overall satisfaction rate for both techniques

Patient's satisfaction	(OIF)group	(DIG)group	P-value
Very dissatisfied	0	0	
Dissatisfied	3 13.5%	3 11.5%	
Satisfied	15 68%	19 73%	
Very satisfied	4 19.3%	4 15.3%	0.96

No significant difference founded regards satisfaction

DISCUSSION

The urethral plate serves as a favorable tissue for neourethral reconstruction in hypospadias surgery, given its embryological role in forming the penile urethra and its rich vascular supply [18]. Its preservation has been associated with reduced complication rates and improved functional outcomes [19]. Additionally, maintaining the integrity of the plate helps

avoid the formation of a dilated neourethra and facilitates effective urine propulsion formation. without diverticulum This supports the rationale for preserving the urethral plate, even in patients with mild to moderate chordee [19]. The introduction of the tubularized incised plate (TIP) technique by Snodgrass in 1994 marked a major advancement in hypospadias repair [4]. The core principle of this technique is the midline incision of the urethral plate, which enables the creation of a tension-free tubularization[20].However, there remains debate regarding the healing process of this incision-some studies suggest epithelial regeneration [21], while others indicate fibrosis, potentially leading to long-term narrowing of the neourethra [22]. A particularly challenging scenario arises when the urethral plate is narrow, as dorsal incision creates a wider raw area with unpredictable healing. Bhat et al. observed a significant rise in complication rates among patients with narrow urethral plates, reporting 50% in adults and 21.4% in children, whereas no complications were noted in cases with wider plates [23]. In a comparable study, Holland and Smith highlighted elevated complication rates when the urethral plate was narrower than 8 mm [16]. Sarhan et al. further supported these findings. reporting greater complications in patients with plates narrower than 8 mm [24]. Consequently, enhancing the narrow urethral plate with either a flap or graft may lead to improved outcomes [9–12]. The OIF technique involves a vascularized preputial flap, which enhances tissue viability. However, the presence of two suture lines may increase risk of urethrocutaneous the fistula. Conversely, the DIG technique, which utilizes a free graft, features a single suture line, although it lacks an intrinsic vascular supply. In this study, both groups were similar in age, type of hypospadias, degree

of ventral curvature, and urethral plate width (Table 1). The complication rates were low and not significantly different between the OIF (13.5%) and DIG (15%) groups (Table 2). These rates are favorable compared to those reported in unaugmented TIP repairs for narrow plates, where complications range from 21.4% to 50% [23]. Postoperative penile straightening was achieved in most patients, with over 86% demonstrating a straight axis. Most cases of chordee were corrected through penile degloving and dissection of fibrous tissue, with only two cases requiring plication. Preservation of the urethral plate did not compromise correction of curvature, consistent with histological findings by Snodgrass et al., who reported healthy vascular tissue in the plate without dysplastic or fibrotic elements [25]. Using the HOSE score to assess outcomes (Table 3), both techniques produced comparable results in terms of urinary stream, penile and fistula formation. Parental axis. satisfaction, assessed via PPPS score (Table 4), also revealed no significant difference in general cosmetic outcome. However, the DIG group showed superior outcomes in terms of meatal location and shape, exhibiting a higher prevalence of vertically slit-shaped and glanular meatus. These findings align with those of Johannes A. et al., who observed similar complication and satisfaction rates for both techniques [12]. Omran M. et al. also reported superior functional results with DIG in narrow plates, although cosmetic results were comparable [26]. Weber D. et al. noted no significant difference in penile appearance after repair between the two techniques [27].

Conclusions:

This study concludes that both Onlay Island Flap and Dorsal Inlay Graft techniques are safe and effective for managing anterior and middle hypospadias with a narrow urethral plate. Although overall functional and cosmetic outcomes are similar, the DIG technique may provide a slight advantage in achieving a more natural-appearing meatus.

Conflict of Interest:

The authors declare no conflict of interest. **Funding:**

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