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Complications of Snodgrass Repair in Hypospadias in Ayub Teaching Hospital Abbottabad

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Abstract: Background: **Objective:** To determine the frequency of complications following Snodgrass repair in patients with hypospadias at Ayub Teaching Hospital Abbottabad. **Study Design:** Descriptive cross sectional study. **Duration and Place of Study:** This study was conducted from July 2025 to October 2025 in the Plastic Surgery and Burn Unit of Ayub Teaching Hospital Abbottabad. **Methodology:** A total of 121 children aged 6 months to 12 years was selected. All patients undergone Snodgrass repair performed by the same consultant surgeon. Postoperative complications were including edema, pericatheter leak, meatal stenosis, urethrocutaneous fistula, wound infection, urethral stricture, penile skin necrosis, and wound dehiscence were assessed up to 6 months. Data were analyzed using chi square test and Fisher exact test. A p value ≤0.05 was taken as significant. **Results:** In this study the mean age was 3.88 ± 1.79 years and mean weight was 15.89 ± 4.22 kg. Distal hypospadias was most common (57.9%). Postoperative edema occurred in 36 children (29.80%) and was the most frequent complication. Pericatheter leak occurred in 22 children (18.20%) and showed highly significant association with hypospadias type ($p < 0.001$). Meatal stenosis was seen in 12 children (9.90%) and showed significant relation with age group ($p = 0.015$) and type of hypospadias ($p < 0.001$). Urethrocutaneous fistula occurred in 12 children (9.90%) and had strong association with type ($p < 0.001$). Urethral stricture (5.80%), penile skin necrosis (5.80%), and wound dehiscence (4.10%) were less frequent. **Conclusion:** Snodgrass repair in this population showed variable complication rates, with postoperative edema being most common.

Keywords: Child, Hypospadias, Postoperative Complications, Surgical Procedures Operative, Urethra, Urethral Diseases

INTRODUCTION

Hypospadias refers to the congenital urethral anomaly found in men where the urethra opens beneath the penis rather than at the end of the penis' glans.[1] Hypospadias can be quite mild and occur at the tip of the penis' glans or severe when the opening occurs closer to the scrotum.[2] In many instances, surgical correction of the condition has been widely asked for with the objective of restoring the functionality and aesthetic nature of the penis.[3] In the many surgical choices available to correct the condition of hypospadias in infants and toddlers that can restore the natural functionality of the penis, the Snodgrass procedure, also known as the tubularized incised plate urethroplasty technique of correcting hypospadias, has been widely employed across the world due to the positive results and the unique ability to retain natural penile structures.[4]

One of the complications which might occur following the Snodgrass procedure involves penile swelling owing to edema.[5] This condition can be rather unpleasant for the patient and might hide other complications. The next possible complication involves catheter leakage. The catheter passes through the urethra so that urine can flow freely during the procedure.[6] The leakage of the catheter can cause infections of the urethra. Infections can also cause meatal stenosis of the urethra. This can cause the urethra to become irritated due to its narrowing as a result of various factors that can necessitate surgery.[6] Additionally, the development of urethrocutaneous

fistula can also be a possible type of complications of the procedure. This can be the development of a fistula due to the injury of the urethra from surgery.[7] This condition can cause continuous leakage of urine from the urethra through the skin. Wound infections also occur due to the surgery and can be rather irritating to the patient as they might also cause complications in the urethra due to their effect on the speed of urethral healing.[8]

Other possible complications are urethral stricture, which refers to the abnormal constriction of the urethra due to scarring.[9] This will cause obstruction of the urinary flow and will often cause the patient immense discomfort due to urinary retention.[10] Another severe type of complication regarded as penile skin necrosis refers to the death of skin found around the surgical location due to low tissue circulation and infections.[11] Dehiscent wound complications can result in the surgical location being opened up due to the failure of the repair surgery.[11] In some instances, the complications may require the patient to undergo additional corrective surgeries. This will cause the patient's recovery time to be longer due to the whole surgical procedure being affected negatively.[11]

In a study by Reddy RP et al. has shown that frequency of postoperative edema was 30%, peri-catheter leak 18%, meatal stenosis 10%, urethrocutaneous fistula 10%, wound infection 10%, urethral stricture 6%, penile skin necrosis 6% and wound dehiscence was 4% in patients with hypospadias.[12]

The study is needed in Abbottabad because the region still shows limited scientific attention, and many important factors are not well examined. The area present unique local conditions, so conducting research here can give more clear understanding that other places not provide. Also, there is very less existing literature from Abbottabad, which create a gap that this study try to fill. Therefore, the study in Abbottabad is consider important for improving knowledge and guiding future academic work.

