

Characteristics and Surgical Outcomes of Pediatric Hypospadias Patients

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Abstract

Hypospadias is a prevalent congenital abnormality in boys, with its exact causes being multifactorial, involving genetic, endocrine, and environmental factors. This study aimed to investigate the characteristics of pediatric hypospadias patients treated at Dr. Hasan Sadikin General Hospital Bandung, Indonesia, from 2020 to 2022. A retrospective descriptive analysis was conducted using secondary data from the medical records of all 85 eligible patients. Over the three-year period, 125 hypospadias surgeries were performed. The findings revealed that the majority of surgeries were performed on children over five years old (57.6%). When assessed from the perspective of the Hadidi classification, proximal hypospadias was the most frequent diagnosis, affecting 55.3% of the children. A significant majority (90.6%) presented with chordee, which was predominantly severe. Furthermore, 37 children had a history of receiving hormone injection therapy, and the most common co-occurring abnormality was a micropenis. In conclusion, the typical hypospadias patient at this institution during the study period was over five years old, presented with severe chordee, and most commonly had the proximal type of hypospadias.

Keywords: Congenital abnormalities, hypospadias, perineum, penis, urologic diseases

Introduction

Hypospadias is one of the most common congenital abnormalities found in boys. Worldwide, the incidence of hypospadias is approximately 20.9 per 100,000 births, affecting approximately 1 in every 200–300 male infants..¹ The prevalence of this congenital disorder varies from country to country. The highest prevalence occurs in North America at 34 per 10,000 births, in Europe at 19.9 per 10,000 births, and is lowest in Asia, with 0.6–69 cases per 10,000 births..^{2,3} Based on a study conducted at Hasan Sadikin Hospital in Bandung, Indonesia, 147 cases of hypospadias were identified from 2015–2018..⁴

Congenital hypospadias is characterized by the abnormal development of the urethral fold and ventral foreskin on the penis, resulting in an abnormal position of the urethral meatus. Hypospadias is classified based on the location of the urethral meatus. One of the most commonly used classifications includes anterior

(subcoronal and glandular), middle (distal, proximal, and midshaft), and posterior (scrotal, penoscrotal, and perineal). Approximately 50% of hypospadias cases occur in the anterior location, 20% in the middle location, and the remainder in the posterior location..⁵ Overall, the subcoronal position is the most common abnormal meatal location, although other studies have reported that approximately 70% of urethral meatuses are located on the distal penile shaft..⁶⁻⁷

The exact cause of hypospadias remains unclear; however, genetic, endocrine, and environmental factors are believed to contribute to its development..⁸ Hypospadias is frequent observed in individuals with impaired androgen production or androgen receptor sensitivity. Recent studies have also suggested that prenatal exposure to estrogenic compounds, which can be found in pesticides used on fruits and vegetables, may have antiandrogenic activity..⁹

However, data on the characteristics of pediatric hypospadias patients and their surgical outcomes in Indonesia, particularly at tertiary referral centers, remain limited.. Therefore, additional data describing the characteristics and surgical outcomes of pediatric hypospadias patients at tertiary referral centers are needed. Surgical correction of hypospadias is typically

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performed during early childhood. Schultz et al. reported that the optimal age for hypospadias repair is between 6 and 18 months, and the American Academy of Pediatrics similarly recommends surgical correction before 18 months of age.¹⁰ Various surgical techniques are available for hypospadias repair include Tubularized Incised Plate, Glandular Approximation Plasty Bracat, Preputial Island Flaps, among others.¹¹ Therefore, this study aimed to describe the characteristics and surgical outcomes of pediatric patients with hypospadias who underwent surgery at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia, between 2020 and 2022.

Methods

This retrospective descriptive study was conducted at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia, and included pediatric patients who underwent hypospadias repair between January 2020 and December 2022. Ethical approval was obtained from Health Research Ethics Committee Dr. Hasan Sadikin General Hospital (No. LB.02.01/X.6.5/499/2023).

Secondary data were collected from hospital medical records using a total sampling approach. Pediatric patients (0–18 years of age) diagnosed with hypospadias and treated surgically during the study period were eligible for inclusion. Only records containing complete information on age, hypospadias classification, presence and severity of chordee, operative procedure, perioperative complications, history of hormonal therapy, and associated anomalies were eligible. Incomplete, unreadable, duplicate, or lacking essential clinical or operative data were excluded.

