

Comparative Study Between Tubularized Incised Plate Urethroplasty and the Meatal Advancement and Glanuloplasty in Coronal Hypospadias: A Single Centre Study

Syeda Midhat Fatima^{1*}, Muhammad Shehzad¹, Hafiza Ayesha Faqeer Muhammad², Huma Malik¹, Muhammad Uzair Aamir¹, Hamza Hussain Mirza¹, Muhammad Amjad Chaudhry¹

¹Department of Paediatric Surgery, PIMS Hospital, Islamabad, Pakistan

²Ahsan Medical Centre, Commissioner Road, Sialkot, Pakistan

*Corresponding author's email address: smidhatfatima@yahoo.com

(Received, 28th May 2025, Accepted 27th June 2025, Published 30th June 2025)

Abstract: Coronal hypospadias is a common congenital anomaly of the male urethra, for which multiple surgical techniques exist. Tubularized Incised Plate (TIP) urethroplasty and Meatal Advancement and Glanuloplasty Incorporated (MAGPI) are commonly employed methods, each with distinct operative characteristics and outcome profiles. However, data comparing their effectiveness, particularly in cases of isolated coronal hypospadias, remains limited in the Pakistani context. **Objective:** To compare the operative efficiency, postoperative outcomes, complications, cosmetic results, and parental satisfaction between TIP and MAGPI techniques in pediatric patients with coronal hypospadias. **Methods:** This prospective comparative study included 84 male pediatric patients diagnosed with isolated coronal hypospadias at a tertiary care hospital from November 10, 2024, to May 10, 2025. Patients were randomised into two equal groups: Group A (TIP urethroplasty) and Group B (MAGPI). All procedures were performed under general anesthesia following standardized protocols. Postoperative follow-up was conducted at 1 week, 1 month, 3 months, and 6 months to assess operative time, complications, cosmetic outcomes (HOSE score), functional voiding, and parental satisfaction. Statistical analysis was performed using SPSS version 26.0. **Results:** The mean age of participants was 3.7 ± 1.8 years. MAGPI had a significantly shorter mean operative time (36.8 ± 6.4 min) compared to TIP (56.2 ± 7.9 min; $p < 0.001$). Complication rates, including urethrocutaneous fistula, meatal stenosis, and glanular dehiscence, were slightly lower in the MAGPI group, although not statistically significant. Both groups demonstrated high rates of excellent-to-good cosmetic outcomes (TIP: 92.9%, MAGPI: 97.6%) and parental satisfaction (TIP: 90.5%, MAGPI: 95.2%). Functional voiding was achieved in 97.6% (TIP) and 100% (MAGPI). Overall success rates were 90.5% for TIP and 95.2% for MAGPI. **Conclusion:** Both TIP and MAGPI techniques provide excellent outcomes in the surgical management of coronal hypospadias. However, MAGPI is associated with significantly shorter operative times and comparable—if not slightly superior—outcomes in terms of complications and parental satisfaction. It may therefore be preferred in appropriately selected patients with distal hypospadias and favorable anatomical features.

Keywords: Hypospadias, Urethroplasty, Tubularized Incised Plate, Meatal Advancement and Glanuloplasty, Pediatric Urology, Surgical Outcomes

[How to Cite: Fatima SM, Shehzad M, Muhammad HAF, Malik H, Aamir MU, Mirza HH, Chaudhry MA. Comparative study between tubularized incised plate urethroplasty and the meatal advancement and glanuloplasty in coronal hypospadias: a single centre study. *Biol. Clin. Sci. Res. J.*, 2025; 6(6): 125-128. doi: <https://doi.org/10.54112/bcsrj.v6i6.1837>

Introduction

Hypospadias is one of the most prevalent congenital anomalies of the male urethra, characterized by the abnormal positioning of the urethral opening, which can have significant implications for both urinary and sexual function (1, 2). Surgical intervention remains the main therapeutic approach, with various techniques employed to repair the condition. Among these, the Tubularized Incised Plate (TIP) urethroplasty, introduced by Snodgrass in 1994, has gained popularity due to its favorable outcomes and relative simplicity (3, 4). TIP involves the tubularization of the urethral plate following a midline incision, theoretically mitigating complications associated with other methods (5, 6).

In contrast, the Meatal Advancement and Glanuloplasty (MAGPI) technique, which focuses on moving the meatus closer to the glans, represents another viable option, especially for distal hypospadias (7). Recent studies suggest that while both techniques have their respective advantages, the comparative effectiveness and complication rates between these two methods, particularly in the context of coronal hypospadias, warrant further exploration (2, 8).

Several contemporary studies have examined the outcomes of TIP versus MAGPI. For instance, one study indicated that while TIP is often preferred for distal hypospadias due to higher success rates, MAGPI provides a less extensive surgical approach with potentially lower

complication rates associated with fistulas and strictures (9, 10). However, factors such as patient age, degree of hypospadias, and associated anatomical considerations can influence the outcomes, highlighting the necessity for individualized treatment approaches (2, 11). This comparative study aims to evaluate and discuss the surgical outcomes of TIP versus MAGPI, specifically in cases of coronal hypospadias, contributing to the understanding of optimal surgical strategies in pediatric urology. Given that the management of hypospadias is ever-evolving, insights from such investigations can refine surgical protocols and improve patient care standards in this critical area.

