

East African Journal of Health and Science

eajhs.eanso.org

Volume 8 Issue 1, 2025

Print ISSN: 2707-3912 | Online ISSN: 2707-3920

Title DOI: <https://doi.org/10.37284/2707-3920>



EAST AFRICAN
NATURE &
SCIENCE
ORGANIZATION

Original Article

Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania

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Article DOI: <https://doi.org/10.37284/eajhs.8.1.3063>

Date Published: ABSTRACT

29 May 2025

Keywords:

*Tubularized
Incised Plate,
Urethroplasty,
Hypospadias,
Children,
Outcomes.*

Background: Hypospadias is an anatomical congenital abnormality characterized by an abnormal development of the urethra fold with a ventral malposition of the urethra opening. Tubularized Incised Plate Urethroplasty (TIPU) is among the repair techniques that are not short of complications. **Methodology:** This was a cross-sectional study with a prospective component conducted in the Urology department from January 2023 to June 2023 with the aim to determine the short-term outcomes of Tubularized Incised Plate Urethroplasty and associated factors among children with hypospadias at Bugando Medical Centre. Children at the age of 4 months to 15 years of age were included in the study after TIPU. STATA version 15.0 was used for analysis as per the objectives of the study. With the use of the Chi-square test, a P-value of < 0.05 was considered to be significant. **Results:** 90 patients were included in the study with a median age of 2.25 years, the age of patients were grouped into two groups, <2 years and >2 years of age. After TIPU, patients were followed - up for 1 month. Glandular hypospadias was in 40 (44.44%) patients, coronal in 29 (32.22%), subcoronal in 15 (16.67%), distal penile in 4 (4.44%), and midshaft in 2 (2.22%) patients. While other factors did not show any association with the outcomes of interest, hypospadias sites were significantly associated with complications (P value = 0.029). **Conclusion.** TIPU is a simple and effective technique for hypospadias repair in children. This study has shown a significant association between interventional complications and site of malformation. With supplementary factors in question, the authors recommend other large multicenter studies to cover the facet of all practical attributes of different techniques currently in place.

APA CITATION

Wambura, E., Jotham, S., Flavian, S., John, I. & Francia, A. (2025). Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania *East African Journal of Health and Science*, 8(1), 521-529. <https://doi.org/10.37284/eajhs.8.1.3063>.

CHICAGO CITATION

Wambura, Erasto, Seth Jotham, Simula Flavian, Igenge John and Arda Francia. 2025. "Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania". *East African Journal of Health and Science* 8 (1), 521-529. <https://doi.org/10.37284/eajhs.8.1.3063>

HARVARD CITATION

Wambura, E., Jotham, S., Flavian, S., John, I. & Francia, A. (2025). "Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania", *East African Journal of Health and Science*, 8(1), pp. 521-529. doi: 10.37284/eajhs.8.1.3063.

IEEE CITATION

E., Wambura, S., Jotham, S., Flavian, I., John & A., Francia "Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania", *EAJHS*, vol. 8, no. 1, pp. 521-529, May. 2025.

MLA CITATION

Wambura, Erasto, Seth Jotham, Simula Flavian, Ige John & Arda Francia. "Short-Term Outcomes of Tubularized Incised Plate Urethroplasty and Associated Factors Among Children with Hypospadias at a Zonal Level Hospital, Lake Zone – Tanzania". *East African Journal of Health and Science*, Vol. 8, no. 1, May. 2025, pp. 521-529, doi:10.37284/eajhs.8.1.3063.

INTRODUCTION

Hypospadias is an anatomical congenital malformation of the male external genitalia. It is characterized by abnormal development of the urethral fold and the ventral foreskin of the penis that causes abnormal positioning of the urethral opening (Donaire *et al.*, 2023; Ahmad *et al.*, 2011; Baskin *et al.*, 2000; Fredell *et al.*, 2002; Aaronson *et al.*, 1997).

