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Original Article

Outcome and Treatment of Adult Non-Urethral Complications Following Hypospadias Repair in Childhood

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ABSTRACT

Hypospadias repair is commonly performed during childhood to restore normal urinary function and achieve a satisfactory penile appearance. However, non-urethral complications may persist or become apparent during adulthood, affecting penile appearance, function, and psychological well-being. **Objective:** To evaluate the frequency, clinical presentation, management, and outcomes of non-urethral complications among adult patients who underwent hypospadias repair during childhood. **Methods:** This descriptive observational study was conducted at Bakhtawar Amin Memorial Trust Hospital in Multan from April 2025 to January 2026. Adult male patients aged 25–40 years with a history of primary hypospadias repair during childhood were evaluated. Consecutive non-probability sampling was employed. A total of 120 patients were evaluated, of whom 82 had non-urethral complications and were included in the complication-specific analysis. Clinical findings, types of complications, management strategies, and postoperative outcomes were recorded and analyzed using SPSS version 25.0. **Results:** Among the 120 evaluated patients, 82 (68.3%) presented with non-urethral complications, whereas 38 (31.7%) had no documented non-urethral complications. Residual or recurrent chordee was the most frequently observed complication, affecting 28 patients (34.1%), followed by penile skin scarring or deficiency in 19 (23.2%), glans dehiscence or asymmetry in 15 (18.3%), penile torsion in 11 (13.4%), trapped or buried penis in 6 (7.3%), and penile shortening in 3 (3.7%). Surgical intervention was performed in 63 patients (76.8%), while 19 (23.2%) received conservative management. **Conclusions:** Non-urethral complications represent an important aspect of long-term morbidity following childhood hypospadias repair. Residual chordee, penile skin abnormalities, and glans deformities were the predominant clinical presentations. Secondary surgical correction provided satisfactory outcomes in most surgically treated patients.

INTRODUCTION

Hypospadias is one of the most common congenital anomalies of the male external genitalia. It is characterized by an ectopic ventral opening of the urethral meatus, varying degrees of ventral penile curvature (chordee), and abnormal development of the foreskin [1]. The condition is typically diagnosed at birth and is usually corrected surgically during infancy or early childhood. Surgery is important to restore functional urination, enable normal sexual function in later life, and achieve acceptable cosmetic outcomes [2]. Over the past few decades, significant advances in surgical techniques, perioperative care, and understanding of penile anatomy have markedly improved the overall success rates of hypospadias repair [3]. As a result, urethral complications such as urethrocutaneous fistula, meatal stenosis, urethral stricture, and diverticulum are the primary determinants of surgical outcome [4]. Non-urethral complications are sometimes perceived as less critical and can significantly influence long-term functional, cosmetic, and psychosocial outcomes. These complications include