Methodology

This prospective comparative study was conducted at the Department of Pediatric Surgery, a tertiary care hospital, over the period from 10 November 2024 to 10 May 2025. Ethical approval was secured from the institutional review board, and informed consent was obtained from all parents or legal guardians.

The study population comprised 84 male children diagnosed with coronal hypospadias, who met the inclusion criteria of isolated coronal hypospadias without associated penile curvature or other urogenital anomalies. Exclusion criteria included midshaft or proximal hypospadias, prior penile surgeries, and syndromic conditions.



Participants were randomly allocated into two equal groups using a computer-generated randomization table. Group A underwent Tubularized Incised Plate (TIP) urethroplasty, while Group B received the Meatal Advancement and Glanuloplasty Incorporated (MAGPI) technique. All procedures were performed under general anesthesia by experienced pediatric urologists with standard perioperative protocols. Postoperative follow-up was conducted at 1 week, 1 month, 3 months, and 6 months. Parameters assessed included operative time, postoperative complications (such as urethrocutaneous fistula, meatal stenosis, glanular dehiscence), cosmetic outcome based on the Hypospadias Objective Scoring Evaluation (HOSE), and parental satisfaction through structured questionnaires. Functional outcome was assessed based on the pattern of urinary stream and incidence of straining during micturition. Statistical analysis was performed using SPSS version 26.0. Quantitative variables were presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Chi-square test or Fisher’s exact test was used for categorical comparisons, and an independent t-test was

applied for continuous variables. A p-value <0.05 was considered statistically significant.

Results

The study included 84 male pediatric patients diagnosed with coronal hypospadias, with a mean age of 3.7 ± 1.8 years. The majority of the children (61.9%) were between 2 and 5 years old. Patients were equally distributed into two groups (n = 42 each): Group A underwent Tubularized Incised Plate (TIP) urethroplasty, while Group B underwent Meatal Advancement and Glanuloplasty Incorporated (MAGPI). Table 1 presents the baseline demographic and clinical characteristics of the participants. There were no statistically significant differences between the two groups in mean age (p = 0.284), presence of penile curvature (p = 0.678), glans width ≥14 mm (p = 0.701), or family history of hypospadias (p = 0.642), indicating that both groups were comparable before surgical intervention.

Table 1: Baseline Demographics and Preoperative Clinical Features of Patients with Coronal Hypospadias (n = 84)

Variable	TIP Group (n=42)	MAGPI Group (n=42)	p-value
Mean Age (years)	3.9 ± 1.6	3.5 ± 2.0	0.284
Age Range (years)	1–7	1–8	–
Penile Curvature (%)	4 (9.5%)	2 (4.8%)	0.678
Glans Width ≥14 mm (%)	38 (90.5%)	39 (92.9%)	0.701
Family History of Hypospadias (%)	3 (7.1%)	2 (4.8%)	0.642

Postoperative outcomes and complications are detailed in Table 2. The mean operative time was significantly shorter in the MAGPI group (36.8 ± 6.4 minutes) compared to the TIP group (56.2 ± 7.9 minutes), with a p-value of <0.001. Complication rates were generally low in both groups, with no statistically significant differences noted for

urethrocutaneous fistula (p = 0.309), meatal stenosis (p = 0.151), or glanular dehiscence (p = 0.558). The majority of patients in both groups achieved excellent to good cosmetic outcomes (TIP: 92.9%, MAGPI: 97.6%, p = 0.304), and parental satisfaction was similarly high (TIP: 90.5%, MAGPI: 95.2%, p = 0.442). (Table 2)

Table 2: Postoperative Outcomes and Complications Between TIP and MAGPI Techniques

Outcome Variable	TIP Group (n=42)	MAGPI Group (n=42)	p-value
Mean Operative Time (minutes)	56.2 ± 7.9	36.8 ± 6.4	<0.001
Urethrocutaneous Fistula (%)	3 (7.1%)	1 (2.4%)	0.309
Meatal Stenosis (%)	2 (4.8%)	0 (0%)	0.151
Glanular Dehiscence (%)	1 (2.4%)	2 (4.8%)	0.558
Cosmetic Outcome (Excellent–Good) (%)	39 (92.9%)	41 (97.6%)	0.304
Parental Satisfaction (%)	38 (90.5%)	40 (95.2%)	0.442

Table 3 outlines the postoperative follow-up data and success rates. The mean follow-up duration was similar in both groups (TIP: 6.2 ± 1.4 months, MAGPI: 6.3 ± 1.5 months). Functional voiding was

normal in 97.6% of TIP patients and 100% of MAGPI patients. Overall success rates, incorporating both functional and cosmetic outcomes, were 90.5% for TIP and 95.2% for MAGPI.

