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MATHIEU WITH MIDLINE URETHRAL PLATE INCISION VERSUS TIP URETHROPLASTY: A COMPARISON OF COMPLICATIONS IN DISTAL PENILE HYPOSPADIAS REPAIR.

Dr. Sayyam Bin Shakir[1], Dr. Usama Ali[2*], Dr. Shahnab Ahmad[3], Dr. Saif Ur Rasool[4], Dr. Iram Uzma Khalid[5], Prof. Dr. Muhammad Kashif[6]

[1]Consultant Surgeon, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan
[2*]Senior Registrar, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan
[3]Associate professor, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan
[4]Senior Registrar, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan
[5]Associate professor, Department of Pediatric Surgery, Nishter Hospital University Multan, Punjab, Pakistan
[6]Professor, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan

Corresponding Author: Dr. Usama Ali
Senior Registrar, Department of Pediatric Surgery, Children Hospital & Institute of Child Health, Multan, Punjab, Pakistan, Email: osamaali44582@gmail.com

Abstract:

Objective: The objective of this study was to evaluate the efficacy of the Mathieu technique with midline urethral plate incision (Mathieu Incised Plate) compared to TIP urethroplasty for distal penile hypospadias repair, focusing on postoperative complications over a three-month follow-up period.

Methodology: 114 patients meeting the inclusion criteria were enrolled in this retrospective study at the Department of Pediatric Surgery, Children Hospital Multan, with 57 patients in each group. Non-probability consecutive sampling was used, and follow-up visits were scheduled weekly for three weeks and then at two and three months postoperatively. Patients were evaluated for meatal size and shape, urethrocutaneous fistula, urine stream, urethral stricture, and diverticulum, with findings recorded on a pre-designed proforma. Data were analyzed descriptively using SPSS version 25, with continuous variables expressed as mean ± SD and categorical variables as frequencies and percentages.

Results: All patients were randomly assigned to 2 groups, Group A: Tubularized Incised Plate and Group B: Mathieu Incised Plate. The patients' ages ranged from 2 to 13 years, with a mean age of 7.5 years. At the end of the three-month follow-up, fistula rates were 8.77% in the TIP group and 10.52% in the MIP group ($p = 0.455$), while overall complication rates were 28.07% and 21.05%, respectively.

Conclusion: Both techniques showed comparable complication rates; the Modified Mathieu method is suitable for narrow urethral plates, while the Snodgrass procedure is preferred for wider ones, with the final choice guided by the surgeon's expertise.

Keywords: Distal hypospadias, Tubularized Incised Plate Urethroplasty, Reverse Flap (Mathieu's) repair, Urethrocutaneous fistula,

Introduction:

Hypospadias affects approximately 1 in 200–300 male births in the United States[1]. Global prevalence varies widely, with reported rates of 34.2 per 10,000 in the USA, 19.9 in Europe, 5.2 in South America, 5.9 in Africa, and 34.8 in Australia[2].A family history increases the risk by 13 times[3]. These variations likely reflect differences in environmental and genetic factors, awareness among clinicians, and inconsistencies in reporting. Hypospadias is characterized by a ventral opening of the glans penis, a variably developed urethral plate, and a hypoplastic urethra lacking corpus spongiosum between the corpora cavernosa. Common associated features include an ectopic urethral meatus, ventral curvature (chordee), and a dorsally hooded foreskin, though these may not be present in all cases. The condition is classified into three main types: anterior hypospadias (about 50% of cases; glanular, coronal, and subcoronal), middle hypospadias (around 30%; midshaft and proximal penile), and posterior hypospadias (approximately 20%; peno-scrotal, scrotal, and perineal subtypes)[4].

Over 200 surgical techniques for hypospadias repair have been described, with no single method proven superior. The goal is to achieve a functionally normal and cosmetically acceptable penis. Common procedures for anterior (distal) hypospadias include Thiersch-Duplay[5], Mathieu[6], Mustarde, Mtal Advancement and Glanuloplasty Incorporated, and Tubularized Incised Plate (TIP) urethroplasty[7]. Among these, Mathieu's and TIP techniques are most widely used. Mathieu's repair, though effective, may lead to urethrocutaneous fistula and meatal stenosis in up to 21% of cases and produces a less natural horizontal meatus. The Snodgrass (TIP) technique offers a more natural vertical meatus with fewer complications.

