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Research Article

Timing of Urethral Stent Removal and Its Impact on Complications after Tubularized Incised Plate Repair of Distal Hypospadias

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ABSTRACT

Background: Distal penile hypospadias is a common congenital anomaly in male children caused by incomplete development of the urethra, foreskin, and ventral penile tissues. Tubularized incised plate (TIP) urethroplasty is widely used for repair, typically employing a urethral stent to maintain neourethral patency and prevent urine leakage. However, prolonged stenting may increase complications such as urinary tract infection (UTI), bladder spasms, and discomfort. The optimal duration of stenting remains controversial.

Objective: This study aimed to compare the incidence of postoperative complications, including urethrocutaneous fistula, wound disruption, and urinary tract infection, between early and delayed stent removal after TIP urethroplasty in pediatric patients with distal penile hypospadias.

Methods: This trial was conducted at the Department of Pediatric Surgery, The Children's Hospital & Institute of Child Health, Multan. A total of 168 patients fulfilling inclusion criteria were randomly assigned to Group A (early stent removal at 72 hours) or Group B (stent removal on postoperative day 8). Neourethra was constructed over a 6–8 Fr nasogastric tube, and both groups received identical perioperative care, including antibiotics and analgesia. Patients were followed at 8, 15, and 30 days postoperatively. Statistical analysis was performed using t-test and chi-square test, with $p < 0.05$ considered significant.

Results: Baseline demographics, including age, weight, and height, were comparable between the groups. Group A demonstrated a significantly lower overall complication rate (17.85% vs 39.28%; p = 0.011) compared to Group B. The incidence of urethrocutaneous fistula was significantly lower in Group A (8.33% vs 20.23%; p = 0.035), and urinary tract infections were also reduced (2.38% vs 13.09%; p = 0.047). There was no significant difference in postoperative wound disruption between the groups. Other complications such as bladder spasms, pain, or psychological distress were not significantly different.

Conclusion: Early stent removal after TIP urethroplasty is safe and associated with fewer postoperative complications, particularly urethrocutaneous fistula formation and urinary tract infections, without increasing the risk of wound-related issues. Early stent removal may improve patient comfort and reduce catheter-related morbidity in pediatric distal hypospadias repair.

Keywords: Distal penile hypospadias, TIP urethroplasty, urethral stent, early stent removal, urethrocutaneous fistula, urinary tract infection

INTRODUCTION

Hypospadias is a common congenital malformation of the male external genitalia, characterized by an abnormal placement of the urethral opening on the ventral surface of the penis due to defective anterior urethral development. It affects approximately 1 in 200–300 male newborns globally and is typically addressed surgically during infancy or early childhood to optimize both functional and cosmetic outcomes [1,2]. Beyond restoring a straight penis and a terminally positioned meatus, modern repair techniques also aim to facilitate normal voiding, achieve satisfactory cosmetic appearance, and minimize long-term psychosocial effects on the patient and family [3,4].

Surgical correction of anterior hypospadias, including distal and mid-penile types, is most commonly achieved through single-stage tubularized incised plate (TIP) urethroplasty, while proximal forms with severe chordee often require staged procedures such as Bracka repair [5,6]. Despite its widespread adoption, TIP urethroplasty is associated with complications including urethrocutaneous fistula, wound dehiscence, and urinary tract infections [7,8]. To mitigate these risks, urinary diversion with urethral stenting is commonly used to support the neourethral suture line, maintain patency, and reduce urine contamination [9]. However, the optimal method and duration of catheterization remain a topic of debate, as prolonged stenting may increase infection risk and patient discomfort, while early removal could compromise proper wound healing [10,11].

Currently, three main approaches to postoperative catheter management are described: short-term (0–3 days), standard (7–10 days), and prolonged (15–21 days) stenting [12,13]. Evidence is inconsistent regarding the ideal duration, with some studies suggesting early removal is safe and reduces morbidity [14,15], while others recommend longer stenting to prevent fistula formation [16,17]. At the Children's Hospital and Institute of Child Health, Multan, TIP urethroplasty is routinely performed with stent removal on postoperative day eight. This practice reflects the standard approach in many pediatric urology centers, though high-quality comparative data remain limited [9,10].

This study aims to compare early versus standard stent removal in anterior hypospadias repair, with the goal of identifying a catheterization protocol that minimizes complications, improves patient comfort, and offers a cost-effective modification to current practice. Generating evidence on optimal postoperative management is essential to inform clinical protocols and enhance outcomes in hypospadias surgery.

