**Original Article**

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# Clinical Outcomes and Complications of Pediatric Hypospadias Repair: Experience from a Tertiary Care Hospital

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**ABSTRACT**

Objective: To evaluate the complication profiles of hypospadias repairs in a tertiary care center and to compare the outcomes of single-stage versus staged surgical approaches.

Methodology: A retrospective cohort study was conducted at the Department of Pediatric Surgery, Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan, from June 2019 to June 2024. Ninety-eight boys aged 9 months to 10 years undergoing primary or reoperative hypospadias repair with a minimum 12-month follow-up were included. Data on patient demographics, meatal location, chordee severity, surgical technique, and postoperative complications were analyzed. Surgical techniques included Tubularized Incised Plate (TIP), Onlay, and two-stage repairs. Complications were categorized as early (≤30 days) and late (>30 days), and outcomes were assessed using the Pediatric Penile Appearance Score (PPAS).

Results: The mean age at surgery was 5.36 ± 2.81 years. Distal hypospadias accounted for 58.2%, mid-penile 24.5%, and proximal 17.3% of cases. TIP was the most used technique (68.4%). A total of 79 complications occurred (80.6%), with urethrocutaneous fistula (31.6%) being the most common, followed by meatal stenosis (17.3%), wound dehiscence (14.3%), urethral stricture (10.2%), and residual chordee (7.1%). Two-stage repairs had significantly higher complication (64.6%) and reoperation (26.7%) rates compared to single-stage repairs. Cosmetic outcomes (PPAS ≥8) were better with TIP (92.5%) than with Onlay (73.7%) or two-stage (66.7%) approaches (p=0.008).

Conclusion: Hypospadias repair carries a high risk of complications, particularly with proximal types and two-stage techniques. TIP urethroplasty showed superior cosmetic and functional outcomes, supporting its continued use as the preferred method for distal and selected mid-penile repairs.

Keywords: Hypospadias, TIP urethroplasty, urethrocutaneous fistula, pediatric urology, surgical outcomes, complication rates

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## Introduction

Hypospadias persists as one of the most frequent congenital anomalies affecting male genitourinary development, with contemporary global epidemiological studies reporting an incidence of 1 in 200–250 live male births. This represents a significant increase over recent decades, attributed to complex interactions between genetic predispositions, endocrine disruptors, and environmental factors.[1] The condition originates from disrupted morphogenesis during gestational weeks 8–14, characterized by incomplete fusion of the urethral folds, arrested migration of the ectodermal glandular plate, and abnormal mesenchymal differentiation.[2] These embryological aberrations manifest clinically as a triad of anomalies: a proximally displaced urethral meatus along the ventral penile shaft (ranging from the corona to the perineum), ventral curvature (chordee) resulting from

dysplastic fibrotic tissues within Buck's fascia, and a characteristic dorsal hooded prepuce with deficient ventral foreskin.[3]

The clinical spectrum is classified based on functional severity *after* intraoperative chordee correction rather than merely meatal position. Distal variants (glandular, subcoronal) constitute 60–70% of cases and typically require single-stage reconstruction. Mid-penile forms (20–25%) present greater technical complexity due to frequent chordee >30°. Proximal defects (penoscrotal, scrotal, perineal; 15–20%) often involve bifid scrotum, penoscrotal transposition, and higher rates of associated syndromes (e.g., disorders of sexual development).[4] Contemporary surgical philosophy emphasizes functional *and* cosmetic restoration: creating a straight phallus with a terminal orthotopic meatus permitting a non-deflected urinary stream, normalized glans configuration, and concealed suture lines. Patient-reported outcome measures (e.g., Pediatric Penile Perception Score) now recognize psychosocial well-being as a critical success metric.[5]

Surgical technique selection remains nuanced, guided by urethral plate quality (elasticity, width >8 mm), glans morphology (groove depth, corporeal disproportion), and severity of chordee after degloving. [6] For distal repairs, tubularized incised plate (TIP) urethroplasty maintains dominance (75–85% utilization) due to its reproducible outcomes and lower fistula rates (5–15%). Proximal hypospadias demands individualized approaches: transverse preputial island flap (TPIF) urethroplasty suits cases with supple plates, while severe curvature (>45°) or atrophic plates necessitate staged Bracka repairs or buccal mucosa grafts.[7] Despite microsurgical advances, barbed sutures, and tissue sealants, contemporary meta-analyses report aggregate complication rates of 15–40%, with proximal repairs carrying 2.3-fold higher risk.[8]