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residual or recurrent chordee, penile torsion, glans dehiscence, glanular or penile skin necrosis, poor cosmetic appearance, penile shortening, scarring, preputial abnormalities, and issues related to penile growth and development [5]. Many of these problems may become more apparent with growth, puberty, or sexual maturation. The reported proportion of non-urethral complications following hypospadias repair varies widely. This is due to the differences in surgical techniques, surgeon experience, severity of hypospadias, age at repair, and duration of follow-up. In adult patients who underwent hypospadias repair during childhood, residual deformities may remain unnoticed for several years or become more clinically significant as penile development progresses. [6]. One of the most important non-urethral complications is residual or recurrent penile curvature. Curvature may reappear despite careful intraoperative assessment and correction. This happens particularly as the child grows. Such deformities may remain asymptomatic in early childhood but become functionally and psychologically dominant during adolescence and adulthood [7]. Penile torsion and rotational deformities are usually considered minor non-urethral complications. These complications can sometimes result in cosmetic dissatisfaction and concern for patients and their families. These deformities may result from asymmetric tissue mobilization or scarring [8]. This, although sometimes subtle, can negatively influence cosmetic outcomes. Parents and patients may call these abnormalities surgical failure even when urinary function is normal. This shows the importance of cosmetic considerations in overall surgical assessment [9]. Complications involving the glans and penile skin also represent a main non-urethral morbidity. Inadequate glans reconstruction, partial or complete glans dehiscence, and asymmetry of the glans can compromise the final appearance of the penis [10]. Glans-related complications are particularly relevant because the glans plays a central role in both cosmetic appearance and sexual function in later life [11]. In more severe types of hypospadias where a large amount of tissue needs to be moved, penile skin-related problems like scars, skin deficiency, and poor skin coverage or pigmentary changes are common. These may affect the look of the penis, cleanliness, comfort, and make future surgery (if necessary) more difficult [12]. As the growth progresses, skin-related problems may increase, and early recognition of the issue and correct management are crucial [13]. In later childhood, children with good surgical results can come with concerns regarding penile shape, size, and appearance. Later symptoms call for continuous assessment until adolescence. Other complications, including trapped or buried penis and penile shortening, may also affect adult patients following childhood hypospadias repair. A trapped or buried penis can result from postoperative fibrosis, abnormal skin fixation, or inadequate skin coverage, whereas penile shortening may be associated with severe chordee, tissue deficiency, or extensive reconstructive procedures. These abnormalities can influence cosmetic satisfaction and may require additional reconstructive intervention [14]. The psychosocial effects of non-urethral complications can occur in addition to physical findings. With increasing age and awareness of their bodies and penis, concerns over the appearance of the penis and body image, and self-esteem may emerge. Dissatisfaction with cosmetics may have a permanent, psychological effect on the child, even if there is a functional disability. Non-urethral outcomes are not only an important surgical parameter, but also a patient's perspective [15]. Postoperative non-urethral complications following hypospadias surgery are a challenge. Secondary corrective procedures are often tough due to altered anatomy, fibrosis, and compromised tissue planes. This is because of previous surgery [16]. The timing and the necessity of intervention should be determined by the nature, severity, and functional and/or cosmetic consequences of the complication, and the risk of further surgery [17]. In some cases, conservative management and observation may be appropriate, whereas others require surgical correction to achieve acceptable outcomes.

Despite their clinical relevance, non-urethral complications are frequently under-reported in outcome reporting and follow-up protocols. Focusing on these complications allows for a more complete evaluation of surgical success, including improvements in surgical planning, parental counseling, and long-term care strategies. Recent studies have highlighted the long-term impact of these deformities on psychosexual well-being, yet there is a paucity of local data regarding their specific management outcomes in the population. This study aimed to bridge this literature gap by evaluating the frequency, management, and outcomes of non-urethral complications following childhood hypospadias repair, providing clinical significance for improving long-term care strategies. Evaluation of these abnormalities among adult patients is important because it provides an opportunity to identify persistent deformities and assess the outcomes of secondary corrective procedures.

METHODS

This descriptive observational study was conducted in the Department of Plastic Surgery and Urology, Bakhtawar Amin Memorial Trust Hospital, Multan. The study period was 10 months, from April 2025 to January 2026. Ethical approval (Reference No. 0571-25/E.C./BAM&DC dated 25 March 2025) was obtained from the institutional review board before the initiation of the study. Informed consent

