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Comparative Outcomes of Urethral Mobilization Versus Tubularized Incised Plate Urethroplasty in the Surgical Management of Distal Hypospadias

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Abstract: ***Introduction: Hypospadias is a prevalent congenital anomaly in male newborns, characterized by an ectopic urethral meatus, chordee, and abnormal prepuce. Surgical intervention remains the mainstay of treatment, aiming to achieve functional and aesthetic normalization. Among various techniques, Urethral Mobilization (UM) and Tubularized Incised Plate (TIP) urethroplasty are widely utilized for distal hypospadias. Materials and Methods: This prospective comparative study was conducted from January 2019 to October 2021 at GSVM Medical College, Kanpur. Fifty patients with distal hypospadias were randomized into two groups: 25 underwent UM and 25 underwent TIP. Ethical approval was obtained and informed consent secured. Demographic data, operative time, postoperative outcomes, and complications were recorded and analyzed statistically. Results: The UM group demonstrated significantly reduced operative time (mean 57.28 ± 5.25 mins vs.79.44 ± 6.49 mins), earlier catheter removal (mean 3.56 ± 0.82 days vs.5.44 ± 0.86 days), and shorter hospital stay (mean 5.64 ± 0.90 days vs.7.52 ± 1.00 days) compared to TIP. Early complications such as edema and skin necrosis were more frequent in TIP. Late complications like fistula and meatal stenosis were significantly higher in the TIP group. Discussion: UM proves to be a time - efficient and safer alternative to TIP for distal hypospadias with fewer complications and shorter hospitalization. However, surgical decision - making should remain individualized.***

Keywords: hypospadias, urethral mobilization, tubularized incised plate, pediatric urology, surgical outcomes

1. Introduction

Hypospadias is one of the most common congenital anomalies of the male genitalia, occurring in approximately 1 in 300 live male births [1]. This condition is characterized by ectopic placement of the urethral meatus on the ventral side of the penis, often accompanied by ventral curvature (chordee) and a dorsal hooded prepuce [1]. The condition can be classified based on the position of the meatus as glanular, coronal, subcoronal, distal penile, midshaft, proximal penile, penoscrotal, scrotal, or perineal [1]. Distal hypospadias, comprising glanular, coronal, and subcoronal types, is the most frequently encountered subtype and is generally associated with milder forms of chordee [2]. The goals of hypospadias surgery include the reconstruction of a straight penis with a urethral meatus positioned at the tip of the glans, preservation of erectile function, and an acceptable cosmetic outcome [3]. Two commonly practiced surgical techniques for the correction of distal hypospadias are Tubularized Incised Plate (TIP) urethroplasty and Urethral Mobilization (UM). TIP urethroplasty, first described by Snodgrass in 1994, involves a longitudinal incision along the urethral plate to widen it, followed by tubularization to form a neourethra [1]. This technique has gained wide acceptance due to its versatility, favorable cosmetic outcomes, and low complication rates. However, complications such as urethrocutaneous fistula, meatal stenosis, and glans dehiscence have been reported in various studies [7, 8]. In contrast, the Urethral Mobilization technique, as described by Belman and refined by Chang, focuses on advancing the native urethra to the glans tip without creating a neourethra [9]. It is particularly suited for distal forms where adequate urethral length and elasticity are present. This approach minimizes the risk of neourethral complications but has limited applicability in more proximal hypospadias due to restricted urethral length [5]. The choice between these two techniques often depends on the surgeon's preference, experience, and the specific anatomic characteristics of the hypospadias [6]. Comparative studies evaluating both methods in terms of operative time, complication rates, hospital stay, and cosmetic satisfaction are relatively scarce. This study aims to compare the outcomes of UM versus TIP urethroplasty in managing distal hypospadias in a tertiary care setting. By analyzing parameters such as operative duration, catheter removal time, hospital stay, and early and late complications, we aim to determine which technique offers a more favorable risk - benefit profile. The findings of this study can help guide clinical decision - making and improve patient outcomes by choosing the optimal surgical approach tailored to individual anatomical and clinical presentations [2, 4].

2. Materials and Methods

This prospective comparative study was conducted at the Department of General Surgery, Lala Lajpat Rai and Associated Hospitals, GSVM Medical College, Kanpur, between January 2019 and October 2021. Ethical approval for this research was obtained from the Institutional Ethical Committee of GSVM Medical College (Approval No. IEC/GSVM/2019/031). Written informed consent was taken from the parents or guardians of all participants. A total of 50 children with distal hypospadias (glanular, coronal, and subcoronal types) were enrolled. Children with proximal or mid - penile hypospadias, significant chordee, or those unfit for surgery were excluded. The patients were randomized into two groups of 25 each using an alternate patient allocation method: Group A underwent Urethral Mobilization (UM) and

Group B underwent Tubularized Incised Plate (TIP) urethroplasty. All surgeries were performed by a single experienced pediatric surgeon under general anesthesia. Preoperative evaluation included detailed history, physical examination, and ultrasonography of the abdomen and kidneys to exclude associated urogenital anomalies. Laboratory investigations included CBC, renal function tests, serum electrolytes, and random blood sugar. In the UM group, the urethra was dissected from surrounding tissues to mobilize it proximally. A glanular tunnel was created to advance the meatus to the tip without neourethral reconstruction. In contrast, the TIP procedure involved a midline incision of the urethral plate and tubularization over a catheter, with coverage using a vascularized dartos or tunica vaginalis flap. Catheters (6Fr or 8Fr infant feeding tubes) were used in both groups and retained until postoperative day 3–4 in the UM group and day 5–6 in the TIP group, depending on wound healing. Dressing was removed on postoperative day 2–3 (UM) or day 5–6 (TIP). Patients were hospitalized postoperatively and received intravenous antibiotics for 5 days, followed by oral antibiotics. Complications were categorized as early (within 10 days) or late (after 3 months) and were documented meticulously. Follow - up was conducted in outpatient clinics and through telephonic communication due to COVID - 19 restrictions. Outcome measures included operative duration, day of catheter removal, duration of hospital stay, incidence of early and late complications (edema, skin necrosis, glans dehiscence, fistula, meatal stenosis, meatal retraction), and cosmetic outcomes. Statistical analysis was conducted using SPSS v13.0, applying t - tests for continuous variables and chi - square or Fisher's Z - test for categorical data. A p - value <0.05 was considered statistically significant.