METHODOLOGY

The study was done as a descriptive work in the Plastic Surgery and Burn Unit of Ayub Teaching Hospital Abbottabad after taking Ethical approval from the hospital committee (Approval Code / Ref. No RC-EA-2025/142), and it continued from July 2025 to October 2025. A sample of 121 children had been calculated through WHO calculator using 95% confidence level, 3.5% margin of error, and expected wound dehiscence rate of 4%.12 Hypospadias was defined as that the urinary opening was lying on the underside of the penis, either distal (on glans/corona), mid-shaft (along penile body), or proximal (near penoscrotal junction, scrotum, or perineum). Children between 6 months and 12 years who were planned for their first Snodgrass repair were included. Patients with previous failed hypospadias repair, past inguinoscrotal surgery, previous circumcision, penile curvature >30 degrees, uncontrolled diabetes, steroid use, or congenital anomalies were excluded. Before recording any information, written consent from parents had been obtained. Demographic data such as age, weight, type of hypospadias, family history of hypospadias, socioeconomic status, residential status, and duration of complaints had been documented.

History and physical examination were done for confirming type of hypospadias and fitness for surgery. Children remained NPO for 6–8 hours and received ceftriaxone 50 mg/kg IV before incision. General anesthesia with caudal block had been administered. Patients were placed supine with frog-leg position. Glans traction stitch was applied and tourniquet used if required. Incision lines were marked around meatus and along urethral plate. U-shaped cuts were extended to glans tip. Urethral plate width stayed about 8–10 mm before relaxation. Penile degloving was performed by dissecting skin and dartos. A midline plate incision widened the plate to around 12–15 mm. Tubularization was done over 6–8 Fr catheter using 7-0 polyglactin interrupted sutures spaced 2–3 mm. A dartos flap about 2 cm was transposed ventrally to cover neourethra. Glans was closed in 2 layers with 6-0 polyglactin and skin was approximated with 7-0 absorbable sutures. Petroleum-based gauze dressing was applied and catheter fixed to abdomen. All procedures were performed by a consultant surgeon with 3-year post-fellowship experience. Postoperatively, hydration and analgesia with acetaminophen 15 mg/kg every 6 hours had been given. Antibiotics continued for 7 days. Patients were monitored for urine output, bleeding, infection, and catheter blockage. Dressing was changed on day 3, and catheter remained for 10 days. Parents were instructed regarding double-diaper method. After catheter removal on day 10, postoperative edema, wound dehiscence, penile skin necrosis, and wound infection were checked based on the definitions above. Sitz bath twice daily and topical antibiotic ointment for 5–7 days had been advised. Follow-up on day 18, at 1 month, 3 months, and 6 months was done to detect meatal stenosis, urethrocutaneous fistula, and urethral stricture.

Postoperative edema meant swelling or puffiness of penis within 10 days; peri-catheter leak meant urine wetness around catheter or wound within 72 hours; meatal stenosis meant difficulty passing appropriate catheter (<6 Fr infants, <8 Fr older children) or thin urine stream; urethrocutaneous fistula meant urine coming from any extra opening after catheter removal within 6 months; wound infection meant redness >1 cm with tenderness and foul discharge within 10 days; urethral stricture meant weak urinary stream, straining, incomplete emptying or >50% narrowing on imaging within 6 months; penile skin necrosis

meant black discoloration or tissue loss within 10 days; wound dehiscence meant stitch-line separation <5 mm or ≥5 mm on day 10. Data were analyzed with SPSS version 26. Qualitative variables were expressed as frequencies and percentages. Quantitative variables were presented as mean ± SD or median (IQR) based on Shapiro-Wilk test. Complications were stratified by age and type of hypospadias, and chi-square or Fisher exact test was applied with p ≤0.05 as significant.