Hypospadias type was classified according to the Hadidi classification as distal, midshaft, or proximal.¹² Chordee severity was categorized as mild, moderate, or severe based on intraoperative assessment/degree of ventral curvature.¹² Micropenis was defined as stretched penile length below -2.5 standard deviations for age.¹² Perioperative complications were defined as adverse events occurring intraoperatively or within 30 days after surgery, including urethrocuteaneous fistula, meatal stenosis, dehiscence, and surgical site infection. Eligible cases were identified from the urology operative registry, retrieved from the medical records unit. Data were extracted using a standardized collection form by two independent reviewers,

and discrepancies were resolved by consensus. Missing data were recorded as such and were not imputed. All data were de-identified before analysis. The final analytical sample comprised 8587 pediatric patients. During the study period, a total of 125 hypospadias-related surgical procedures were performed.

Statistical analysis was performed using descriptive methods. Categorical variables were summarized as numbers and percentages, and continuous variables as means with standard deviations or medians with interquartile ranges, according to their distribution. No formal hypothesis testing was performed because the primary objective of this study was to describe patient characteristics, surgical techniques, and postoperative outcomes. Statistical analyses were conducted using IBM SPSS Statistics version 25.

Results

The research focuses on the characteristics of age, type of hypospadias, surgical techniques, postoperative complications, penile chordee, associated abnormalities, history of hormonal injections, and urethrocuteaneous fistulas. A total of 87 cases of hypospadias were yielded from the year 2020–2022 (Table 1).

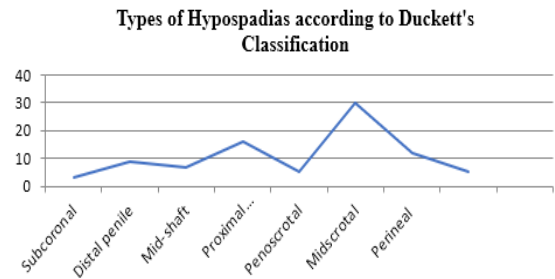
The annual number of hypospadias surgeries increased from 29 cases in 2020 to 22 cases in 2021 and 36 cases in 2022. According to the Hadidi classification, proximal hypospadias was the most common type, accounting for 49 cases (56.3%), followed by penile hypospadias in 30 cases (34.5%). Based on the Duckett classification, penoscrotal hypospadias was the most frequent subtype, occurring in 30 patients (34.5%) (Table 1 and Figure 1).

The most prevalent type of hypospadias in patients with chordee from 2020 to 2022 was the severe degree, with 75 cases (86.2%) (see Figure 2). Among patients who received hormonal injections, four injections represented the most common treatment frequency, accounting for 29 cases (33.3%).

The most common associated abnormality was micropenis, with 25 cases (28.7%) from 2020 to 2022. In cases of associated abnormalities, 13 individuals experienced more than one associated abnormality, all of them having two associated abnormalities. In 2020, four individuals had more than one associated abnormality, five in 2021, and four in 2022 (Table 1).

Table 1 Characteristics of Patients with Hypospadias (n=87)

Variable	n (%)
Type of Hypospadias (Duckett Classification)	
Glanular	3 (3.4)
Subcoronal	9 (10.3)
Distal penile	7 (8.0)
Mid-shaft	16 (18.4)
Proximal penile	5 (5.7)
Penoscrotal	30 (34.5)
Midscrotal	12 (13.8)
Perineal	5 (5.7)
Type of Hypospadias (Hadidi Classification)	
Glanular	3 (3.4)
Penile	30 (34.5)
Proximal	49 (56.3)
Perineal	5 (5.7)
Age at Surgery	
<1 year	0 (0)
1–5 years	35 (40.2)
>5 years	52 (59.7)
Chordee Severity	
Mild (<30°)	4 (4.6)
Severe (≥30°)	75 (86.2)
No chordee	8 (9.2)
Associated Abnormalities*	
Undescended testis (UDT)	10 (11.5)
Scrotal bifida	5 (5.7)
Penoscrotal transposition	23 (26.4)
Micropenis	25 (28.7)
Bilateral/unilateral retractile testis	12 (13.8)
46,XY disorder of sex development (DSD)	1 (1.1)
Webbed penis	2 (2.3)
Testicular atrophy	1 (1.1)
Polydactyly	1 (1.1)
Trapped penis	1 (1.1)
More than one associated abnormality	13 (14.9)
History of Preoperative Hormonal Injection	
None	49 (56.3)
2 injections	2 (2.3)
3 injections	7 (8.0)
4 injections	29 (33.3)

**Figure 1 Prevalence of Hypospadias Types According to Duckett Classification**

Postoperative complications are presented in Table 2. Urethrocuteaneous fistula was the most common complication, occurring in 10 of 87 patients (11.5%), followed by meatal stenosis in 5 patients (5.7%). No cases of edema, wound dehiscence, urethral diverticulum, glans dehiscence, or recurrent penile curvature were observed during the study period.