Despite numerous surgical refinements, complications such as fistula formation, urethral stricture, meatal stenosis, penile torsion, chordee, infection, and wound dehiscence remain common after hypospadias repair. This study evaluates TIP urethroplasty and Mathieu's repair focusing on postoperative outcomes—particularly meatal stenosis, fistula formation, uretheral stricture and uretheral diverticulum**.**

Methodology:

This randomized controlled trial was conducted in the Department of Pediatric Surgery, The Children's Hospital and Institute of Child Health, Multan, over a period of twelve months from january 2020 to december 2020 to compare the outcomes of Tubularized Incised Plate (TIP) urethroplasty and Mathieu's repair in distal penile hypospadias. A total of 114 patients, aged 1–14 years, were enrolled using a non-probability consecutive sampling technique and randomized by the lottery method into two equal groups of 57 patients each. The sample size was calculated using the formula for comparing two proportions, based on complication rates reported in previous study[8] with a 5% margin of error and 80% power. Children with distal penile hypospadias, a normal-sized meatus, and healthy ventral penile skin, along with optimal hemoglobin and weight for age, were included. Exclusion criteria comprised previous hypospadias repair, circumcised phallus, chordee, mega-meatus, coexisting systemic illnesses such as diabetes mellitus, hypertension, renal failure, tuberculosis, immunodeficiency, or any other congenital anomalies, as well as refusal to participate.

In the TIP urethroplasty, a circumferential incision is made below the hypospadiac meatus, followed by penile degloving and midline incision of the urethral plate. The plate is tubularized with 6-0 polyglactin sutures in two layers to create the neourethra, calibrated over an appropriately sized catheter. A vascularized preputial flap is used to cover the repair, and glanuloplasty is completed for

optimal cosmetic outcome. A urethral stent and compressive dressing are maintained for seven days postoperatively while In the modified Mathieu urethroplasty, a U-shaped incision was made based on the measured distance from the hypospadiac meatus to the glans tip, ensuring a wider flap base. The urethral plate was divided along the midline, and a perimeatal-based flap was advanced and sutured over a catheter with 6-0 polyglactin in two layers to create the neourethra. A dartos flap was interposed to protect the suture line, and glanular wings were approximated symmetrically. The penile skin was redraped, and patients received postoperative antibiotics, compressive dressing, and regular follow-up after stent removal.

Ethical approval was obtained from the Hospital Ethical Committee. After enrollment, demographic details and clinical findings were recorded, and relevant investigations were performed, with any abnormalities corrected preoperatively. Informed written consent was obtained from parents or guardians after explaining the procedure, benefits, and risks. All surgeries were performed by pediatric surgery consultants following standard protocols. Patients were discharged on the 8th postoperative day and followed up weekly for three weeks, then at the second and third postoperative months. During follow-up, the meatus size and shape, urinary stream, and presence of complications such as urethrocutaneous fistula were assessed and recorded on a predesigned proforma for data analysis.

Data were analyzed descriptively using SPSS version 25. Means were calculated for continuous variables (age, weight), while frequencies and percentages were used for categorical outcomes such as fistula, meatal shape and urethral stricture.

Results:

The patients' ages ranged from 2 to 13 years, with a mean age of 7.5 years.

Table 1:Distribution of patients by age group.

Age (Years)	TIP (n = 57)	MIP (n = 57)	p-value
2–4	28 (49.12%)	26 (56.14%)	
5–7	14 (24.56%)	17 (29.82%)	
8–10	9 (15.78%)	9 (15.78%)	
11–13	6 (10.52%)	5 (8.77%)	
Total	**57 (100%)**	**57 (100%)**	**0.139**

Values are presented as number of patients with corresponding percentages in parentheses. No statistically significant difference was observed between the two groups in terms of age distribution (**p = 0.139**).

Table 2:Location of the Ectopic or Abnormal Meatus in Patients with Distal Hypospadias.

Urethral Meatal Location	TIP (n = 57)	MIP (n = 57)	p-value
Distal	32 (56.14%)	29 (50.87%)	
Subcoronal	8 (14.03%)	10 (17.54%)	
Coronal	17 (29.82%)	18 (31.57%)	
Total	**57 (100%)**	**57 (100%)**	**0.675**

Values represent the number of patients with corresponding percentages in parentheses. There was no statistically significant difference between the two groups regarding the location of the urethral meatus (**p = 0.675**).

All patients assigned to the intervention completed the procedure successfully. A total of 57 patients in the TIP group and 57 in the MIP group were evaluated during the first postoperative week.