Worldwide prevalence of hypospadias shows a significant increase from time to time and occurs in 1 out of 300 males (Springer *et al.*, 2016) and currently, the incidence of hypospadias occurs in 1 out of every 250 male births (Arendt *et al.*, 2017; Fernandez *et al.*, 2016). The mean prevalence in Africa is estimated to be 5.9 per 10,000 live births though its exact trend is still difficult to estimate due to lack of collaboration and synchronization of national and international birth registries (Paulozzi *et al.*, 1997).

Hypospadias more often occurred in children whose fathers had hypospadias and in children with low birth weight. Elevated risks have been observed in children whose fathers were sub-fertile, whose parents had undergone fertility treatment, and in twin or triplet pregnancies. Maternal use of iron supplements, maternal smoking, paternal prescriptive drug use, and paternal exposure to pesticides during the 3 months immediately prior to conception or in the first trimester of pregnancy also appeared to increase the risk of hypospadias (Brouwers *et al.*, 2007).

There are multiple surgical options and several proposed algorithms to guide urethroplasty decision-making. Current practices appear to suggest that procedure selection is often guided by surgeon experience. Ongoing efforts to prospectively track surgical outcomes will hopefully lead to more standardized, evidence-based hypospadias decision-making. Surgical procedures can be divided into one- or two-stage procedures and into procedures that involve urethral plate (UP) tubularization, UP augmentation, and UP replacement (Keays *et al.*, 2017). TIPU overall success is about 77%-90% and even higher in proximal hypospadias repair at a success rate of 88% (Eliçevik *et al.*, 2004; Chen *et al.* 2000).

Despite the significant number of hypospadias repairs in Tanzania, little is known about the outcome and factors related to using tubularized incised plate urethroplasty as the definitive mode of management. And so, this study was conducted so as to determine the short-term outcomes of Tubularized Incised Plate Urethroplasty and associated factors among children with hypospadias at Bugando Medical Centre (BMC), a zonal referral facility and a teaching hospital for the Catholic University of Health and Allied Sciences.

METHOD AND MATERIALS**Data Source and Study Design**

This was a hospital-based cross-sectional study with a prospective component conducted from January 2023 to June 2023 in the urology department at Bugando Medical Centre (BMC) Mwanza. BMC is a tertiary referral hospital for

eight regions that serves a catchment population of more than 8 million people (Kilasi *et al.*, 2024). The urology department is well equipped with both amenities and personnel capable of offering specialized services to both adults and children.

Study Population, Sample Size and Sampling Procedures

All children who underwent single primary Tubularized Incised Plate Urethroplasty as a technique of hypospadias repair and consented/assented to participate were included in the study. Those with posterior hypospadias and those with any previous hypospadias repair surgery were excluded from the study. Using the Kish and Lisle formula (1965) the sample size was estimated to be 90 patients.

$$N = \frac{Z^2 p (1-p)}{d^2}$$

d^2

Where;

N=sample size

Z=Z score for 95% confidence interval =1.96

p =prevalence of complications of tubularized incised plate urethroplasty on primary distal hypospadias = 0.063

d=tolerable error = 5%

$$N = \frac{1.96 \times 1.96 \times 0.063 (1-0.063)}{(0.05)^2}$$

(0.05)²

Hence, the Sample size is estimated to be 90 patients.

Data Collection Method

Patients' information on social demographics, risk factors and clinical information on the type of hypospadias and complications were collected using a well-structured questionnaire, a checklist was used to collect information on the operative details information already made available in the Electronic Health Management System (EHMS). Follow-up was done from 24 hours up to 1 month postoperatively.

Data Processing and Analysis

All data collected were entered into an Excel sheet and then transferred to STATA version 15.0 software for analysis. Categorical data were expressed as frequencies and percentages (%), and continuous data were expressed as mean and standard deviations (SDs) as per their distribution. The chi-square test was used to check for association between variables and a P value of < 0.05 was considered statistically significant.

