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Efficacy of the Posterior Urethral Incision Technique (PUIT) in Urethrocutaneous Fistula Repair Following Hypospadias Surgery

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ARTICLE INFO **ABSTRACT** **ORIGINAL RESEARCH ARTICLE**

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Background: Urethrocutaneous fistula (UCF) is the most common complication following hypospadias repair, often requiring secondary surgical intervention. Despite advancements in surgical techniques, recurrence remains a significant challenge. The Posterior Urethral Incision Technique (PUIT) has been proposed as an alternative approach to improve UCF repair outcomes. This study evaluates the efficacy of PUIT in reducing UCF recurrence following hypospadias surgery. **Methods:** This prospective interventional study was conducted in the Pediatric Surgery Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh, from January 2017 to April 2018. A total of 30 patients aged 1–12 years with single UCF at least 6 months post-urethroplasty were included. PUIT was performed in all cases, and outcomes were assessed based on fistula closure rates and recurrence. Data were analyzed using SPSS version 26, with a significance level of $p < 0.05$. **Results:** The most common site of UCF was the coronal region (40%), followed by distal penile (33.3%), mid-penile (13.3%), and proximal penile (13.3%) sites. The overall success rate of PUIT was 83.3%, with 5 patients (16.7%) experiencing recurrence. Recurrence was highest in coronal fistulas (40%), with a statistically significant association between fistula location and recurrence ($p < 0.001$). **Conclusion:** PUIT is an effective technique for UCF repair, achieving a high success rate and low recurrence rate. It improves tissue approximation and reduces suture line tension, making it a reliable approach for fistula closure. Further studies with larger sample sizes and longer follow-up periods are recommended to validate its long-term efficacy.

INTRODUCTION

Hypospadias is a common congenital anomaly of the male genitalia, characterized by an ectopic urethral meatus on the ventral surface of the penis, which may be located anywhere from the glans to the perineum [1]. The condition affects approximately 1 in 300 live male births [2] and typically requires surgical intervention to achieve both functional and cosmetic restoration. The goal of hypospadias repair is to create a straight penis (orthoplasty), reconstruct a urethra with a terminal meatus (urethroplasty), and provide an aesthetically normal glans and penile shaft. Despite advancements in surgical techniques, postoperative complications remain a significant concern, with urethrocutaneous fistula (UCF) being the most prevalent and challenging complication [3].

UCF formation following hypospadias surgery remains a considerable issue, with its incidence varying based on the severity of hypospadias, the surgical technique employed, and the experience of the surgeon. Reported rates range from 5% to 20%, with more complex cases showing higher recurrence rates [4]. Several factors contribute to fistula formation, including local ischemia, infection, inadequate tissue handling, distal obstruction due to meatal stenosis, and improper suture techniques [5]. The risk of recurrence is particularly high for fistulas located at the corona or glans, as these sites are prone to increased tension and limited tissue coverage [6].

Over time, various surgical refinements have been introduced to reduce the incidence of UCF. These include the meticulous handling of tissues, the use of magnification for precision, multilayer closure techniques, interposition flaps, and the incorporation of vascularized tissues to reinforce the repair [7]. While these advancements have improved surgical outcomes, no single technique has proven to be universally effective in preventing fistula recurrence. The choice of repair method often depends on the size, location, and complexity of the fistula, as well as the condition of the surrounding tissues.

Small fistulas (<2 mm) may close spontaneously; however, persistent or larger UCFs often require surgical intervention. Traditional repair methods include simple direct closure, Y-V advancement flaps, and buccal mucosa grafts, all of which have demonstrated variable success rates [8-10]. Despite these techniques, recurrence remains a concern, with rates reported as high as 29% [11,12]. The high failure rate of conventional repairs has led to the exploration of alternative approaches to optimize fistula closure and reduce recurrence.

One such approach is the posterior urethral incision technique (PUIT), which is based on the tubularized incised plate principle. This technique involves making a midline longitudinal incision along the posterior wall of the urethra at the site of the fistula, facilitating improved tissue apposition and reducing tension across the repair site [13]. The rationale behind this method is to optimize the anatomical alignment of tissue layers, minimize suture line tension, and enhance vascularization, all of which contribute to better healing and lower recurrence rates.