Urethrocutaneous fistula (15–35% of complications) persists as the most prevalent adverse outcome, followed by meatal stenosis (10–20%), wound dehiscence (8–15%), urethral stricture (5–12%), and residual chordee (5–10%). Staged repairs demonstrate particularly high reoperation rates (25–50%), with fistulae occurring most frequently at the proximal anastomosis or glans wings. Modifiable risk factors include surgeon experience (≥50 cases annually reduces complications by 32%), suture material (monocryl > PDS), catheter duration (7–10 days optimal), and specialized dressings (silicone-lined compression > gauze). Non-modifiable risks encompass proximal severity, glans width <14 mm, and prior failed repairs.[9,10]

This study from Qazi Hussain Ahmad Medical Complex addresses critical gaps in region-specific outcomes literature. We analyze 98 consecutive repairs (2019–2024) to: (1) quantify complication incidences in a tertiary Pakistani cohort, (2) compare single-stage versus staged repair outcomes, and (3) identify locally relevant risk mitigation strategies. Findings aim to optimize surgical protocols in resource-variable settings while contributing to global evidence on hypospadias management.

# Methodology

This retrospective cohort study was conducted at the Department of Pediatric Surgery, Qazi Hussain Ahmad Medical Complex, Nowshera, Pakistan, analyzing 98 consecutive patients who underwent hypospadias repair between June 2019 and June 2024. After obtaining ethical approval from the Institutional Review Board (Ref: No. 36/ERB/NMC) with a waiver of informed consent due to the anonymized retrospective design, patients were selected based on inclusion criteria of; males aged 9 months to 10 years undergoing primary or re-operative hypospadias repair with complete medical records and a minimum 12-month postoperative follow-up. Exclusion criteria included disorders of sex development, severe comorbidities (cardiac/renal), concomitant penoscrotal anomalies, or inadequate documentation. Data information was extracted from electronic health records and operative logs including demographics (age, weight, prior repairs), hypospadias characteristics (meatal position: distal/mid/proximal; chordee severity: none, <30°, ≥30°; glans width), operative variables (surgical technique, operative time), and outcomes (early complications ≤30 days: wound infection, dehiscence, fistula; late complications >30 days: stricture, meatal stenosis, residual chordee; reoperation rate).

All procedures were performed by under supervision of consultant pediatric surgeons under general anesthesia following standard preoperative and prophylactic protocols. Surgical Techniques Used: Tubularized Incised Plate (TIP) Urethroplasty (i.e. Snodgrass technique) was used for glandular and subcoronal hypospadias, whereas Onlay Urethroplasty or Two-Stage Repairs was used for proximal hypospadias.

Outcomes were defined using HOPE criteria: urethrocutaneous fistula was confirmed by non-meatal

urinary leakage; meatal stenosis required calibration <8Fr; stricture diagnosis combined uroflowmetry (Qmax <5 mL/s) with post-void residual >20 mL; residual chordee was objectively measured as >15° curvature during intraoperative erection testing. Cosmetic success was quantified via the Pediatric Penile Appearance Score (PPAS ≥8/12) assessed jointly by surgeons and parents. Statistical analysis utilized SPSS v26.0, with continuous variables reported as mean ± SD and categorical variables as frequencies and percentages. Comparative analyses using chi-square and independent sample t-test were employed for qualitative and quantitative variables. P-value <0.05 was considered as significant.

# Results

A total of 98 patients underwent hypospadias repair and met the study inclusion criteria. The mean age at surgery was 5.36 ± 2.81 years (range: 9 months to 10 years). Hypospadias severity varied across the cohort, with 58.2% (n=57) presenting with distal, 24.5% (n=24) with mid-penile, and 17.3% (n=17) with proximal meatal locations. Chordee was identified in 67.3% (n=66) of patients, including 41.8% (n=41) with curvature <30° and 25.5% (n=25) with ≥30° curvature. Prior hypospadias repairs were documented in 14.3% (n=14) of cases (Table I).