RESULTS

Patients' Characteristics

Among the total of 90 patients included in the study with age range from 4 months to 15 years of age (median age 2.25), the majority (84, 93.34%) presented with isolated hypospadias, while a smaller number (6, 6.67%) had classical hypospadias. The distribution of hypospadias defects cases among the patients was as follows: glandular in 40 (44.44%), coronal in 29 (32.22%), subcoronal in 15 (16.67%), distal penile in 4 (4.44%), and midshaft in 2 (2.22%). The study population predominantly consisted of patients aged 2 years and above, with a majority of 60 (66.67%). Table 1 provides a detailed summary of these findings.

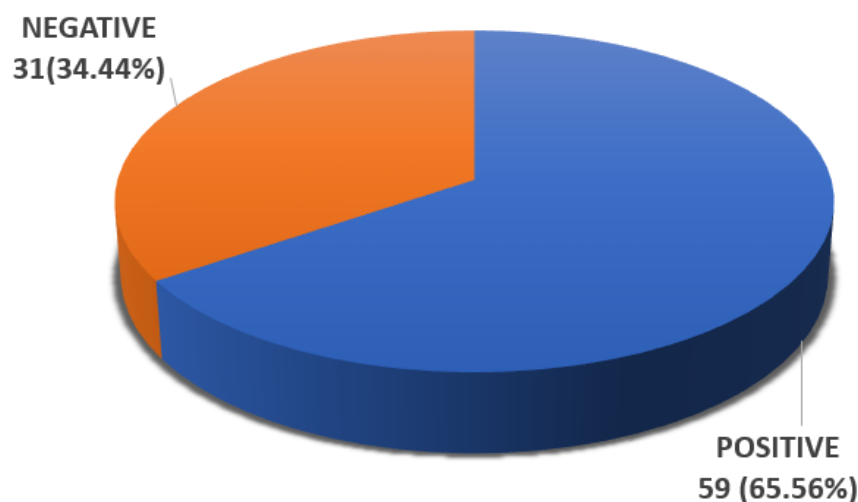
Table 1: Patients' Characteristics

Characteristics	Frequency (n)	Percentage (%)
Patient age		
≥ 2 years	60	66.67
< 2 years	30	33.33
Hypospadias type		
Glandular	40	44.44
Coronal	29	32.22
Subcoronal	15	16.67
Distal penile	4	4.44
Midshaft	2	2.22
Hypospadias features		
Classical	6	6.67
Isolated	84	93.33

Proportion of Short-term Outcomes

In total, 31 patients (34.44%) experienced negative outcomes which are urethral complications after TIPU. The distribution of short-term outcomes among the patients was as

follows: 14 patients (45.16%) had bleeding, 12 patients (38.71%) had fever, 10 patients (32.26%) had fistula formation, 8 patients (25.81%) had surgical infections, 6 patients (19.35%) had wound dehiscence, and 2 patients (6.45%) had stenosis. Figure 1 and Table 2 show more details.

Figure 1: Overall Proportion of Short-term Outcome**Table 2: Distribution of Negative Short-term Outcome**

Complication	Frequency (n)	Percentage (%)
Bleeding	14	45.16
Fever	12	38.71
Fistula	10	32.26
Infection	8	25.81
Dehiscence	6	19.35
Stenosis	2	6.45
Stricture	0	0

Distribution of Short-term Outcomes

A total of 31 patients experienced urethral complications following TIPU, with the majority of these complications occurring after coronal

hypospadias repair at a rate of 41.94%, while the fewest complications were noted in cases of distal penile hypospadias repair. Table 3 below depicts the findings.

Table 3: Distributions of Frequency of Hypospadias Type with Short-term Outcome

Hypospadias type	Positive	Negative	Total
Coronal	16 (27.12 %)	13 (41.94 %)	29 (32.22 %)
Distal penile	3 (5.08 %)	1 (3.23 %)	4 (4.44 %)
Glandular	32 (54.24 %)	8 (25.81 %)	40 (44.44 %)
Midshaft	0 (0 %)	2 (6.45 %)	2 (2.22 %)
Subcoronal	8 (13.56 %)	7 (22.58 %)	15 (16.67 %)
Total	59 (65.56 %)	31 (34.44%)	90 (100 %)

Factors Associated with Short-term Outcomes

A bivariate analysis was conducted using the chi-square test to determine the significance of categorical factors in relation to short-term

outcomes. Only the hypospadias type based on location was found to be statistically significant (P value = 0.029), indicating its association with short-term outcomes. Further information on other factors is presented in Table 4 below.