The most frequently performed surgical technique was urethroplasty, with 72 cases. Among the urethroplasty techniques, the most commonly used one was CEDU (chordee excision & distal urethroplasty). The most prevalent type of urethroplasty layer was staged urethroplasty, with 20 cases. In 2020, 31 cases required more than one surgical technique. In 2021, 25 cases needed multiple techniques, with two cases requiring 3 and 4 techniques, respectively. In 2022, 26 cases required more than one surgical procedure (Table 3).

The characteristics of patients who developed urethrocuteaneous fistula are shown in Table 4. Among the 10 fistula cases, the complication occurred most frequently in patients with subcoronal hypospadias according

**Figure 2 Chordee in Hypospadias Patients**

Table 2 Post Operative Complications

Complications	2022	2021	2020	Total
Edema	0	0	0	0
Wound dehiscence	0	0	0	0
UCF	6	3	1	10
Meatal stenosis	1	2	2	5
Urethral diverticulum	0	0	0	0
Glans dehiscence	0	0	0	0
Urethral diverticula	0	0	0	0
Recurrent penile curvature	0	0	0	0

Note: UCF; Urethrocuteaneous Fistula

to the Duckett classification. Based on the Hadidi classification penile and proximal hypospadias

were the most common categories associated with fistula formation.

Table 3 Primary Urethroplasty Techniques and Adjunctive Procedures Used for Hypospadias Repair (n=87)

Surgical Technique	n (%)
Primary Urethroplasty Technique*	
Urethroplasty, technique not further specified	72 (82.8)
Chordee excision and distal urethroplasty (CEDU)	12 (13.8)
Thiersch-Duplay	7 (8.0)
Tubularized incised plate (TIP)	6 (6.9)
Buccal mucosal graft (BMG)	6 (6.9)
Mathieu (single-stage longitudinal island flap, SLAM)	3 (3.4)
Onlay island flap (OIF)	2 (2.3)
Glandular urethral disassembly (GUD)	1 (1.1)
Meatal advancement and glanduloplasty (MAGPI)	0 (0.0)
Urethroplasty Staging	
Staged	20 (23.0)
Distal	16 (18.4)
Proximal	0 (0.0)
Adjunctive Procedures*	
Chordectomy	63 (72.4)
Scrotoplasty	22 (25.3)
Preputial graft	9 (10.3)
Circumcision	3 (3.4)
Orchidopexy	3 (3.4)
Release of webbed penis	2 (2.3)
Penile reconstruction	2 (2.3)

*Percentages are calculated using the total number of patients (n=87) as the denominator. Because some patients underwent more than one primary technique or more than one adjunctive procedure, percentages within each section do not sum to 100%. CEDU, chordee excision and distal urethroplasty; TIP, tubularized incised plate; BMG, buccal mucosal graft; SLAM, single-stage longitudinal island flap (Mathieu); OIF, onlay island flap; GUD, glandular urethral disassembly; MAGPI, meatal advancement and glanduloplasty

Table 4 Urethrocutaneous Fistula Complications

Characteristics	n
Duckett Classification	
Glanular	0
Subcoronal	4
Distal penile	0
Mid-shaft	2
Proximal penile	1
Penoscrotal	2
Midscrotal	1
Perineal	0
Hadidi Classification	
Glanular	0
Penile	4
Proximal	4
Perineal	0
Distal	2
Surgical Techniques	
Primary closure	0
Secondary closure	8
Tertiary closure	2

Discussion

This study describes the characteristics and surgical outcomes of 87 pediatric patients who underwent hypospadias repair at a tertiary referral hospital in Indonesia between 2020 and 2022. The principal findings were that most patients were older than five years at the time of surgery, proximal hypospadias was the most frequent type according to the Hadidi classification, severe chordee was present in the majority of cases, micropenis was the most common associated abnormality, and urethrocutaneous fistula was the most frequent postoperative complication.

According to the Duckett classification, penoscrotal hypospadias was the most common subtype in this cohort, while the Hadidi classification identified proximal hypospadias as predominant. This predominance of proximal and severe cases contrasts with several previous reports in which distal or anterior forms were more common, and may reflect referral bias, as tertiary centers such as ours tend to receive more complex cases referred from primary and secondary care facilities.^{1,2} Previous Indonesian studies have reported varying distributions: Mahadi et al. found penile hypospadias to be most common, whereas Duarsa et al. and Limatahu

et al. reported penoscrotal hypospadias as predominant, similar to our Duckett-based findings.³ These differences across studies likely reflect variation in referral patterns, study populations, and the classification systems applied, rather than true differences in underlying disease distribution.