Success Rate after First Month:
Patients without postoperative complications were considered successful outcomes. The success rate for the TIP group was 42/57 (73.68%; 95% CI: 52.79–83.79%)**,** while for the MIP group it was 45/57 (78.94%; 95% CI: 64.9–90.87%)**.** The difference between the two groups was not statistically significant (p = 0.128)**.**

Complication Rate after First Month:
Complications occurred in 12/57 patients (21.05%; 95% CI: 9.17–38.71%) in the MIP group and 15/57 patients (26.31%; 95% CI: 17.71–46.71%) in the TIP group. The difference was not statistically significant (p = 0.128)**.**

Tabel 3: Comparison of complications between TIP and MIP techniques after the first postoperative month

Complications	TIP (n = 57)	MIP (n = 57)	P value
Meatal stenosis	8 (14.03%)	3 (5.26%)	0.479
Urethrocutaneous fistula	4 (7.01%)	6 (10.52%)	0.114
Urethral stricture	3 (5.26%)	1 (1.75%)	0.526
Urethral diverticulum	2 (3.50%)	—	—
Total complications	**15 (26.31%)**	**12 (21.05%)**	—

Success Rates After the Third Month
At the end of the three-month follow-up, 41 patients (71.92%) in the TIP group were discharged without any complications. In comparison, 45 patients (78.94%) in the MIP group experienced uneventful recoveries and were discharged without complications.

Complication Rates After the Third Month
A total of 16 patients (28.07%) in the TIP group required reoperation due to postoperative complications, whereas 12 patients (21.05%) in the MIP group were rebooked for surgical revision. The complication rate for the TIP group was 28.07% (95% CI: 20.08–50.59)**,** compared to 21.05% (95% CI: 11.13–39.33) for the MIP group. Although the MIP group demonstrated a lower complication rate, the difference between the two groups was not statistically significant.

Table 4:Comparison of Complications Between TIP and MIP After the Third Month

Complication	TIP (n = 57)	MIP (n = 57)	p-value
Meatal stenosis	8 (14.03%)	3 (5.26%)	0.676
Urethrocutaneous fistula	5 (8.77%)	6 (10.52%)	0.455
Urethral stricture	3 (5.26%)	1 (1.75%)	1.000
Urethral diverticulum	2 (3.50%)	—	—
Total complications	**16 (28.07%)**	**12 (21.05%)**	—

The overall success rate was comparable between groups—71.92% (95% CI 54.20–84.50) for TIP and 78.94% (95% CI 57.18–89.91) for MIP. The most frequent complications included urethrocutaneous fistula (8.77%), meatal stenosis (14.03%), and urethral stricture (5.26%) in the TIP group.

Discussion:
Globally, hypospadias affects approximately one in every 300 live births, representing a considerable pediatric urological challenge that requires timely and appropriate surgical intervention

to prevent functional and psychological sequelae[9]. The outcome of distal hypospadias repair is largely influenced by the location of the ectopic urethral meatus, with more proximal variants posing greater technical complexity[10].

There was no statistically significant difference in postoperative complication rates between the two techniques (P = 0.105). The t-test (P = 0.483) and Chi-square test (P = 0.117) confirmed that complication development was independent of surgical method. Although patients undergoing TIP showed a 1.48-fold higher relative risk (RR = 1.48, 95% CI 0.90–2.80) of complications compared to MIP, this difference was not statistically significant. Similarly, Fisher's exact test (P = 0.398) demonstrated no association between surgical technique and the type of complication.

The comparable success rates between TIP and MIP raise the ongoing question of optimal technique selection, a matter debated extensively in prior literature. The MIP technique offers certain technical advantages, notably lateral positioning of the suture lines, which may reduce fistula formation by avoiding overlap between glandular and flap suture lines[11]. Conversely, the Snodgrass (TIP) procedure involves a midline urethral plate incision that facilitates tubularization but potentially increases the risk of stricture formation. Snodgrass and colleagues reported that incorporating a double-layered closure significantly reduced fistula rates from 33% to 11% in proximal hypospadias repair[3]. Historically, the Snodgrass technique evolved from the Thiersch-Duplay method, which was associated with a higher fistula rate (10–65%)[7]. The key innovation in the TIP repair lies in the "relaxing incision" of the urethral plate, initially described by Ordeszewski in 1987, which allows for tension-free tubularization.

While some authors have reported inconsistent findings regarding overall complication rates between TIP and Mathieu repairs[12], some other studies emphasized that multilayer closure and preputial flap coverage significantly reduce postoperative complications in distal hypospadias repair[13]. Subsequent studies have produced mixed results observed fewer fistulas with the Mathieu technique, whereas Snodgrass reported a 3% fistula rate with the TIP approach. Study described that Mathieu repair as a reliable technique with favorable functional and cosmetic outcomes[14], while other reported higher complication rates for both techniques (TIP = 25%, MIP = 75%) in early series[15]. local studies found meatal stenosis rates of 3.12% with Mathieu and 0% with TIP, with total complication rates of 21.87% and 6.2%, respectively, favoring the Snodgrass repair. Conversely, some studies reported no significant differences in complication or fistula rates (TIP = 2.63%, MIP = 3.6%), concluding that both methods are equally effective, with comparable success rates of 94.45% and 80.02%[16].