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was obtained from all the participants, and assent was obtained where applicable. Patient data were anonymized to ensure confidentiality and data protection. The study included male adults aged 25 to 40 who underwent primary hypospadias repair during childhood and were evaluated for the presence of non-urethral complications. Patients with documented non-urethral complications were included in the complication-specific analysis. Patients with distal, mid-penile, and proximal hypospadias were included regardless of the initial surgical technique. Patients were eligible for inclusion if they had undergone primary hypospadias repair during childhood and had a documented follow-up period of more than five years after the primary procedure (defined as >5 years post-primary repair). The duration of follow-up was verified from individual patient records. Patients presenting with isolated urethral complications, such as urethrocutaneous fistula or urethral stricture, without associated non-urethral complications, were excluded. Patients with disorders of sexual development, major congenital genital anomalies other than hypospadias, incomplete medical records, or a history of hypospadias repair performed outside childhood were also excluded. The initially calculated sample size was 323 participants. However, during the study period, 120 eligible adult patients with a history of childhood hypospadias repair were evaluated. Among these, 82 patients had documented non-urethral complications and were included in the complication-specific analysis, while 38 patients had no documented non-urethral complications. Consecutive sampling was used, and all eligible patients presenting during the study period were assessed. As the calculated sample size could not be achieved, the findings were analyzed descriptively, and subgroup comparisons were considered exploratory. The final sample therefore consisted of all eligible patients identified during the defined study period. The smaller sample size may have reduced the precision and statistical power of the estimates and limited the generalizability of the findings. Consecutive sampling was used and no claim is made that the calculated sample-size target was achieved. Clinical data were collected retrospectively from hospital medical records and prospectively through direct clinical evaluation. Retrospective data included age at primary repair, type of hypospadias, primary surgical technique, operative details, and previously documented postoperative complications, where available. Prospective data included current clinical findings, the presence and severity of non-urethral complications, penile appearance, curvature, skin coverage, glans configuration, management decisions, and outcomes assessed during the study evaluation. Variables recorded included age at initial repair, age at presentation, type and severity of hypospadias, presence of chordee, and primary surgical technique details. Complications were categorized into residual/recurrent chordee, penile torsion, glans dehiscence/asymmetry, penile skin deficiency, scarring, trapped/buried penis, penile shortening, skin necrosis, and poor cosmetic outcome. A detailed physical examination was conducted to evaluate the penile appearance, penile curvature, skin coverage, and glans configuration. The degree of penile curvature was evaluated clinically during the test of artificial erection or spontaneous erection if possible. Cosmetic and functional outcomes were assessed through clinical examination and documentation of non-urethral complications, including residual or recurrent chordee, penile skin scarring or deficiency, glans dehiscence or asymmetry, penile torsion, trapped or buried penis, and penile shortening. Parental concerns and validated scoring instruments were not included in the outcome assessment. Management strategies were based on the type and severity of the complication, patient age, functional impact, and cosmetic concerns. Residual/recurrent chordee was managed with penile degloving, dorsal plication, or ventral corporoplasty. Penile torsion was corrected through detorsion sutures or realignment procedures. Glans complications were managed with glans reconstruction. Penile skin-related complications were treated with local skin flaps, Z-plasty, skin advancement, or release of fibrotic bands. Trapped or buried penis was assessed for postoperative scarring, abnormal skin fixation and inadequate skin coverage, while penile shortening was evaluated as an additional anatomical and cosmetic abnormality. Conservative management with observation was adopted in selected cases with mild cosmetic concerns not affecting function. Outcomes were assessed based on the resolution or improvement of the complication, cosmetic appearance, and the need for additional surgery. A successful outcome was defined as satisfactory correction with acceptable cosmetic appearance and no requirement for further corrective surgery during the follow-up period.

Data were analyzed using SPSS version 25. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The chi-square test or Fisher's exact test was used, as appropriate, to assess associations between categorical variables. Crude odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the association between the original hypospadias location and selected non-urethral complications, using distal hypospadias as the reference category. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 120 adults who had undergone hypospadias repair in childhood later presented with postoperative

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complications. Among these, 82 patients (68.3%) were identified as having one or more non-urethral complications and were included in the final analysis. The remaining 38 patients (31.7%) did not have documented non-urethral complications and were not included in the complication-specific analysis. The baseline characteristics and complication patterns reported below refer to the 82 patients unless otherwise specified (Table 1).