Most patients in this cohort underwent surgery after five years of age, considerably later than the 6–18 month window recommended by the American Academy of Pediatrics and supported by Schultz et al.¹⁰ This finding is consistent with the study by Indira et al., who similarly reported a predominance of cases older than five years, with peak incidence in the 6–10 year age group.⁴ Delayed presentation in our setting may reflect limited awareness among caregivers, delayed referral from primary care, or limited access to pediatric urology services outside tertiary centers; because this study did not formally assess these factors, this interpretation remains speculative. Delayed surgical correction carries potential implications for the psychological well-being of affected children and underscores the importance of earlier diagnosis and referral pathways in this setting.^{1,2,4,5}

Severe chordee was observed in the majority of patients, consistent with the predominance of proximal hypospadias in this cohort, as proximal defects are generally associated with more extensive ventral curvature.⁶ This is consistent with previous reports describing a strong association between proximal hypospadias and significant chordee. In contrast to a previous study in which most patients had no chordee and severe chordee was uncommon, severe chordee was the predominant finding in our cohort; this discrepancy may again reflect the referral-based case mix at a tertiary center.⁴ As chordee severity directly influences surgical planning and reconstructive technique, its high prevalence in this cohort is consistent with the frequent use of staged and complex urethroplasty techniques observed in our surgical outcomes.⁸

Micropenis was the most common associated abnormality identified in this study, supporting the hypothesis that disturbances in androgen production or action during fetal development contribute to abnormal genital formation in a subset of patients.¹ Both androgens and estrogens are involved in genital differentiation, and hormonal imbalance during embryogenesis has been proposed to underlie the co-occurrence of hypospadias, micropenis, and other genital anomalies.⁹ While our study was not designed

to evaluate causal mechanisms, the pattern of associated abnormalities observed is consistent with this shared developmental pathway described in the literature.

Preoperative hormonal stimulation was used in a substantial proportion of patients in this cohort, most commonly with four injections. This is consistent with the widespread use of hormonal stimulation, particularly dihydrotestosterone, to promote penile growth and improve both functional and cosmetic outcomes before repair of more severe hypospadias, as supported by previous studies.¹⁰ The relatively frequent use of hormonal therapy in our cohort is consistent with the high proportion of proximal and severe cases, for which preoperative stimulation is more often indicated to facilitate reconstruction.

Urethroplasty was the most frequently performed primary procedure, and staged urethroplasty was the most common approach among urethroplasty subtypes, consistent with the predominance of proximal hypospadias in this cohort. A two-stage approach, typically involving initial placement of a preputial graft or Byars flap followed by tubularization after an interval of several months, is generally preferred for proximal defects with significant ventral curvature, as it offers a reliable and reproducible option for achieving successful outcomes.¹¹ The choice of urethroplasty technique in our cohort, including the relatively frequent use of CEDU and buccal mucosal graft procedures, likely reflects the technical demands of managing a caseload weighted toward complex, proximal disease.¹³

Urethrocuteaneous fistula was the most common postoperative complication in this study, consistent with its recognized status as the most frequent complication following hypospadias repair. The literature reports a wide range of fistula rates, generally attributed to differences in surgical technique, tissue handling, case severity, and surgeon experience.^{14,15} The predominance of proximal hypospadias and severe chordee in our cohort, both recognized risk factors for fistula formation, offers a plausible explanation for the complication pattern observed, particularly given the higher technical demands and longer suture lines associated with staged and proximal repairs. Other recognized contributors to fistula formation include local or systemic infection, inadequate tissue handling, and distal obstruction from stenosis or encrustation, none of which were specifically assessed in this study.¹⁰

This study has several limitations. First, its retrospective design may introduce information

bias due to incomplete or non-standardized documentation in medical records. Second, the study was conducted at a single tertiary referral center, which may limit the generalizability of the findings to other hospitals or regions. Third, long-term functional and cosmetic outcomes could not be assessed because follow-up was limited and not uniform across patients. Finally, potential confounding factors such as surgeon experience, technique modifications, and adherence to postoperative care protocols were not fully controlled. These limitations should be considered when interpreting the results.

Future research should prioritize multicenter studies to improve generalizability, longer and more standardized follow-up to capture long-term functional and cosmetic outcomes, and formal comparative analyses to clarify the factors influencing complication rates such as urethrocuteaneous fistula.