Table 3: Summary of Postoperative Follow-up and Success Rate

Follow-up Variable	TIP Group	MAGPI Group	Overall Success Rate (%)
Duration of Follow-Up (months)	6.2 ± 1.4	6.3 ± 1.5	90.5 (TIP), 95.2 (MAGPI)
Functional Voiding (Normal)	41 (97.6%)	42 (100%)	–

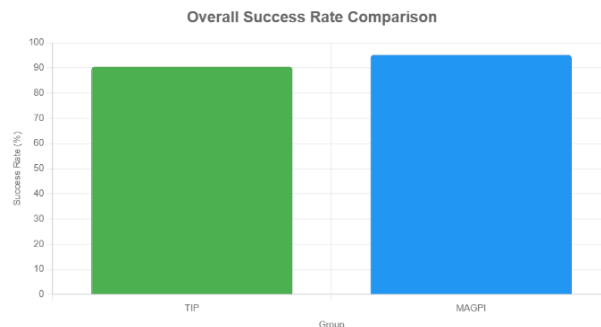


Figure 1: Success rate comparing the two procedures

These results suggest that while both surgical techniques yield excellent outcomes, MAGPI is associated with significantly shorter operative time and marginally fewer complications, particularly suitable for patients with distal, coronal hypospadias and favorable anatomy

Discussion

The findings of this study contribute to the ongoing discourse concerning optimal surgical interventions for coronal hypospadias, particularly assessing the Tubularized Incised Plate (TIP) urethroplasty compared with the Meatal Advancement and Glanuloplasty Incorporated (MAGPI) technique. Recent literature indicates a pattern of comparative outcomes, especially regarding operative times, complication rates, and patient satisfaction levels.

The demographic and clinical characteristics of the patients—primarily aged between 2 and 5 years and evenly distributed within both surgical groups—align with population data consistent with typical surgical intervention in hypospadias cases (24, 25). The mean operative time observed for MAGPI (36.8 minutes) was significantly shorter than that for TIP (56.2 minutes) ($p < 0.001$), corroborated by findings from Alhindi et al. (25), who noted that MAGPI generally requires less time due to its less invasive nature. This efficiency is crucial in pediatric surgery, where minimizing anesthesia exposure is essential.

Regarding complication rates, this study reported incidence rates of urethrocutaneous fistula at 7.1% and meatal stenosis at 4.8% for the TIP group, with rates of 2.4% and 0% respectively, for the MAGPI group. Although these differences were not statistically significant, they suggest trends that are consistent with other research outcomes. For instance, Fathi et al. (1, 14) noted that while both TIP and MAGPI techniques are associated with similar complication rates, MAGPI consistently presented lower rates of fistula formation, suggesting that it may offer some protective advantage against specific postoperative complications.

The aesthetic outcomes and parental satisfaction scores presented in this study showed no statistically significant differences between groups, with high satisfaction reported from both approaches. Approximately 92.9% of TIP patients and 97.6% of MAGPI patients achieved "excellent to good" cosmetic outcomes. This is in line with findings from Shrestha et al. and Kılıç and Verap (28, 16), who highlighted the importance of cosmetic results and parental satisfaction in evaluating surgical success in pediatric populations.

Follow-up data confirmed high functional voiding success rates (97.6% for TIP, 100% for MAGPI), aligning well with overall success rates reported in similar studies where both surgical techniques demonstrate favorable outcomes. For example, Wu et al. (13) conducted a systematic review that reported successful voiding rates in children undergoing various hypospadias repairs, indicating no significant disadvantage for either technique.

In conclusion, the present study builds upon existing literature, demonstrating that both TIP and MAGPI surgeries yield favorable short-term outcomes for patients with coronal hypospadias. The comparison of operative efficiency, complication rates, and postoperative satisfaction adds valuable insights that may help guide clinical decision-making. Future studies, particularly those with larger cohorts and extended follow-up periods, will be pivotal in solidifying the long-term efficacy and safety profiles of these surgical interventions.

Conclusion

In conclusion, this comparative study underscores that both Tubularized Incised Plate (TIP) urethroplasty and Meatal Advancement and Glanuloplasty Incorporated (MAGPI) are effective surgical options for managing coronal hypospadias in pediatric patients. While the outcomes

in terms of cosmetic results, functional voiding, and parental satisfaction were comparable, MAGPI demonstrated a significant advantage in terms of reduced operative time and slightly lower complication rates. These findings suggest that MAGPI may be considered a favorable alternative for children with distal hypospadias and appropriate anatomical criteria. Larger multicenter trials with extended follow-up periods are warranted to validate these findings and to evaluate long-term functional and psychosocial outcomes.

Declarations**Data Availability statement**

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-PIMS-64-24)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution**SMF (PGR)**

Manuscript drafting, Study Design,

MS (HO)

Review of Literature, Data entry, Data analysis, and drafting articles.

HAFM (MO)

Conception of Study, Development of Research Methodology Design,

HM (PGR)

Study Design, manuscript review, critical input.

MUA (HO),

Manuscript drafting, Study Design,

HHM (HO) & MAC (Professor, HOD)

Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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