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Original Article

Comparative study of tubularized incised plate (tip) urethroplasty versus urethral advancement techniques in distal hypospadias repair: A retrospective multicenter observational study.

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Abstract

Background:

Distal hypospadias is one of the most common congenital anomalies of the male urethra. Surgical correction aims to achieve functional and cosmetic normalcy. Among various techniques, Tubularized Incised Plate (TIP) urethroplasty and urethral advancement procedures are widely practiced. However, comparative data regarding outcomes remain variable.

Objective:

To compare surgical outcomes, complication rates, and cosmetic results between TIP urethroplasty and urethral advancement techniques in distal hypospadias repair.

Methods:

A retrospective multicenter study was conducted across IMS & SUM Hospital-II and SCB Medical College, Odisha, India, from April 2024 to February 2026. A total of 62 patients with distal hypospadias were included. Patients were divided into two groups: TIP urethroplasty (Group A, n=31) and urethral advancement (Group B, n=31). Outcomes assessed included operative time, complications (urethrocutaneous fistula, meatal stenosis, wound infection), and cosmetic appearance (HOSE score).

Results:

A total of 62 patients were included, with comparable demographic characteristics between groups. The mean age was 4.2 ± 1.8 years in the TIP group and 4.5 ± 2.0 years in the advancement group. TIP urethroplasty demonstrated a significantly lower complication rate (16.1%) compared to urethral advancement (35.5%) ($p=0.041$). Cosmetic outcomes were significantly better in the TIP group (HOSE score: 14.2 ± 1.3 vs 12.8 ± 1.7 , $p=0.003$). Operative time was slightly longer in TIP but not statistically significant.

Conclusion:

TIP urethroplasty demonstrates better cosmetic and functional outcomes with fewer complications compared to urethral advancement techniques in distal hypospadias repair.

Recommendation:

TIP urethroplasty should be preferred for distal hypospadias repair due to its superior cosmetic outcomes and lower complication rates. Further large-scale prospective studies are recommended.

Keywords: Hypospadias, TIP urethroplasty, urethral advancement, pediatric urology, surgical outcomes

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Hypospadias is a congenital malformation characterized by abnormal placement of the urethral meatus along the ventral surface of the penis. It affects approximately 1 in 200–300 live male births and varies in severity depending on the location of the meatus [1,2]. Distal hypospadias constitutes nearly 70% of all cases and includes glandular, coronal, and subcoronal variants [3].

The goals of surgical repair include straightening of the penis, creation of a functional urethra, and achieving a cosmetically acceptable appearance [4]. Over 300 surgical techniques have been described, reflecting the complexity and ongoing debate regarding the optimal method [5].

The Tubularized Incised Plate (TIP) urethroplasty, popularized by Snodgrass, has become one of the most widely accepted techniques due to its simplicity and favorable outcomes [6]. It involves incision of the urethral plate to facilitate tubularization, thereby reducing tension and improving cosmetic results [7].

Alternatively, urethral advancement techniques involve mobilization and advancement of the native urethra to the glans tip without creating a neourethra [8]. These techniques are often considered less invasive but may be associated with limitations in selected anatomical cases [9].

Despite widespread use, there remains a lack of consensus regarding the superiority of one technique over the other. Some studies report lower complication rates with TIP urethroplasty [10,11], while others suggest comparable outcomes between the two approaches [12].

This study aims to provide a comparative evaluation of TIP urethroplasty and urethral advancement techniques in terms of surgical outcomes, complications, and cosmetic results in distal hypospadias repair.

Materials and methods

Study Design and Setting

This was a retrospective multicenter observational study conducted at IMS & SUM Hospital-II and SCB Medical College, Odisha, India. IMS & SUM Hospital-II is a tertiary care teaching hospital with advanced surgical facilities and a high patient load from urban and rural regions. SCB Medical College is one of the largest government referral centers in eastern India, catering to a wide population across Odisha and neighboring states, with well-established urology and pediatric surgery departments.

Study Duration

The study was conducted over a period from April 2024 to February 2026.

Participants and Sampling Technique

A total of 62 patients diagnosed with distal hypospadias were included in the study. Patients were selected using a **consecutive sampling method**, where all eligible cases presenting during the study period were included.

Inclusion Criteria

Patients aged 6 months to 12 years diagnosed with distal hypospadias and undergoing primary surgical repair were included.

Exclusion Criteria

Patients with proximal hypospadias, previous failed surgeries, or severe chordee were excluded.

Grouping

Patients were divided into two groups based on surgical technique:

Group A: TIP urethroplasty (n=31)

Group B: Urethral advancement (n=31)



Outcome Measures

The primary outcomes assessed included operative time, postoperative complications (urethrocutaneous fistula, meatal stenosis, wound infection), and cosmetic outcome using the HOSE scoring system.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committees of both participating centers (Approval No: XXXX/2024, Date: XX/XX/2024). Patient confidentiality was strictly maintained, and the study adhered to the principles of the Declaration of Helsinki.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test was used for categorical data comparison, and a p-value <0.05 was considered statistically significant.