Considering the challenges associated with urethrocutaneous fistula (UCF) repair and the necessity for improved surgical outcomes, this study aims to assess the efficacy of the posterior urethral incision technique (PUIT) in the management of UCF following hypospadias surgery. Specifically, it seeks to evaluate whether this technique significantly reduces fistula recurrence compared to conventional repair methods and to determine its viability as a preferred surgical approach for optimizing UCF closure.

METHODOLOGY

Study Design: This study was conducted as a prospective interventional study to evaluate the efficacy of the Posterior Urethral Incision Technique (PUIT) in the repair of urethrocutaneous fistula (UCF) following hypospadias surgery.

Study Setting and Duration: The study was carried out in the Department of Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh, over a period from January 2017 to April 2018. The study protocol was approved by the Ethical Review Committee (ERC) of Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh in November 2016, and subsequently, the Institutional Review Board (IRB) re-approved the protocol and issued certification on January 13, 2018.

Study Population and Sample Size: A total of 30 patients diagnosed with urethrocutaneous fistula (UCF) following hypospadias surgery were included in this study. All patients were admitted to the Pediatric Surgery Department of Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh Hospital (MMCH) through routine outpatient department (OPD) procedures.

Sampling and Eligibility Criteria: Purposive sampling was used to select participants based on predefined inclusion and exclusion criteria. Patients were included if they had UCF at least 6 months post-urethroplasty, were aged 1 to 12 years, and had a primary single fistula with no associated complications. Exclusion criteria included UCF occurring within 6 months of surgery, presence of comorbidities, active local infection, or recurrent/multiple fistulas.

Data Collection: Data were collected using a pre-designed questionnaire, following written informed consent from the parents/guardians. Detailed history-taking, clinical examination, and relevant investigations were performed to confirm eligibility for the study.

Investigations, Treatment, and Follow-up: Preoperative assessment included laboratory tests (complete blood count, serum creatinine, blood grouping, urine R/M/E, and culture/sensitivity) and imaging studies (chest X-ray and ultrasonography of the KUB region). For preoperative preparation, a detailed history was taken, including urinary stream pattern, urinary tract infections, and previous surgeries. Physical examination assessed the meatal position and caliber, fistula site and size, distal urethra, glans, local skin condition, and residual chordee. The surgical procedure involved dissection and trimming of the fistula edges, a posterior midline incision, and layered closure using 6-0 vicryl sutures. Urinary diversion was maintained with a PVC feeding tube, and postoperative dressing was done with povidone-iodine ointment. Postoperative care included pain management, IV and oral antibiotics, urinary stenting for 10 days, and bladder irrigation to prevent blockage. Patients were closely monitored for bleeding, edema, infection, or urinary complications, with dressings removed after 72 hours and stents removed on the 10th postoperative day (POD). Patients were followed up at 14th POD, 4 weeks postoperatively, and monthly for two months, assessing urinary stream, leakage, and potential complications. If narrowing of the urinary stream was observed, urethral calibration was performed from the 14th POD onwards.

Statistical Analysis: Collected data were analyzed using Statistical Package for Social Sciences (SPSS), version 26. Descriptive and inferential statistical analyses were performed, and a p-value <0.05 was considered statistically significant.

RESULTS

Table 1 presents the age distribution of the study population undergoing urethrocutaneous fistula (UCF) repair following hypospadias surgery using the Posterior Urethral Incision Technique (PUIT). Among the 30 patients, the highest proportion (36.7%) belonged to the 5-8 years age group, followed by 1-4 years (33.3%) and 9-12 years (30.0%).

Table 1: Age distribution of the study population

Age (years)	No of patients	Percent (%)
1-4	10	33.3
5-8	11	36.7
9-12	9	30.0
Total	30	100.0

Table 2 illustrates the distribution of urethrocutaneous fistula (UCF) sites among patients who underwent repair using the Posterior Urethral Incision Technique (PUIT) following hypospadias surgery. The majority of fistulas were located in the coronal region (40%), followed by distal penile fistulas (33.3%), while mid-penile and proximal penile fistulas were less frequent, each accounting for 13.3% of cases.