METHODOLOGY

This study was conducted in the Department of Paediatric Surgery. The trial was approved by the hospital's ethical review committee, and written informed consent was obtained from the parents or legal guardians of all participants. Children aged 1–12 years diagnosed with distal penile hypospadias and scheduled for primary TIP urethroplasty were included, while those with chordee, small phallus (<3 cm), previous urethroplasty or penile surgery, or whose guardians declined consent were excluded. Eligible patients were recruited using non-probability consecutive sampling and were randomly assigned to two equal groups (A and B) using a lottery method.

The required sample size was calculated using a two-proportion formula, based on previously reported complication rates (P_1 = 2.3%, P_2 = 13.8%) with a 5% margin of error and 80% study power, resulting in 84 patients per group (total n = 168). Preoperative assessment included a complete blood count and viral hepatitis screening, and parents were counseled in detail regarding the procedure, postoperative care, and potential complications. All surgeries were performed under general anesthesia by a consultant pediatric surgeon to ensure standardization of technique. The TIP urethroplasty was performed in three layers: the first layer of the neourethra was closed in continuous fashion using 6/0 Vicryl, the second (dartos) layer was reinforced in interrupted fashion with 6/0 Vicryl, and the skin was closed using interrupted 5/0 Vicryl sutures. A 6–8 Fr nasogastric tube was used as a stent according to patient age, and intravenous ceftriaxone (50–100 mg/kg) was administered at induction.

Postoperative management was standardized for all patients. In group A, the urethral stent was removed on postoperative day 3, while in group B, it was removed on day 8. Patients were followed on postoperative days 8, 15, and 30. During follow-up, clinical examination and diagnostic investigations were used to identify complications, including urethrocutaneous fistula, wound disruption, and urinary tract infection (UTI). Fistulas and wound disruptions were confirmed clinically and, when necessary, by urethrogram, while UTI was confirmed by clinical signs and urine culture.

Data were recorded using a pre-tested structured proforma and verified by the supervising consultant. Quantitative variables such as age, weight, and height were presented as mean ± standard deviation (SD), and categorical variables,

including fistula formation, wound disruption, and UTI, were expressed as frequency and percentage. Comparisons between groups were performed using the Chi-square test for categorical variables and Student's t-test for continuous variables. Statistical analysis was conducted using SPSS version 25, and a p-value ≤0.05 was considered statistically significant.

RESULTS

A total of 168 patients undergoing tubularized incised plate (TIP) urethroplasty for distal penile hypospadias were included in this study. The patients were equally divided into two groups: Group A (early stent removal) and Group B (late stent removal), with 84 patients in each group.

Table 1: Baseline demographic characteristics of patients in both study groups (n = 168)

Variable	Group A (Early stent removal) n = 84	Group B (Late stent removal) n = 84	Total (n = 168)	*p*-value
Age (years)	6.87 ± 3.45 (1–12)	6.56 ± 3.67 (1–12)	6.71 ± 3.56 (1–12)	0.126
Weight (kg)	18.44 ± 6.65 (11–38)	18.77 ± 5.40 (9–34)	18.10 ± 6.04 (9–38)	0.542

Values are expressed as mean ± standard deviation (range). Independent sample t-test applied. p > 0.05, statistically insignificant.

The baseline demographic characteristics of both study groups are summarized in Table 1. The mean age of patients in Group A was 6.87 ± 3.45 years, compared with 6.56 ± 3.67 years in Group B, with no statistically significant difference between the groups (p = 0.126). Similarly, the mean weight was 18.44 ± 6.65 kg in Group A and 18.77 ± 5.40 kg in Group B, which was also statistically insignificant (p = 0.542). These findings indicate that both groups were comparable at baseline.

Table 2: Comparison of overall postoperative complications between study groups (n = 168)

Complications	Group A (Early stent removal) n = 84	Group B (Delayed stent removal) n = 84	*p*-value
Yes	15 (17.85%)	33 (39.28%)	0.011
No	69 (82.15%)	51 (60.72%)	

Chi-square test = 2.45; p = 0.011 (statistically significant).

The comparison of overall postoperative complications between the two study groups is shown in Table 2. In the early stent removal group (Group A), postoperative complications were observed in 15 patients (17.85%), whereas in the delayed stent removal group (Group B), complications occurred in 33 patients (39.28%).