RESULTS

The study included total 121 patients with mean age of 3.88±1.79 years and average weight was 15.89±4.22 kg. The duration of complaints was noted as 93.00±67.77 weeks (as shown in Table-I). Regarding type of hypospadias, majority patients had distal type which was 70 cases (57.9%), followed by midshaft type in 30 cases (24.8%) and proximal type was found in 21 cases (17.4%). When looking at family socioeconomic status, 54 patients (44.6%) belongs to low socioeconomic status, 40 patients (33.1%) were from middle class families and 27 patients (22.3%) had high socioeconomic status. The residential distribution showed that 66 patients (54.5%) were coming from rural areas while 55 patients (45.5%) belongs to urban areas. Family history of hypospadias was positive in 24 patients (19.8%) whereas 97 patients (80.2%) had no family history of this condition (as shown in Table-I).

Table- I: Patient Demographics

Demographics	**Mean ± SD**
Age (years)	3.88±1.79
Weight (kg)	15.89±4.22
Duration of Complaints (weeks)	93.00±67.77
Type of Hypospadias	
Distal n (%)	70 (57.9%)
Midshaft n (%)	30 (24.8%)
Proximal n (%)	21 (17.4%)
Family Socioeconomic Status	
Low n (%)	54 (44.6%)
Middle n (%)	40 (33.1%)
High n (%)	27 (22.3%)
Residential Status	
Rural n (%)	66 (54.5%)
Urban n (%)	55 (45.5%)
Family History of Hypospadias	
Yes n (%)	24 (19.8%)
No n (%)	97 (80.2%)

The complications after Snodgrass repair was observed in different frequencies. Postoperative edema was most common complication occurring in 36 patients (29.80%), followed by ericatheter leak which was seen in 22 patients (18.20%). Three complications showed equal frequency of 12 cases each (9.90%) which includes meatal stenosis, urethrocutaneous fistula and wound infection. Urethral stricture and penile skin necrosis both occurred in 7 patients each (5.80%). Wound dehiscence was least common complication occurring in only 5 patients (4.10%) as shown in Table-II.

Table- II: Frequency of Complications Following Snodgrass Repair in Hypospadias

Complications	**Frequency**	**% age**
Postoperative Edema	36	29.80%
Pericatheter Leak	22	18.20%
Meatal Stenosis	12	9.90%
Urethrocutaneous Fistula	12	9.90%
Wound Infection	12	9.90%
Urethral Stricture	7	5.80%
Penile Skin Necrosis	7	5.80%
Wound Dehiscence	5	4.10%

When analyzing association of postoperative edema with age groups, it occurred in 26 patients (27.7%) who were ≤5 years age and in 10 patients (37.0%) who were >5 years age, this difference was not statistically significant (p=0.348). Similarly, postoperative edema distribution across different types of hypospadias showed 20 cases (28.6%) in distal type, 10 cases (33.3%) in midshaft type and 6 cases (28.6%) in proximal type with no significant association (p=0.885) as demonstrated in Table-III. For ericatheter leak, the age-wise distribution showed 17 cases (18.1%) in ≤5 years