**Table I: Patient Demographics and Clinical Characteristics. (n=98)**

| Characteristic | n (%) |
|---|---|
| **Age (years)** | |
| Mean ± SD | 5.36 ± 2.81 |
| **Meatal Position** | |
| - Distal | 57 (58.2%) |
| - Mid-penile | 24 (24.5%) |
| - Proximal | 17 (17.3%) |
| **Chordee Severity** | |
| - None | 32 (32.7%) |
| - <30° | 41 (41.8%) |
| - ≥30° | 25 (25.5%) |
| **History of Prior Repairs** | 14 (14.3%) |

Tubularized Incised Plate (TIP) urethroplasty was the most frequently used technique (68.4%, n=67), primarily in distal and mid-penile hypospadias. Onlay urethroplasty was used in 19.4% (n=19), while two-stage repairs were reserved for complex and proximal cases (12.2%, n=12). Two-stage procedures were significantly longer (142 ± 26 minutes) compared to TIP (95 ± 22 minutes) and Onlay repairs (118 ± 24 minutes) ($p$<0.001) (Table II).

A total of 79 complications were recorded, resulting in an overall complication rate of 80.6%. The most common complication was urethrocutaneous fistula, occurring in 31.6% (n=31) of cases. Other frequent complications included meatal stenosis (17.3%, n=17), wound dehiscence (14.3%, n=14), urethral stricture (10.2%, n=10), and residual chordee (7.1%, n=7). A comparison of complication rates by surgical approach revealed that the two-stage repair group accounted for 64.6% (n=51) of all complications, significantly higher than the single-stage group (35.4%, n=28) ($p$<0.001) (Table III).

**Table II: Surgical Approach and Operative Details.**

| Variable | TIP (n=67) | Onlay (n=19) | Two-Stage (n=12) | p-value |
|---|---|---|---|---|
| **Meatal Position** | | | | |
| Distal | 52 (91.2%) | 5 (8.8%) | 0 (0.0%) | <0.001 |
| Mid-penile | 15 (62.5%) | 9 (37.5%) | 0 (0.0%) | |
| Proximal | 0 (0.0%) | 5 (29.4%) | 12 (70.6%) | |
| **Operative Time (min)** | | | | |
| Mean ± SD | 95 ± 22 | 118 ± 24 | 142 ± 26 | <0.001 |

**Table III: Complication Distribution by Surgical Approach.**

| Complication | Total (n=98) n (%) | Single-Stage (n=86) n (%) | Two-Stage (n=12) n (%) | p-value |
|---|---|---|---|---|
| Urethrocutaneous fistula | 31 (31.6%) | 19 (22.1%) | 12 (100.0%) | <0.001 |
| Meatal stenosis | 17 (17.3%) | 15 (17.4%) | 2 (16.7%) | 0.956 |
| Urethral stricture | 10 (10.2%) | 6 (7.0%) | 4 (33.3%) | 0.008 |
| Wound dehiscence | 14 (14.3%) | 10 (11.6%) | 4 (33.3%) | 0.038 |
| Residual chordee | 7 (7.1%) | 5 (5.8%) | 2 (16.7%) | 0.167 |
| **Total Complications*** | **79 (80.6%)** | **28 (32.6%)** | **51 (64.6%)** | **<0.001** |

Reoperation was required in 9.2% (n=9) of the total cohort. The reoperation rate was significantly higher in the two-stage repair group (26.7%) compared to single-stage repairs (13.3%) ($p$=0.042). Cosmetic outcomes, measured using the Pediatric Penile Appearance Score (PPAS), were superior in the TIP group (92.5% achieving PPAS ≥8) compared to Onlay (73.7%) and two-stage techniques (66.7%) ($p$=0.008) (Table IV).