This study found that pediatric hypospadias patients treated at this tertiary referral center between 2020 and 2022 most commonly presented with proximal hypospadias, severe chordee, and delayed age at surgery beyond the recommended window, with micropenis as the most frequent associated abnormality and urethrocuteaneous fistula as the most common postoperative complication. These descriptive findings highlight the need for earlier diagnosis and referral in this setting to support timely surgical correction.

References

1. Yu X, Nassar N, Mastroiacovo P, Canfield M, Groisman B, Bermejo-Sánchez E, et al. Hypospadias prevalence and trends in international birth defect surveillance systems, 1980–2010. *Eur Urol*. 2019;76(4):482–90. doi:10.1016/j.eururo.2019.06.027
2. Fathi BA, Elgammal AA, Ghoneimy OM, Alrefaey AA, Abouelgreed TA. Urethral advancement and glanuloplasty versus tubularized incised plate urethroplasty for distal hypospadias repair: a prospective randomized study. *Ann Pediatr Surg*. 2023;19(1):1–10. doi:10.1186/s43159-023-00233-0
3. Springer A, van den Heijkant M, Baumann S. Worldwide prevalence of hypospadias. *J Pediatr Urol*. 2016;12(3):152.e1–7. doi:10.1016/j.jpuro.2015.12.002
4. Noegroho BS, Siregar S, Firmansyah I.

- Karakteristik pasien hipospadia di Rumah Sakit Hasan Sadikin Bandung tahun 2015–2018. *Dep Bedah Urol Fak Kedokt Univ Padjajaran*. 2018;1(38):10–2. doi: -
5. Abbas TO. An objective hypospadias classification system. *J Pediatr Urol*. 2022;18(4):481.e1–8. doi:10.1016/j.jpuro.2022.05.001
 6. van der Horst HJR, de Wall LL. Hypospadias, all there is to know. *Eur J Pediatr*. 2017;176(4):435–41. doi:10.1007/s00431-017-2864-5
 7. Sheng X, Xu D, Wu Y, Yu Y, Chen J, Qi J. The risk factors of urethrocutaneous fistula after hypospadias surgery in the youth population. *BMC Urol*. 2018;18(1):1–6. doi:10.1186/s12894-018-0368-1
 8. Rodríguez Fernández V, López Ramón Y, Cajal C, Marín Ortiz E, Sarmiento Carrera N. Accurate diagnosis of severe hypospadias using 2D and 3D ultrasounds. *Case Rep Obstet Gynecol*. 2016;2016:2450341. doi:10.1155/2016/2450341
 9. Haraux E, Braun K, Buisson P, Stéphan-Blanchard E, Devauchelle C, Ricard J, et al. Maternal exposure to domestic hair cosmetics and occupational endocrine disruptors is associated with a higher risk of hypospadias in the offspring. *Int J Environ Res Public Health*. 2016;14(1):27. doi:10.3390/ijerph14010027
 10. Keays MA, Dave S. Current hypospadias management: diagnosis, surgical management, and long-term patient-centred outcomes. *Can Urol Assoc J*. 2017;11(1–2):S48–53. doi:10.5489/cuaj.4386
 11. Duarsa GWK, Tirtayasa PMW, Daryanto B, Nurhadi P, Renaldo J, Tarmono, et al. Risk factors for urethrocutaneous fistula following hypospadias repair surgery in Indonesia. *J Pediatr Urol*. 2020;16(3):317. e1–6. doi:10.1016/j.jpuro.2020.03.030
 12. Hadidi AT, Azmy AF, eds. *Hypospadias Surgery: An Illustrated Guide*. 2nd ed. Berlin, Germany: Springer; 2014. doi:10.1007/978-3-642-37831-6
 13. Almusafer M, Abduljabbar OH, Buchholz N. Stented versus non-stented Snodgrass urethroplasty for distal hypospadias repair. *Urol Int*. 2020;104(1–2):156–9. doi:10.1159/000503861
 14. Epelboym Y, Estrada C, Estroff J. Ultrasound diagnosis of fetal hypospadias: accuracy and outcomes. *J Pediatr Urol*. 2017;13(5):484. e1–4. doi:10.1016/j.jpuro.2017.03.024
 15. Li X, Liu A, Zhang Z, An X, Wang S. Prenatal diagnosis of hypospadias with 2-dimensional and 3-dimensional ultrasonography. *Sci Rep*. 2019;9(1):8662. doi:10.1038/s41598-019-45172-4