Table-2: Site of fistula

Site of fistula	No of patients	Percent (%)
Coronal	12	40
Distal penile	10	33.3
Mid penile	4	13.3
Proximal Penile	4	13.3
Total	30	100.0

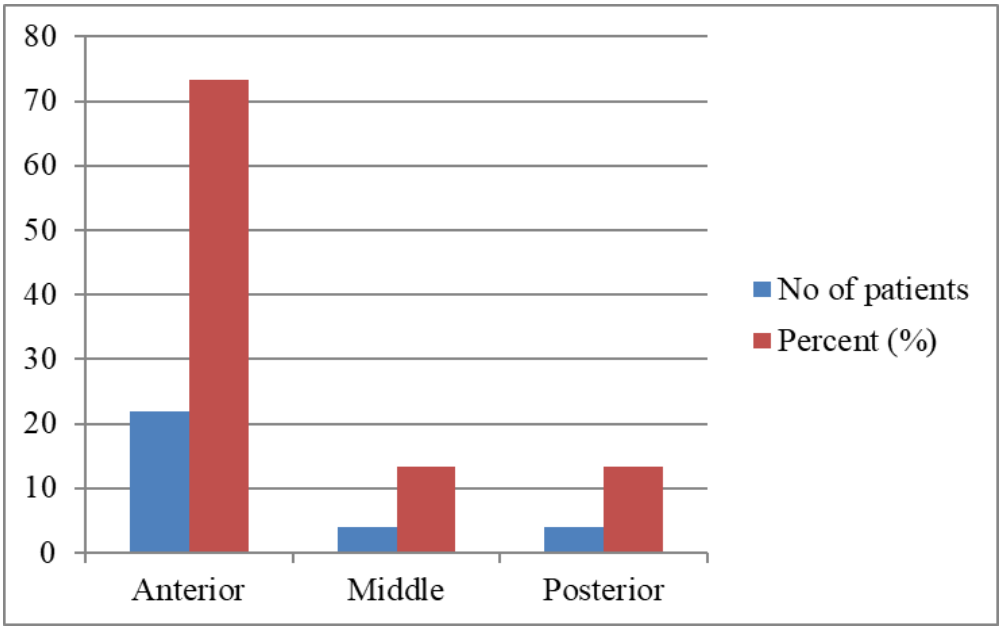

Figure 1: Types of hypospadias

Figure 1 shows the distribution of types of hypospadias among the study population. Anterior hypospadias was the most common type, accounting for approximately

21 patients (70%). Middle hypospadias was observed in 5 patients (16.7%), while posterior hypospadias was the least common, affecting 4 patients (13.3%).

Table 3 presents the distribution of urethroplasty techniques used in the primary hypospadias repair among the study population. The tubularized incised plate (TIP) urethroplasty was the most commonly performed procedure, accounting for 20 patients (66.7%), followed by the Mathieu technique in 6 patients (20%). The staged procedure was the least frequently used, performed in 4 patients (13.3%).

Table-3: Procedure of urethroplasty

Technique of primary surgery	No of patients	Percent (%)
TIP	20	66.7
Mathieu	6	20
Stage procedure	4	13.3
Total	30	100.0

Table 4 demonstrates that 5 patients (16.7%) experienced recurrent urethrocutaneous fistula (UCF) after surgery, while 25 patients (83.3%) had no recurrence. This indicates a relatively low recurrence rate, suggesting that the Posterior Urethral Incision Technique (PUIT) is effective in reducing UCF recurrence.

Table 4: Occurrence of recurrent urethrocutaneous fistula after operation

Recurrent urethrocutaneous fistula	No of patients	Percent (%)
Yes	5	16.7
No	25	83.3
Total	30	100.0

Table 5 highlights the distribution of recurrent urethrocutaneous fistula (UCF) sites among patients who experienced recurrence after surgery. The coronal region was the most common site, accounting for 2 patients (40%), followed by proximal penile (20%) and mid-penile (20%) fistulas. The p-value (<0.001) suggests a statistically significant association between fistula recurrence and its location, indicating that coronal fistulas may be more prone to recurrence.