**Table IV: Cross-Tabulation of Outcomes and Surgical Technique.**

| Outcome | TIP (n=67) | Onlay (n=19) | Two-Stage (n=12) | Total (n=98) | p-value |
|---|---|---|---|---|---|
| **Reoperation Required** | 4 (6.0%) | 2 (10.5%) | 3 (26.7%) | 9 (9.2%) | 0.042 |
| **Satisfactory Cosmetic outcome (PPAS ≥8)** | 62 (92.5%) | 14 (73.7%) | 8 (66.7%) | 84 (85.7%) | 0.008 |

# Discussion

Urethrocutaneous Fistula, which was the most common complication which we encountered in our study, approximately 31.6% of the cases. This aligns with the reports from other studies, which say that the fistula rate ranges from 10 to 40% of the patients and it depends upon the severity of the hypospadias and the technique of the repair applied.[11] Fistula formation is linked mostly to ischemia at the suture line and inadequate tissue perfusion, if there is excessive tension on the suture line and the occurrence of infection. Many studies suggest that if a well-vascularized tissue flap is used, it can greatly reduce the risk of fistula formation.[12] Other studies have found that using a meticulous surgical technique, applying fine suture material, and attention-free closure play an important role in preventing fistula formation.[13]

The second most common complication in our study was Meatal Stenosis, and it accounted for 17.3% of the patients. Meatal Stenosis is typically caused by ischemic injury to the neomeatus in the initial stages or inflammation or scar formation later.[14] The development of obstructive symptoms to the urinary stream can be prevented by early post-operative monitoring for the signs of stenosis and early intervention in the form of urethral dilatation at the initial stages or a formal meatoplasty later .[15]

The third most common complication in our study was stricture formation, which occurred in 10.2% of the patients. And this complication was mostly observed in patients with proximal hypospadias repair. Stricture formation occurs because of many factors, and these include tissue ischemia, poor tissue quality, excessive fibrosis, or infection.[16] Modern research has found that using a technique of urethral plate preservation or applying a vascularized graft can decrease the rate of stricture formation and improve the long-term outcomes in cases of severe hypospadias.[17]

Wound dehiscence is also one of the feared complications, and in our study, it occurred in 14.3% of the cases, and this was observed in patients with infection or excessive penile edema. Good suture approximation, use of proper dressing technique, and antibiotic prophylaxis are important steps to consider in minimizing wound complications and especially wound dehiscence.[18] Residual chordee was seen in 7.1% of the patients, and this complication was mostly noted in patients undergoing two-stage repair. Residual cordee was checked at the end of the procedure by saline injection test. Cordee persists in these patients when the ventral curvature is not adequately corrected during the initial procedure. This result also in accordance with the previous study like study of Shukla AK, et al.[19]

Age of the patient at the time of surgery is also an important factor in determining the outcome. Some of the studies suggest that hypospadias should be repaired before the age of 18 months to achieve better healing and lower the complication rates.[20] Studies have found that if the procedure is delayed beyond 2-3 years, the complication rates are significantly increased in older age as a result of increased fibrosis and reduced tissue pliability; the fistula formation and structure formation rates are considerably increased. Still, other authors argue that an age beyond or near 3-4 years is associated with lesser rate of complications because these patients cooperate better in catheter removal and the dressing changes during the post-operative care .[21]

The exceptional performance of TIP urethroplasty (92.5% satisfactory cosmesis, 13.4% fistula rate) reinforces its status as the gold standard for distal repairs. However, our data suggest mobilization techniques warrant consideration for coronal/subcoronal cases, particularly for surgeons in training. The dramatic operative time difference between TIP (95±22 minutes) and staged repairs (142±26 minutes) has practical implications for resource-constrained theaters where theater time directly impacts surgical capacity. Similar results have been noted in previous literature.[22] Hypospadias surgery remains a challenging procedure with definite complications. To prevent complications & optimize the long-term outcomes of hypospadias surgery, the collaboration between pediatric urologists, reconstructive surgeons, and wound care specialists cannot be over-emphasized.

# Conclusion

This study highlights the considerable complication burden associated with hypospadias repair, particularly in proximal cases and two-stage procedures. Urethrocutaneous fistula remained the most common postoperative issue, with significantly higher rates observed in the staged repair group. Tubularized Incised Plate (TIP) urethroplasty demonstrated superior cosmetic and functional outcomes, reinforcing its role as the preferred technique for distal and select mid-penile hypospadias. Tailoring surgical approaches to anatomical severity and optimizing perioperative protocols are

essential to improve outcomes in resource-constrained settings.

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