Table 1: Baseline Characteristics of the Evaluated Patients and Patients Included in the Final Complication Analysis

Variables	n (%) / Mean ± SD
Total Patients Evaluated	120
Patients with Non-Urethral Complications	82 (68.3%)
Mean Age at Presentation (years)	32.1 ± 4.4
Follow-Up Duration (years)	6.2 ± 0.9 years

The duration of follow-up was calculated for each patient from the date of primary hypospadias repair to the date of the final clinical assessment. The mean postoperative follow-up duration was 6.2 ± 0.9 years, with a minimum follow-up of 5.1 years and a maximum of 8.5 years. All patients included in the study had a documented follow-up period exceeding five years. The mean follow-up duration, standard deviation, and range were determined from the individual patient records

Distal hypospadias was the most common type, observed in 41 patients (50.0%), followed by mid-penile in 25 patients (30.5%) and proximal hypospadias in 16 patients (19.5%). The most common non-urethral complication was residual or recurrent chordee, observed in 28 patients (34.1%), followed by penile skin scarring or deficiency in 19 patients (23.2%). Glans-related complications were noted in 15 patients (18.3%), and penile torsion was identified in 11 patients (13.4%) (Table 2). For descriptive analysis, each patient was classified according to the primary non-urethral complication recorded in the study database. The frequencies and percentages therefore represent patients classified into each category, rather than the total number of individual complications (Table 2).

Table 2: Hypospadias Types and Types of Non-Urethral Complications

Variables	n (%)
Type of Hypospadias	
Distal	41 (50%)
Mid-penile	25 (30.5%)
Proximal	16 (19.5%)
Total	82 (100%)
Non-Urethral Complication	
Residual/Recurrent Chordee	28 (34.1%)
Penile Skin Scarring/Deficiency	19 (23.2%)
Glans Dehiscence/Asymmetry	15 (18.3%)
Penile Torsion	11 (13.4%)
Trapped/Buried Penis	6 (7.3%)
Penile Shortening	3 (3.7%)
Total	82 (100%)

Surgical intervention was required in 63 patients (76.8%), while 19 patients (23.2%) were managed conservatively. Among patients who underwent surgical correction, successful resolution with a satisfactory cosmetic outcome was achieved in 55 patients (87.3%). Minor postoperative complications were observed in 8 patients (12.7%), including mild edema and superficial wound infection. No major complications or need for more than one secondary corrective procedure were recorded (Table 3).

Table 3: Management Approach for Non-Urethral Complications and Outcome of Secondary Management

Variables	n (%)
Management Modality	
Surgical Management	63 (76.8%)
Conservative Management	19 (23.2%)
Total	82 (100%)
Outcomes	
Successful Outcome	55 (87.3%)
Minor Complications	8 (12.7%)
Major Complications	0 (0%)
Total (Surgical Cases)	63 (100%)

Minor postoperative complications were defined in this study as mild edema or superficial wound infection. No major postoperative complications were recorded

Subgroup analysis revealed that proximal hypospadias was significantly associated with a higher of residual chordee and penile skin complications compared to distal hypospadias ($p<0.05$). The association between hypospadias type and major non-urethral complications is presented. The findings present the distribution of postoperative complications according to the anatomical type of hypospadias. Chordee was the most frequently observed complication, occurring in 28 (34.1%) patients, followed by skin scarring or deficiency in 19 (23.2%) patients and glans dehiscence or asymmetry in 15 (18.3%) patients. Chordee was more frequent among patients with proximal hypospadias (56.3%) compared with those having mid-penile (40.0%) and distal hypospadias (22.0%). Similarly, skin scarring or deficiency was observed in 37.5% of proximal cases, 24.0% of mid-penile cases, and 17.1% of distal cases. Trapped or buried penis and penile shortening were less frequently reported complications. Overall, the frequency of several postoperative complications appeared higher in patients with proximal hypospadias (Table 4).

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Table 4: Postoperative Complications According to Type of Hypospadias

Postoperative Complications	Distal (n=41), n (%)	Mid-penile (n=25), n (%)	Proximal (n=16), n (%)	Total (n=82), n (%)
Chordee	9 (22.0%)	10 (40.0%)	9 (56.3%)	28 (34.1%)
Skin Scarring/Deficiency	7 (17.1%)	6 (24.0%)	6 (37.5%)	19 (23.2%)
Glans Dehiscence/Asymmetry	5 (12.2%)	6 (24.0%)	4 (25.0%)	15 (18.3%)
Penile Torsion	–	–	–	11 (13.4%)
Trapped/Buried Penis*	1 (2.4%)	2 (8.0%)	3 (18.8%)	6 (7.3%)
Penile Shortening*	1 (2.4%)	1 (4.0%)	1 (6.3%)	3 (3.7%)