group and 5 cases (18.5%) in >5 years group with p=1.000 showing no significant difference. However, when analyzing according to type of hypospadias, ericatheter leak showed highly significant association (p<0.001) as no cases occurred in distal type (0.0%), while 15 cases (50.0%) occurred in midshaft type and 7 cases (33.3%) in proximal type (as shown in Table-III). Meatal stenosis occurred in 6 patients (6.4%) in ≤5 years age group and 6 patients (22.2%) in >5 years age group, showing statistically significant difference (p=0.015). Type of hypospadias also showed highly significant association with meatal stenosis (p<0.001) with no cases in distal type (0.0%), 9 cases (30.0%) in midshaft type and 3 cases (14.3%) in proximal type as shown in Table-III. Urethrocutaneous fistula occurred in 10 patients (10.6%) in younger age group and 2 patients (7.4%) in older age group with no significant difference (p=0.734). However, type of hypospadias showed highly significant association (p<0.001) with no cases in distal type (0.0%), 6 cases (20.0%) in midshaft type and 6 cases (28.6%) in proximal type (as shown in Table-III). Wound infection showed 8 cases (8.5%) in ≤5 years group and 4 cases (14.8%) in >5 years group without significant association (p=0.463). Distribution across hypospadias types was 7 cases (10.0%) in distal, 3 cases (10.0%) in midshaft and 2 cases (9.5%) in proximal types, showing no significant association (p=1.000) as demonstrated in Table-III. Urethral stricture occurred in 6 patients (6.4%) in younger age group and 1 patient (3.7%) in older age group showing no significant difference (p=0.695). However, type of hypospadias showed significant association (p=0.001) with no cases in distal type (0.0%), 6 cases (20.0%) in midshaft type and 1 case (4.8%) in proximal type (as shown in Table-III). Penile skin necrosis was observed in 7 patients (7.4%) in ≤5 years age group with no cases in >5 years age group (0.0%), this difference was not statistically significant (p=0.205). Type of hypospadias showed significant association (p=0.004) with no cases in distal type (0.0%), 4 cases (13.3%) in midshaft type and 3 cases (14.3%) in proximal type as shown in Table-III. Wound dehiscence occurred in 5 patients (5.3%) in younger age group with no cases in older age group (0.0%), showing no significant difference (p=0.349). Type of hypospadias demonstrated significant association (p=0.010) with no cases in distal type (0.0%), 2 cases (6.7%) in midshaft type and 3 cases (14.3%) in proximal type (as shown in Table-III).

Table-III: Association of Complications with Age Group and Type of Hypospadias

Variables		**Complications**		**p-value**
		Yes n(%)	**No n(%)**	
Postoperative Edema				
Age Group	≤5 years	26 (27.7%)	68 (72.3%)	0.348
	>5 years	10 (37.0%)	17 (63.0%)	
Type of Hypospadias	Distal	20 (28.6%)	50 (71.4%)	0.885
	Midshaft	10 (33.3%)	20 (66.7%)	
	Proximal	6 (28.6%)	15 (71.4%)	
Pericatheter Leak				
Age Group	≤5 years	17 (18.1%)	77 (81.9%)	1.000*
	>5 years	5 (18.5%)	22 (81.5%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	<0.001*
	Midshaft	15 (50.0%)	15 (50.0%)	
	Proximal	7 (33.3%)	14 (66.7%)	
Meatal Stenosis				
Age Group	≤5 years	6 (6.4%)	88 (93.6%)	0.015
	>5 years	6 (22.2%)	21 (77.8%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	<0.001*
	Midshaft	9 (30.0%)	21 (70.0%)	
	Proximal	3 (14.3%)	18 (85.7%)	
Urethrocutaneous Fistula				
Age Group	≤5 years	10 (10.6%)	84 (89.4%)	0.734*
	>5 years	2 (7.4%)	25 (92.6%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	<0.001
	Midshaft	6 (20.0%)	24 (80.0%)	
	Proximal	6 (28.6%)	15 (71.4%)	
Wound Infection				
Age Group	≤5 years	8 (8.5%)	86 (91.5%)	0.463*
	>5 years	4 (14.8%)	23 (85.2%)	
Type of Hypospadias	Distal	7 (10.0%)	63 (90.0%)	1.000*

	Midshaft	3 (10.0%)	27 (90.0%)	
	Proximal	2 (9.5%)	19 (90.5%)	
Urethral Stricture				
Age Group	≤5 years	6 (6.4%)	88 (93.6%)	0.695*
	>5 years	1 (3.7%)	26 (96.3%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	0.001*
	Midshaft	6 (20.0%)	24 (80.0%)	
	Proximal	1 (4.8%)	20 (95.2%)	
Penile Skin Necrosis				
Age Group	≤5 years	7 (7.4%)	87 (92.6%)	0.205*
	>5 years	0 (0.0%)	27 (100.0%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	0.004*
	Midshaft	4 (13.3%)	26 (86.7%)	
	Proximal	3 (14.3%)	18 (85.7%)	
Wound Dehiscence				
Age Group	≤5 years	5 (5.3%)	89 (94.7%)	0.349*
	>5 years	0 (0.0%)	27 (100.0%)	
Type of Hypospadias	Distal	0 (0.0%)	70 (100.0%)	0.010*
	Midshaft	2 (6.7%)	28 (93.3%)	
	Proximal	3 (14.3%)	18 (85.7%)	