Table 4: Factors Associated with Short-term Outcome

Factor(s)	Complication		Chi-square	P-value
	Positive n (%)	Negative n (%)	χ^2	
<i>Age</i>				
< 2 years	18(60.00)	12(40.00)	0.6151	0.433
≥ 2 years	41(68.33)	19(31.67)		
<i>Hypospadias type</i>				
Coronal	16(55.17)	13(44.83)	11.988	0.029
Distal penile	3(75.00)	1(25.00)		
Glandular	32(80.00)	8(20.00)		
Midshaft	0(0.00)	2(100.00)		
Subcoronal	8(53.33)	7(46.67)		
<i>Hypospadias features</i>				
Classical	3(50.00)	3(50.00)	1.566	0.411
Isolated	56(66.67)	28(33.33)		
<i>Suture size</i>				
3-0	3(42.86)	4(57.14)	0.567	0.150
4-0	31(73.81)	11(26.19)		
5-0	25(62.50)	15(37.50)		
6-0	0(0.00)	1(100.00)		
<i>Surgeon experience</i>				
≤ 2 years	8(57.14)	6(42.86)	1.678	0.471
> 2 years	51(67.11%)	25(32.89%)		

DISCUSSION

Tubularized Incised Plate Urethroplasty (TIPU) has gained wide acceptance as a preferred surgical technique for hypospadias repair due to several advantages. It is a one-stage procedure that is

relatively easy to learn and provides versatility in its application. TIPU is associated with a low complication rate and offers favourable cosmetic and function outcomes, including a vertically oriented meatus with a slit-like appearance with

good urine stream outflow. However, it is important to recognize that various factors, such as anatomical variations of meatus opening and surgical technique, can influence the surgical outcome (Ducket *et al.*, 1980).

Studies have reported the occurrence of complications following TIPU and their respective frequencies. In this study, the overall percentage of post-operative complications within 30 days after TIPU was found to be 34.44%, this is consistent with a study by Appeadu-Mensah *et al.* (2015) which reported 28%. Also, the current study reported an overall distribution of complications as follows; bleeding accounted for 15.55%, fistula for 11.11%, infection for 8.88%, dehiscence for 6.67%, and stenosis for 2.22%. These findings are consistent with other studies that have reviewed the literature and existing techniques reported similar ranges for various complications such as infection (5% to 10%), fistula (3% to 10%), bleeding (5% to 10%), dehiscence (0.2% to 2%), and stenosis (5% to 10%) (Appeadu-Mensah *et al.*, 2015; Snodgrass *et al.*, 2017; Snodgrass *et al.*, 2010; Bhat *et al.*, 2008).

The influence of age on the occurrence of complications following TIPU in hypospadias patients has been a topic of interest and investigation. Some studies suggest that age may not be a significant factor associated with complications, while others may report conflicting results. In this study we found that age does not influence complications, this observation is consistent with other studies as Alshafei *et al.* (2020) evaluated the outcomes of TIPU in different age groups and found no statistically significant association between age and complications. Similarly, a study by Güler *et al.* (2020), analyzed multiple studies on TIPU outcomes and identified no significant association between age and complications. They concluded that patient age does not appear to be a crucial determinant of complication rates in TIPU surgeries.

The study found hypospadias sites to have a significant statistical association with the occurrence of complications. A similar result has

been reported in different studies such as that of Sarhan and others conducted at a single center and included a cohort of 500 patients who underwent TIP urethroplasty for different types of hypospadias. The site of hypospadias was categorized into several groups, such as glandular, coronal, distal penile, mid penile, proximal penile, and scrotal. The authors assessed the surgical outcomes and identified factors that influenced the success and complications of TIP urethroplasty. The findings of the study revealed that the site of hypospadias significantly affected the surgical outcomes of TIPU. The success rates varied among different hypospadias sites, with the glandular and coronal sites demonstrating the highest success rates (Sarhan *et al.*, 2009).