The findings show the crude odds ratios (ORs) with their corresponding 95% confidence intervals (CIs) for postoperative complications, using distal hypospadias as the reference category. Patients with proximal hypospadias had higher odds of developing chordee compared with those with distal hypospadias (OR = 4.57, 95% CI: 1.33–15.70, p=0.024). However, the association between hypospadias type and skin scarring or deficiency was not statistically significant. Similarly, glans dehiscence or asymmetry did not demonstrate a statistically significant association with the anatomical type of hypospadias. Trapped or buried penis showed increased odds in proximal cases (OR = 9.23), although this association did not reach statistical significance (p=0.063). Penile shortening also showed no statistically significant association. Overall, proximal hypospadias demonstrated higher odds of selected postoperative complications, particularly chordee (Table 5).

Table 5: Crude Odds Ratios for Postoperative Complications

Complication	Comparison	OR	95% CI	p-value
Chordee	Mid-penile vs distal	2.37	0.80–7.05	0.162
Chordee	Proximal vs distal	4.57	1.33–15.70	0.024
Skin Scarring/Deficiency	Mid-penile vs distal	1.53	0.45–5.23	0.535
Skin Scarring/Deficiency	Proximal vs distal	2.91	0.80–10.68	0.158
Glans Dehiscence/Asymmetry	Mid-penile vs distal	2.27	0.61–8.43	0.308
Glans Dehiscence/Asymmetry	Proximal vs distal	2.40	0.55–10.42	0.250
Trapped/Buried Penis*	Mid-penile vs distal	3.48	0.30–40.50	0.552
Trapped/Buried Penis*	Proximal vs distal	9.23	0.88–96.61	0.063
Penile Shortening*	Mid-penile vs distal	1.67	0.10–27.90	1.000
Penile Shortening*	Proximal vs distal	2.67	0.16–45.40	0.486

DISCUSSION

Hypospadias repair performed during childhood is primarily done to achieve both functional and cosmetic outcomes that remain satisfactory into adolescence and adulthood. Among the 120 evaluated patients, 82 (68.3%) presented with non-urethral complications. While urethral complications are considered the principal determinants of surgical success, growing evidence indicates that non-urethral complications constitute a substantial and clinically relevant component of long-term morbidity. The findings of the present study highlight that non-urethral complications are common, particularly in severe forms of hypospadias, and often require secondary intervention to achieve acceptable outcomes. These findings align with a study by Rynja *et al.* which emphasized the long-term functional and cosmetic challenges [3], although the current study reports a slightly higher proportion of non-urethral complications, possibly due to the inclusion of more proximal cases and longer follow-up duration. Non-urethral complications are the most common, occurring in the current group mostly as residual or recurrent chordee. This finding is similar to that of long-term follow-up studies, which suggest that although penile curvature may be corrected at the time of the primary operation, it can persist or recur. It has been noted that there is a limitation of short-term follow-up, as recurrent curvature can start to become obvious years after a repair has been performed, often when the penis is growing [18]. Severe chordee can be a significant clinical problem, potentially affecting erectile function and causing psychological problems in adolescence if not corrected. Non-urethral morbidity is another important issue with penile skin-related conditions such as skin deficiency, scarring, and trapped or buried penis. Haid *et al.* pointed out that skin deformities are risks in hypospadias, especially in cases where there is extensive tissue mobilization, such as in proximal hypospadias [13]. The current study identified a significant skin complication rate; however, unlike a study by Ceccarelli *et al.* which reported few skin complications with modern tissue-sparing techniques, surgical technique and tissue handling still need improvement [6]. Glans-related complications were also observed, like glans dehiscence and asymmetry in this study. Earlier studies which evaluated cosmetic outcomes over the long term have also found glans deformity to be a primary source of patient and