*Fisher Exact Test

DISCUSSION

In current study, postoperative edema was most common complication occurring in 36 patients (29.80%). This high frequency can be explained because edema is natural inflammatory response of tissue to surgical trauma. The delicate penile skin undergoes significant handling during procedure which leads to disruption of lymphatic drainage and venous congestion, but typically resolves spontaneously within few weeks. Pericatheter leak was second most common complication seen in 22 patients (18.20%) and showed highly significant association with type of hypospadias (p<0.001). No cases occurred in distal type (0.0%) while 15 cases (50.0%) occurred in midshaft type and 7 cases (33.3%) in proximal type. This is because more proximal hypospadias requires longer urethral reconstruction with increased tension on suture lines and the tissue quality in proximal cases is often poorer which compromises healing. Meatal stenosis occurred in 12 patients (9.90%) and showed significant association with age group (p=0.015) and type of hypospadias (p<0.001). The higher occurrence in older age group with 6 cases (22.2%) compared to younger group with 6 cases (6.4%) may be due to increased fibrosis in older children. The absence in distal type (0.0%) compared to 9 cases (30.0%) in midshaft suggests that in proximal repairs, the neomeatus may have inadequate vascularity leading to scarring and contracture. Urethrocutaneous fistula occurred in 12 patients (9.90%) with highly significant association to type of hypospadias (p<0.001). No cases in distal type (0.0%) versus 6 cases (20.0%) in midshaft and 6 cases (28.6%) in proximal type shows that fistula is complication of more complex repairs. This happens due to breakdown of urethral suture line because of infection, poor tissue vascularity or excessive tension. Proximal hypospadias requires more extensive dissection which compromises blood supply. Urethral stricture was seen in 7 patients (5.80%) with significant association to type of hypospadias (p=0.001), with 6 cases (20.0%) in midshaft type. Stricture formation results from excessive scarring during healing which causes narrowing of urethral lumen due to ischemia of tissue and surgical factors. Penile skin necrosis occurred in 7 patients (5.80%) and showed significant association with type of hypospadias (p=0.004). The absence in distal type (0.0%) compared to 4 cases (13.3%) in midshaft and 3 cases (14.3%) in proximal types is because skin necrosis results from inadequate blood supply to penile skin flaps. During proximal repairs, extensive mobilization of skin flaps may compromise vascular supply leading to ischemic necrosis.

These findings shows higher complication rates compared to several other studies. Abdullah *et al.* [13] reported overall complication rate of 27.2% with UCF being most common at 9.6%, which is similar to current study UCF rate of 9.90%. Similarly, Ikram ud Din *et al.* [14] found UCF in 10% and meatal stenosis in 6% cases which closely matches present findings. However, Qureshi *et al.*[15] reported much lower complication rate of only 7.27% with UCF in 5.45% cases, this difference may be due to their strict inclusion criteria of urethral plate width >8 mm and use of TIPS technique with spongioplasty which provides better tissue coverage and reduces tension on suture line.

The higher overall complication rate in present study may be attributed to inclusion of all types of hypospadias including proximal cases which are more complex, whereas studies like Abdullah *et al.* [13] Ikram ud Din *et al.* [14] and Qureshi *et al.* [15] included only distal hypospadias cases. Mohammed *et al.* [16] reported even higher complication rate of 61.6% with UCF in 40.5% and meatal stenosis in 11.1% cases in their large series of 252 patients over 10 years period. Their higher rates may be explained by longer follow-up duration allowing detection of late complications and inclusion of more proximal cases which constituted 31.7% of their cohort. The finding that proximal hypospadias had more complications is consistent with current study where pericatheter leak showed highly significant association with type, occurring in 0% distal, 50% midshaft and 33.3% proximal cases ($p<0.001$).