Table 5: Distribution of Site of recurrent urethrocutaneous fistula

Site of Fistula	No of patients	Percent (%)	p Value
Coronal	2	40	<0.001
Proximal penile	1	20	
Mid penile	1	20	
Distal penile	1	20	

DISCUSSION

Urethrocutaneous fistula (UCF) remains the most common complication following hypospadias repair, often requiring secondary surgical intervention. The Posterior Urethral Incision Technique (PUIT) has been explored as a method to enhance surgical outcomes and reduce recurrence rates. This study aimed to evaluate the efficacy of PUIT

in UCF repair, assessing its success rate and risk factors associated with recurrence.

The age distribution in this study showed that the majority of patients undergoing UCF repair were in the 5–8 years age group (36.7%), followed by 1–4 years (33.3%) and 9–12 years (30.0%). This is comparable to findings in previous studies, where the mean age of UCF repair has been reported as 7.6 years [14], 5 years [10], 6.5 years [13], and 6.5 years [15]. These similarities suggest that UCF repair is commonly performed in early childhood, likely due to the timing of primary hypospadias surgery and the development of complications.

In terms of fistula location, the coronal region was the most common site (40%), followed by distal penile (33.3%), mid-penile (13.3%), and proximal penile (13.3%) fistulas. This distribution aligns with findings from Elbakry (2001), who reported coronal fistulas in 50% of cases, and Shankar et al. (2002), who found 60% of UCFs at the coronal site [14,12]. The higher incidence of coronal fistulas may be attributed to increased suture line tension and reduced vascularization in this region, leading to a higher risk of breakdown following primary urethroplasty.

Regarding hypospadias classification, anterior hypospadias was the most prevalent (70%), followed by middle (16.7%) and posterior hypospadias (13.3%). This trend is consistent with epidemiological studies that report anterior hypospadias as the most frequently encountered subtype requiring surgical correction.

The primary urethroplasty techniques used in these patients varied, with TIP urethroplasty being the most common (66.7%), followed by the Mathieu technique (20%) and staged repair (13.3%). These findings are in agreement with Elsaket and Habib (2009), who reported that TIP urethroplasty was performed in 73.3% of distal hypospadias cases [6]. The choice of surgical technique can influence the risk of UCF formation, with studies indicating that procedures with increased suture line tension or inadequate vascular support may have higher complication rates.

One of the key findings of this study was the UCF recurrence rate of 16.7%, indicating that PUIT was successful in 83.3% of cases. This success rate is comparable to other established repair techniques, such as simple closure with transpositional skin flaps 71% [12], dartos-based flap repair 91.3% [16], buccal mucosa grafts 78.6% [17], and multilayer simple closure 71% [14]. Studies focusing on PUIT for UCF repair have demonstrated high success rates, including 92.3% [10], 86.67% [13], 97.1% [18], and 97.3% [19], supporting the effectiveness of this approach.

Among the five recurrent cases (16.7%), 40% were located in the coronal region, while the remaining 60% were distributed across proximal penile, mid-penile, and distal penile sites. The p-value (<0.001) suggests a statistically significant association between fistula location and recurrence, indicating that coronal fistulas may be more prone to failure. Similar findings have been reported in previous studies, where recurrence rates were higher for coronal fistulas due to their anatomical and vascular characteristics [12,14].

The low recurrence rate observed in this study (16.7%) is significantly lower than previously reported rates, such as 35% [20], 29% [12], and 29% [14], suggesting that PUIT may be a superior technique for reducing UCF recurrence.

Limitations of the study

This study was limited by a small sample size, short follow-up period, and procedural variability, as surgeries were performed by different teams. These factors may have influenced the outcomes, highlighting the need for larger, long-term

studies with standardized surgical techniques for more conclusive results.

CONCLUSION

The Posterior Urethral Incision Technique (PUIT) is a promising approach for urethrocutaneous fistula (UCF) repair following hypospadias surgery. It offers a reliable method for improving surgical outcomes by enhancing tissue approximation and reducing tension at the repair site. This technique may be particularly beneficial in cases where fistula location and tissue viability impact healing.

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