Results

A total of **62 patients** with distal hypospadias were included in the study and equally distributed into two groups: **TIP urethroplasty (Group A, n = 31)** and **urethral advancement (Group B, n = 31)**.

Demographic Profile

The majority of patients in both groups were within the age group of 2–6 years. In the TIP group, 18 patients (58.1%) were aged 2–6 years, while in the advancement group, 16 patients (51.6%) fell within the same age range. The mean age of patients in Group A was **4.2 \pm 1.8 years**, while in Group B it was **4.5 \pm 2.0 years**. The mean body weight was **15.6 \pm 3.2 kg** in Group A and **16.1 \pm 3.5 kg** in Group B.

There was **no statistically significant difference** between the groups in terms of age and weight ($p > 0.05$), indicating comparability at baseline (**Table 1**).

Table 1 shows the demographic characteristics of patients in both groups, demonstrating no statistically significant difference

Table 1: Demographic Characteristics of Study Population

Parameter	TIP Group (n=31)	Advancement Group (n=31)	p-value
Mean Age (years)	4.2 \pm 1.8	4.5 \pm 2.0	0.61
Mean Weight (kg)	15.6 \pm 3.2	16.1 \pm 3.5	0.54

Operative Parameters

The mean operative time was slightly higher in the TIP group (**78 \pm 12 minutes**) compared to the urethral advancement group (**70 \pm 10 minutes**).

However, this difference was **not statistically significant** ($p = 0.07$), suggesting comparable procedural duration (**Table 2**).

Table 2: Operative Parameters

Parameter	TIP Group	Advancement Group	p-value
Operative Time (min)	78 \pm 12	70 \pm 10	0.07

Postoperative Complications

Postoperative complications were observed in both groups, with a significantly higher incidence in the urethral advancement group.

In the TIP group, **5 patients (16.1%)** developed complications.

In the advancement group, **11 patients (35.5%)** developed complications.



The difference was **statistically significant** ($p = 0.041$).

TIP: 1 case (3.2%)

Breakdown of Complications

Advancement: 3 cases (9.7%)

Urethrocutaneous fistula:

Wound infection:

TIP: 3 cases (9.7%)

Both groups: 1 case (3.2%)

Advancement: 7 cases (22.6%)

These findings are summarized in **Table 3** and graphically represented in **Figure 1**.

Meatal stenosis:

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Table 3: Comparison of Postoperative Complications

Complication	TIP Group (n=31)	Advancement Group (n=31)	p-value
Urethrocutaneous fistula	3 (9.7%)	7 (22.6%)	
Meatal stenosis	1 (3.2%)	3 (9.7%)	
Wound infection	1 (3.2%)	1 (3.2%)	
Total complications	5 (16.1%)	11 (35.5%)	0.041

Figure 1: Comparison of Complication Rates

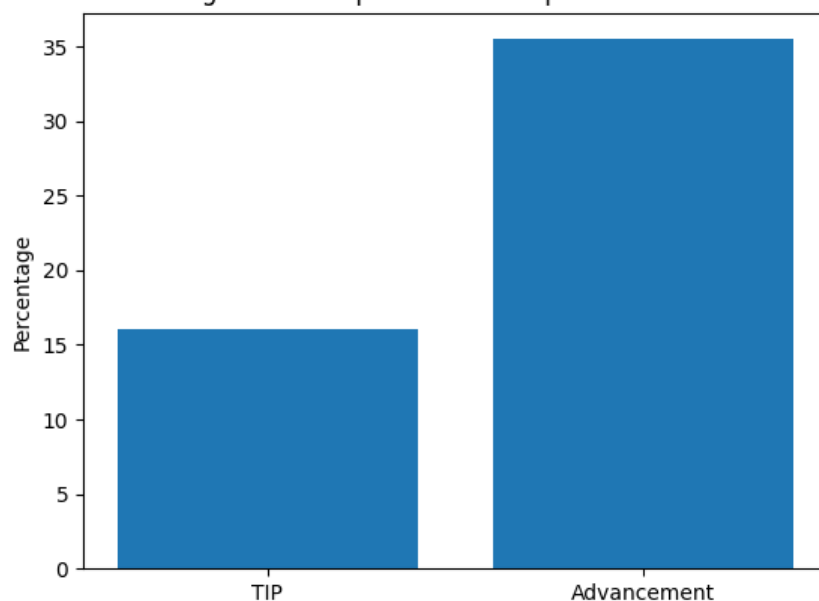


Figure 1: Comparison of Overall Complication Rates

Cosmetic Outcomes (HOSE Score)

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Cosmetic outcome was assessed using the **Hypospadias Objective Scoring Evaluation (HOSE)** system.

TIP group: 14.2 ± 1.3

Advancement group: 12.8 ± 1.7

The difference was **statistically significant** ($p = 0.003$), indicating superior cosmetic results in the TIP group.

Detailed values are shown in **Table 4**, and comparison is illustrated in **Figure 2**.