Overall, the findings of this study align with much of the published literature, indicating that both TIP and MIP techniques yield comparable success and complication rates. Technique selection should therefore be guided by the individual patient's anatomical characteristics, surgeon expertise, and intraoperative findings.

Conclusion:

Both the Tubularized Incised Plate (TIP) and Modified Incised Plate (MIP) urethroplasty techniques demonstrated comparable efficacy and safety in the surgical management of distal hypospadias. The MIP technique showed a slightly lower frequency of postoperative complications, particularly meatal stenosis and urethral stricture, although this difference was not statistically significant. The most frequent complications observed in both groups were meatal stenosis and urethrocutaneous fistula, findings consistent with previous literature. Overall, both procedures proved technically feasible, safe, and effective for achieving satisfactory short-term outcomes. Therefore, the selection between TIP and MIP may reasonably depend on the surgeon's experience, intraoperative anatomical findings, and patient-specific considerations. Further prospective studies with larger sample sizes and longer follow-up are warranted to better evaluate their long-term functional and cosmetic results. The study was limited by a small sample size, potential selection bias, and its single-center design, highlighting the need for larger multicenter studies to validate the findings.

References:

1. Cunha GR, Sinclair A, Risbridger G, Hutson J, Baskin LS. Current understanding of hypospadias: relevance of animal models. *Nat Rev Urol.* 2015;12(5):271–280.
2. Springer A, Van Den Heijkant M, Baumann S. Worldwide prevalence of hypospadias. *J Pediatr Urol.* 2016;12(3):152.e1–152.e7.
3. Snodgrass W, Koyle M, Manzoni G, Hurwitz R, Caldamone A, Ehrlich R. Tubularized incised plate hypospadias repair. *J Urol.* 1996;156(2 Pt 2):839–841
4. Shahzad SM. Comparative study between tubularized incised plate urethroplasty (Snodgrass) and reverse flap (Mathieu) repair in distal hypospadias. *Ann Pak Inst Med Sci.* 2012;8(2):96–100.
5. Ross MD, David FF. Distal hypospadias repair by the modified Thiersch-Duplay with or without hinging the urethral plate. *J Urol.* 1999;162(3 Pt 2):1156–1158.
6. Minevich E, Pecha BR, Wacksman J, Sheldon CA. Mathieu hypospadias repair. *J Urol.* 1999;162(6):2141–2143.
7. Snodgrass WT. Tubularized incised urethral plate urethroplasty for distal hypospadias. *J Urol.* 1994;151(2):464–465.
8. Khalil M, Gharib T, El-shaer W, Sebaey A, Elmohamady B, Elgamal K. Mathieu technique with incision of the urethral plate versus standard tubularised incised-plate urethroplasty in primary repair of distal hypospadias: a prospective randomized study. *Arab J Urol.* 2017;15(3):242–247.
9. Springer A. Assessment of outcome in hypospadias surgery – a review. *Front Pediatr*. 2014;2:2. doi:10.3389/fped.2014.00002
10. Bhat A, Mandal AK. Acute postoperative complications of hypospadias repair. *Indian J Urol*. 2008;24(2):241–248. doi:10.4103/0970-1591.40614
11. Ordeszewski M. A new one-stage procedure for correction of hypospadias. *Pol Przegl Chir*. 1987;59(6):661–666.
12. Braga P, Lorenzo JL, Pippi Salle JL. Tubularized incised plate urethroplasty for distal hypospadias: a literature review. *Indian J Urol.* 2008;24(2):219–225.
13. Mouriquand P, Mure PY. Hypospadias. In: Gearhart J, Rink R, Mouriquand PDE, editors. Pediatric urology. Philadelphia: W.B. Saunders; 2001. p. 713–728.
14. Minevich E, Barry R. Mathieu hypospadias repair: experience in 202 patients. *J Urol.* 1999;162(2 Pt 2):11–17.
15. El-Saket H. Primary distal hypospadias repair: tubularized incised plate urethroplasty (Snodgrass) versus the perimeatal-based flap (Mathieu). *J Plast Reconstr Surg.* 2004;28(1):55–61.
16. Moradi M, Moradi A. Comparison of Snodgrass and Mathieu surgical techniques in anterior distal shaft hypospadias repair. *Urol J.* 2005;2(1):28–31.