The choice of suture size used in TIPU procedures can vary among surgeons, and there is ongoing debate regarding its impact on surgical outcomes and the risk of complications. In this study we explored four different suture sizes as follows; 3-0, 4-0, 5-0, 6-0 and we found no statistical significance to the complications. Similar results are reported by other several studies that investigated the influence of suture size on TIPU outcomes, particularly in distal hypospadias cases. Another study evaluated the use of different suture sizes in TIPU for distal hypospadias repair and reported similar rates of complications between suture sizes (Ducket *et al.*, 1980).

Hypospadias features, classical (typical presentation) and isolated (without associated anomalies), are important considerations in the management and outcomes of distal hypospadias repair. While the specific association between these features and complications may vary across studies, the presence of classical or isolated hypospadias in distal cases generally suggests a better prognosis and lower risk of complications. In this study, we investigated the hypospadias features and found no statistically significant difference in terms of complication rate. Similar results have been seen in a study done in Thailand which investigated the outcomes of TIPU in 80 hypospadias patients, the author did not find a significant association between hypospadias features (including classical presentation and

isolated hypospadias) and the occurrence of complications. The study reported low overall complication rates in distal hypospadias patients, supporting the notion that these cases have favourable outcomes. Another study by Workineh and others. Examined the surgical outcomes of TIPU in 129 hypospadias patients, distal hypospadias were the most common type of hypospadias corrected with TIPU having no association with the presenting features (Viseshsindh *et al.*, 2014; Workineh *et al.*, 2022).

It is common knowledge that “Surgeon experience plays a crucial role in the outcomes of surgical procedures”: The association between surgeon experience and complications in Tubularized Incised Plate Urethroplasty (TIPU) procedures may vary across studies, however, there is evidence suggesting that the experience of the surgeon can influence the occurrence of complications. In this particular study, no statistically significant difference was found between surgeon experience and complications. It is important to note that the difference in findings compared to other studies may be attributed to the sample size, as studies with larger samples might probably give a different observation. A study conducted by Horowitz *et al.* examined the impact of surgeon experience on TIPU outcomes, the study included 231 cases performed by one pediatric urologist by observing the outcome of patients operated on in the given timeline over five consecutive years. The authors found that surgeon experience had a significant influence on the occurrence of complications as they reported an absolute decrease in complication rate between the first two and the last two years of a given surgeon. Similarly, Özman *et al.* reported complication rate significantly decreases among surgeons after two years of experience. The same surgeon who had a higher complication rate observed a profound increase in success rate after just two years of practising from 65% to 91% (Horowitz *et al.*, 2006; Özman *et al.*, 2019).

Other variables such as the double dartos layer were not analyzed because all surgeons used the double dartos layer during TIPU, and all surgeries used vicryl as a uniform suture material because

these variables were constantly distributed and then excluded in the analysis.

CONCLUSION

TIPU is the easiest technique for primary hypospadias repair due to its high success rate compared to other techniques. Despite its high success rate, complications are still there predisposing the patients to other consecutive surgeries. The age of the patients in this study was not an independent risk factor for the development of complications hence suggesting the use of TIPU at any age in children. The study observed a significant association between hypospadias type on meatal location and with the development of complications. However, suture size and surgeon experience were not associated with the development of complications.

Recommendation

Being a single-centre study done at a tertiary hospital, its results cannot be generalized due to different care protocols and even the number of patients included in the study. Also, most of the cases were performed by two surgeons making it difficult to justify an observed lack of association between the surgeon's experience to other short-term outcomes against common existing knowledge. We therefore recommend another multicenter study to enhance the generalizability and robustness of these findings by incorporating diverse populations, clinical settings, expertise and surgical experiences.

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