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parent dissatisfaction. A study by Dodds showed that glans appearance is a key factor in the perceived overall success of any surgical procedure without regard to urinary function performance, as measured by the Pediatric Penile Perception Score [9]. These results indicate that extreme care should be taken in the process of glans reconstruction during primary repair. In the current cohort, a relevant complication other than urethral was penile torsion. Asymmetric tissue mobilization and scarring after surgery can lead to rotational deformities, which can become more prominent as growth continues. The same was noted by Mohammed *et al.* who described penile torsion as one of the many penile deformities remaining after the primary operation that need to be corrected [19]. Trapped or buried penis was identified in 6 patients (7.3%). This complication may result from postoperative fibrosis, abnormal skin fixation or inadequate penile skin coverage. Its recognition is important because it may cause cosmetic dissatisfaction and require additional reconstructive procedures. Penile shortening was observed in 3 patients (3.7%). Although less frequent than other complications, it may have considerable clinical and psychological implications. The relationship between penile length and surgical reconstruction has been discussed [12]. Complications that did not involve the urethra were mostly managed surgically, and many of these complications were successfully resolved after secondary surgeries. These findings are concordant with those of Stojanovic *et al.* who showed that, when properly planned and executed, the one-stage corrective surgery of non-urethral deformities is associated with a low rate of complications and good cosmetic and functional outcome [5]. Patients with a proximal hypospadias showed more problems other than urethral. Proximal hypospadias frequently necessitates extensive dissection, aggressive chordee repair, and complex reconstruction, increasing the likelihood of post-operative deformities not involving the urethra. The results resemble those of Bhatia et al. who reported that severity of hypospadias is one of the most important factors influencing long-term complications and reoperation rate [20]. In addition to deformities, non-urethral complications have significant psychosocial implications. During adolescence, problems with the appearance of the penis, body image, and self-esteem can grow more important. Even if the cosmetic appearance is poor and the function is normal, it can also affect the quality of life, as reported by Xess *et al.* [17]. Patients with proximal hypospadias had significantly higher odds of chordee than those with distal hypospadias. Although the odds of skin scarring or deficiency were also higher in the proximal group, this association did not reach statistical significance. These findings suggest that the original severity and anatomical location of hypospadias may influence the pattern of subsequent non-urethral complications.

The present study has a few limitations. The study did not achieve its initially calculated sample size of 323 participants. Only 120 eligible patients were evaluated, of whom 82 had non-urethral complications. This smaller sample may have reduced the statistical power to detect differences between subgroups and resulted in wider confidence intervals. Therefore, subgroup comparisons and estimates of association should be interpreted cautiously. The single-center design and relatively small sample size may limit the generalizability of the findings. The retrospective nature of data collection for primary surgical details introduces potential documentation biases. Furthermore, the lack of long-term psychosexual assessment tools in the age group of 25-40 years restricts our ability to fully quantify the psychological impact of these complications. Thus, there is a need for long-term outcome evaluation of repaired hypospadias, both from a cosmetic and a psychosocial perspective. Future research should focus on multi-center prospective studies with larger sample sizes to validate these findings. Additionally, studies comparing different primary surgical techniques regarding the proportion of these specific complications are warranted.

CONCLUSIONS

Non-urethral complications following childhood hypospadias repair represent a significant source of long-term morbidity, particularly in proximal and more complex cases. Residual chordee, penile skin deformities, glans asymmetry, and penile torsion are frequently observed and may adversely affect cosmetic appearance and psychosocial well-being. Timely recognition and individualized secondary surgical interventions can achieve favorable functional and aesthetic outcomes with high success rates. These findings emphasize the importance of meticulous surgical technique during primary repair, proactive management of non-urethral complications, and comprehensive long-term follow-up to optimize overall patient outcomes.

Authors' Contribution

Conceptualization: ASK
Methodology: MU, BG
Formal analysis: MU
Writing and Drafting: MU, BG, S, IA, MA
Review and Editing: MU, ASK, BG, S, IA, MA

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflict of Interest

All the authors declare no conflict of interest.

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