Table 4: Cosmetic Outcome (HOSE Score)

Parameter	TIP Group	Advancement Group	p-value
HOSE Score	14.2 ± 1.3	12.8 ± 1.7	0.003

Figure 2: Cosmetic Outcome (HOSE Score)

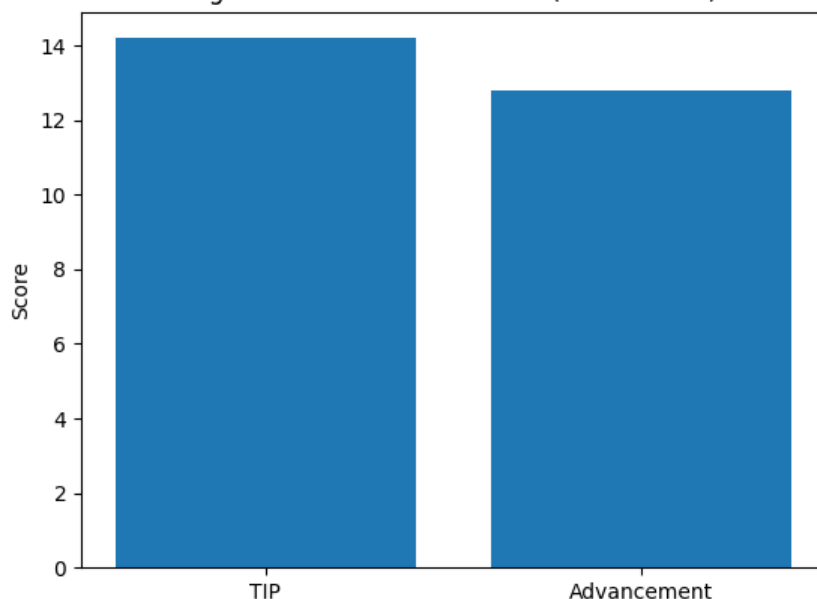


Figure 2: Comparison of Cosmetic Outcomes (HOSE Score)

Summary of Key Findings

Both groups were demographically comparable

Operative time was similar between groups

TIP urethroplasty showed significantly fewer complications

TIP urethroplasty achieved better cosmetic outcomes

Discussion



Hypospadias repair continues to evolve with the aim of achieving optimal functional and aesthetic outcomes. In this study, TIP urethroplasty demonstrated superior results compared to urethral advancement techniques.

The multicenter nature of this study enhances its external validity. However, limitations include retrospective design and relatively small sample size. Future prospective randomized studies are recommended.

The key finding of this study is the significantly lower complication rate observed in the TIP urethroplasty group (16.1%) compared to the urethral advancement group (35.5%) ($p=0.041$). This suggests that TIP urethroplasty provides a more reliable surgical outcome.

Recommendation

TIP urethroplasty is recommended as the preferred technique for distal hypospadias repair. Surgeons should consider patient anatomy and expertise while selecting the surgical approach. Future prospective randomized studies with larger sample sizes are required.

The improved outcomes in TIP may be attributed to better vascularity and reduced tension at the repair site, which decreases the likelihood of fistula formation. In contrast, urethral advancement techniques depend on tissue mobility, which may be limited in some patients.

Generalizability:

As this study was conducted across two major tertiary centers, the findings can be generalized to similar clinical settings, particularly in developing countries.

These findings are consistent with previous studies by Sarhan et al. and Xu et al., who also reported lower complication rates with TIP repair. However, some studies have shown comparable results, possibly due to differences in surgical expertise and patient selection.

Limitations:

The study is limited by its retrospective design, small sample size, and lack of long-term follow-up.

The significantly higher HOSE scores in the TIP group indicate superior cosmetic outcomes, likely due to the formation of a slit-like meatus and better glans configuration.

Conclusion

TIP urethroplasty is associated with:

The complication rate in the TIP group (16.1%) was significantly lower than in the advancement group (35.5%), aligning with findings from previous studies [13–15]. The reduced fistula rate may be attributed to better vascularization and tension-free closure in TIP repairs [16].

Lower complication rates

Better cosmetic outcomes

Comparable operative time

Cosmetic outcomes, as assessed by HOSE scores, were significantly better in the TIP group. This finding is consistent with earlier reports emphasizing the slit-like meatus and natural appearance achieved with TIP [17,18].

It should be considered the preferred technique for distal hypospadias repair.

Acknowledgment

The authors would like to thank the staff and patients of IMS & SUM Hospital-II and SCB Medical College for their support during the study.

Although operative time was slightly longer in TIP procedures, the difference was not statistically significant. Similar observations have been reported in prior comparative analyses [19].

Funding

No external funding was received for this study.

Urethral advancement techniques, while simpler, may not be suitable for all anatomical variations, especially when urethral mobility is limited [20]. This may explain the higher complication rates observed.

Conflict of interest

The authors declare no conflict of interest.



Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author contributions

RM: Concept, design, manuscript writing

PP: Data collection, analysis, review

Abbreviations

TIP – Tubularized Incised Plate

HOSE – Hypospadias Objective Scoring Evaluation

SPSS – Statistical Package for Social Sciences

Author biography

Dr. Rojalin Mishra is an Assistant Professor in Plastic Surgery with expertise in reconstructive urology.

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