3. Results

A total of 50 patients were included in the study, with equal distribution into two groups: 25 patients underwent TIP urethroplasty and 25 underwent UM. The age range was 1 to 15 years, with the majority (86%) aged between 1–5 years. The distribution of hypospadias types included glanular (10%), coronal (56%), and subcoronal (34%).

Table 1: Distribution by Age Group

Age Group (Years)	Number of Patients	Percentage
1–5	43	86%
6–10	4	8%
11–15	3	6%

Table 2: Type of Hypospadias

Type	Number of Patients	Percentage
Glanular	5	10%
Coronal	28	56%
Subcoronal	17	34%

Table 3: Presence of Chordee

Chordee Severity	Number of Patients	Percentage
None	43	86%
Mild	6	12%
Moderate	1	2%

Table 4: Operative Techniques Used

Procedure	Number of Patients	Percentage
TIP	25	50%
Urethral Mobilization	25	50%

Table 5: Comparison of Operative Parameters

Parameter	TIP (Mean ± SD)	UM (Mean ± SD)	p – value
Catheter Removal Day	5.44 ± 0.86	3.56 ± 0.82	<0.0001
Duration of Surgery (min)	79.44 ± 6.49	57.28 ± 5.25	<0.0001
Hospital Stay (days)	7.52 ± 1.00	5.64 ± 0.90	<0.0001

Table 6: Early Postoperative Complications

Complication	TIP Group (n=25)	UM Group (n=25)
Edema of Glans	8 (32%)	3 (12%)
Skin Necrosis	2 (8%)	0
Glans Dehiscence	1 (4%)	0
Complete Dehiscence	0	0

Table 7: Late Postoperative Complications

Complication	TIP Group (n=25)	UM Group (n=25)
Urethrocutaneous Fistula	7 (28%)	2 (8%)
Meatal Stenosis	6 (24%)	1 (4%)
Meatal Retraction	4 (16%)	2 (8%)
Postoperative Chordee	1 (4%)	0

UM was associated with statistically significant reductions in operative duration, catheterization time, and hospital stay. Early postoperative complications, particularly edema and skin necrosis, were higher in the TIP group. Late complications such as fistula and meatal stenosis were also significantly more frequent in the TIP group. These findings underscore the relative safety and efficiency of UM in distal hypospadias repair.

4. Discussion

This study compared the outcomes of two commonly employed surgical techniques for distal hypospadias—Urethral Mobilization (UM) and Tubularized Incised Plate (TIP) urethroplasty. The data reveals that UM is associated with significantly lower operative time, earlier catheter removal, reduced hospital stay, and fewer complications. The shorter operative duration with UM (mean 57.28 minutes) compared to TIP (79.44 minutes) is expected, given that UM avoids neourethral construction and flap manipulation. This simplicity translates to faster surgical execution and potentially fewer intraoperative risks. Previous studies, such as those by Atala and Awad, similarly reported decreased operating times with UM [2, 5]. Postoperative catheterization is a critical determinant of patient comfort and recovery. In this study, catheters were removed significantly earlier in the UM group (mean 3.56 days) than in the TIP group (5.44 days). This aligns with earlier findings by Roodsari et al., who advocated shorter catheter duration in UM due to its lower incidence of urinary leakage and reduced anastomosis manipulation [4]. Hospitalization duration is another important metric for assessing recovery and healthcare resource utilization. The UM group exhibited a significantly shorter mean hospital stay (5.64 days) compared to TIP (7.52 days). This can be attributed to fewer postoperative complications and faster recovery, supporting earlier

discharge [6]. In terms of complications, early issues such as edema and skin necrosis were notably more prevalent in the TIP group. This may be due to increased tissue handling and longer operative time, consistent with reports by Braga et al. [7]. Late complications, particularly urethrocutaneous fistula and meatal stenosis, were also significantly higher with TIP. These findings mirror the results of Snodgrass and Borer et al., who documented fistula rates as high as 7–28% with TIP, depending on technique and experience [1, 8]. On the other hand, UM, while limited to very distal hypospadias due to its dependency on native urethral length and elasticity, appears to have fewer complications and offers excellent cosmetic and functional outcomes in selected patients. Our findings are consistent with historical literature supporting UM as a simple, effective method when applied judiciously [3, 5, 9]. Despite its advantages, UM must be cautiously selected for appropriate cases. It may not be suitable for patients with proximal hypospadias or those with insufficient urethral length to reach the glans without tension. TIP remains a versatile technique with broader applicability, especially in more complex or proximal variants. In conclusion, this study demonstrates that for appropriately selected cases of distal hypospadias, UM offers superior outcomes compared to TIP urethroplasty in terms of operative efficiency and reduced complications. However, surgical approach should always be tailored to individual patient anatomy and surgeon expertise. Further multicentric, randomized studies with longer follow - up are recommended to validate these findings [6, 7].

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