Table 3: Comparison of specific postoperative complications at 1-month follow-up between study groups (n = 168)

Type of complication	Outcome	Group A (Early stent removal) n = 84	Group B (Delayed stent removal) n = 84	*p*-value
Urethrocutaneous fistula	Yes	7 (8.33%)	17 (20.23%)	0.035
	No	77 (91.67%)	67 (79.77%)	
Wound disruption	Yes	6 (7.14%)	5 (5.95%)	0.83
	No	78 (92.86%)	79 (94.05%)	
Urinary tract infection	Yes	2 (2.38%)	11 (13.09%)	0.047
	No	82 (97.62%)	73 (86.91%)	

Chi-square test applied; $p < 0.05$ considered statistically significant.

At 1-month follow-up, patients in the early stent removal group had significantly fewer urethrocutaneous fistulas (8.33% vs 20.23%) and urinary tract infections (2.38% vs 13.09%) compared with the delayed stent removal group ($p < 0.05$). However, the rate of wound disruption was comparable between the two groups and did not show a statistically significant difference (p = 0.83). Overall, early stent removal was associated with better postoperative outcomes without increasing wound-related complications.

DISCUSSION

The primary goal of hypospadias repair is to achieve both functional and cosmetic restoration of the penis, including a straight penile shaft during erection, a slit-like meatus at the tip of the glans, and a urethra capable of producing a single, well-directed urinary stream. Over the years, more than 250 surgical techniques have been described to correct hypospadias. Among these, the tubularized incised plate (TIP) urethroplasty, introduced by Snodgrass, has gained widespread acceptance for the repair of distal hypospadias because of its technical simplicity and favorable cosmetic and functional outcomes[18]. Despite its popularity, certain aspects of postoperative management, particularly the optimal duration of urethral stenting, remain controversial.

Urethral stents are commonly placed during TIP urethroplasty to maintain urethral patency, facilitate urinary drainage, and protect the suture line during the early healing phase. However, the appropriate timing of stent removal is still debated. Some authors have suggested that prolonged catheterization may increase the risk of infection and catheter-related complications, whereas others believe that delayed removal provides additional support for urethral healing[19]. In the present study, baseline demographic characteristics such as age were comparable between the early and delayed stent removal groups, minimizing potential confounding factors. Importantly, the overall complication rate was significantly lower in the early stent removal group compared with the delayed stent removal group.

Urethrocutaneous fistula remains the most common complication following hypospadias repair, with reported rates ranging from 4% to 28% in the literature[20]. In the present study, the incidence of fistula formation was significantly lower in the early stent removal group compared with the delayed removal group. Additionally, urinary tract infections were more frequent among patients with delayed stent removal, which supports previous evidence that prolonged catheterization increases the risk of bacterial colonization and infection. In contrast, the rate of wound disruption did not differ significantly between the two groups, suggesting that early stent removal does not adversely affect wound healing.

The role of urethral stenting in hypospadias surgery has been widely investigated. Snodgrass initially recommended maintaining the urethral stent for 5–7 days to support urethral healing, although several studies have reported comparable outcomes with shorter durations of catheterization or even overnight stenting[21]. Experimental evidence suggests that re-epithelialization of the incised urethral plate begins early after surgery, and early restoration of urinary flow through the neourethra may help prevent concentric scarring and stricture formation. Nevertheless, this study has certain limitations, including its single-center design and relatively short follow-up period. Further multicenter studies with larger sample sizes and longer follow-up are required to determine the optimal timing of urethral stent removal after TIP urethroplasty.

CONCLUSION

Early urethral stent removal following TIP urethroplasty is associated with a lower overall complication rate, particularly reducing the incidence of urethrocutaneous fistula formation and urinary tract infections, compared to delayed stent removal. No significant difference was observed in postoperative wound infections between the two groups. These findings suggest that early stent removal is a safe and effective strategy that may improve patient outcomes and reduce catheter-related morbidity without compromising urethral healing.

Limitations

This study was limited by its single-center design, which may affect the generalizability of the findings. The follow-up period of one month was relatively short and may not reflect long-term complications such as urethral stricture or meatal stenosis. In addition, variations in surgical materials and postoperative care may have influenced the outcomes. Further multicenter studies with longer follow-up are recommended.

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