Meatal stenosis in present study occurred in 12 cases (9.90%) which is higher than rates reported by Anwar-ul-Haq *et al.* [17] who found 5.5% in Snodgrass group and Anwar Ul Haque *et al.* [18] who reported only 2% cases. The current study also found significant association of meatal stenosis with age group ($p=0.015$) with higher occurrence in >5 years age group 6 cases (22.2%) compared to ≤5 years group 6 cases (6.4%), which contradicts findings of Abdullah *et al.* [13] who reported younger age group had more complications. This discrepancy may be because meatal stenosis is late complication resulting from scar contracture which takes time to develop and may be more pronounced in older children due to increased fibrosis tendency, whereas immediate complications like UCF and skin necrosis are more common in younger children due to delicate tissue handling issues as shown by Abdullah *et al.* [13] where Group A (6-18 months) had highest UCF rate of 25.9% and skin necrosis 7.4%.

Penile skin necrosis in current study occurred in 7 cases (5.80%) with significant association to type of hypospadias ($p=0.004$), being 0% in distal, 13.3% in midshaft and 14.3% in proximal types. This finding is supported by Shivapur *et al.* [19] who reported skin necrosis as most common immediate complication in 24% cases with 64% occurring specifically in Snodgrass repair cases. The higher rates in their study may be due to technical factors or tissue handling during surgery. In contrast, Abdullah *et al.* [13] reported skin necrosis in only 1.5% cases but their study included only distal hypospadias where tissue handling is less complex and skin flaps are shorter with better vascularity.

Urethral stricture in present study was 5.80% with significant association to type ($p=0.001$), being highest in midshaft type at 20%. This is comparable to Saleem *et al.* [20] who reported stricture in 3.3% of Snodgrass cases and Mohammed *et al.* [16] who found 3.2% stricture rate. However, Ikram ud Din *et al.* [14] reported no urethral stricture in their series which may be due to smaller sample size of 50 patients and shorter follow-up period as stricture is late complication that may take months to years to develop.

Wound infection in present study occurred in 12 cases (9.90%) with no significant association to age or type of hypospadias ($p=1.000$), showing equal distribution across all types. This rate is lower than Saleem *et al.* [20] who reported 10% infection in Snodgrass group and Shafaatullah *et al.* [21] who found 7.5% wound infection. The similar rates across different types in current study suggests that infection is related to general surgical factors like sterility, antibiotic prophylaxis and postoperative care rather than complexity of repair.

Several comparative studies have shown that Snodgrass repair has lower complication rates compared to other techniques. Anwar-ul-Haq *et al.* [17] found UCF was significantly higher in Mathieu repair 7.7% compared to Snodgrass 3.3%, while Saleem *et al.* [20] reported lower complications in Snodgrass 40% compared to Bracka's 60%. Similarly, Qazi Amjad Ali *et al.*[22] found UCF in 9% of Snodgrass compared to 18% in Bracka technique, though difference was not statistically significant. These findings supports use of Snodgrass as preferred technique for anterior hypospadias repair due to single-stage procedure with good cosmetic outcomes and acceptable complication rates.

There are some limitations in the research. Firstly, the research was done in one center. This might affect the ability to generalize the results. Secondly, the research was carried out on 121 patients. This might affect the statistical power. Thirdly, the follow-up period was variable. This might affect the sensitivity in detecting late complications. Fourthly, the research was performed in one center. This means that the research lacks comparison. However, it might help in comparing the success rate of the Snodgrass procedure. Fifthly, in the research, the issue of the surgeon's experience was not controlled. Sixthly, some researches might encounter problems in the completeness of the documentation. Additionally, the research might encounter some biases in recall.

CONCLUSION

Conclusion of the current research work reveals that the complications occurring in the post-operative period of the Snodgrass procedure performed on hypospadias patients are diverse in nature. Among them, the primary complications are the occurrence of post-operative edema, pericatheter leak, urethrocutaneous fistula, meatal stenosis, and then the incidence of wound infection. Additionally, the current research work also reveals the significant association of hypospadias types with the majority of the complications. According to the research outcomes, complications are higher in the

proximal/mid-shaft hypospadias types in comparison to the distal hypospadias.

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