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Evaluation of the Pre-operative GMS Hypospadias Score Correlation with Post-operative Outcomes (HOSE Score)

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ABSTRACT

Background: Among the most prevalent congenital abnormalities is hypospadias, a condition where the urethral opening is sited on the penis's ventral side. Evidence suggests that the incidence of hypospadias is on the rise. Having a penis that is functional and aesthetically normal for the boy is the surgical aim of hypospadias correction. Nevertheless, hypospadias surgery is still correlated with a great risk of complications, with a reported rate of 50% or more.

Aim and objectives: This study aimed to determine the association among the pre-operative GMS score [glans (G), meatus (M), and penile shaft (S)] of boys with hypospadias and their postoperative hypospadias objective scoring evaluation (HOSE) score.

Subjects and methods: This was a cross-sectional trail, in which, we enrolled 21 patients with hypospadias who presented to Pediatric Surgery Clinic, Suez Canal University hospital. The condition of the enrolled patients was assessed preoperatively by the GMS score and their postoperative outcomes were assessed by HOSE score.

Results: Preoperative GMS scores and postoperative HOSE scores were not significantly associated with patients' characteristics. However, and more importantly, we found a significant positive connection among preoperative GMS score and postoperative HOSE score, where lower preoperative GMS score was associated with higher postoperative HOSE score.

Conclusions: Hypospadias patients with severe conditions preoperatively, guided by GMS score, would have poorer postoperative outcomes, as assessed with HOSE scores.

Keywords: Hypospadias, GMS, HOSE.

INTRODUCTION

One of the most frequent congenital abnormalities is called hypospadias, which means the presence of the urethral opening on the ventral side of the penis [(1)].

The prevalence of hypospadias has been shown to be increasing [(2)].

The presentation of hypospadias varies widely. Some boys have a mild anomaly posing only a slight cosmetic issue, while other patients can be severe enough to affect the urinary and/or reproductive function [(3)]. While, the most prevalent method for assessing the severity of hypospadias is by examining the position of the urethral meatus, this represents only one among numerous anatomical factors that may influence the prognosis of patients. In addition to the meatal location, other characteristics of the anomaly, involving the magnitude of the chordee, the quality of the urethral plate, and the extent of the glans, can significantly influence the efficacy of surgery [(4)].

Standardized criteria for categorizing the severity of hypospadias prompted the development of the GMS hypospadias scale. The advantages of the glans (G), meatus (M), and penile shaft (S) that are readily observable comprise this scale. The combined value of these scores constitutes the GMS total score. Every component of the 3 is assigned a numerical score ranging from 1 to 4, with greater values denoting more unfavorable attributes. Consequently, severe hypospadias is classified as GMS score 12, while the minimum score of 3 indicates very moderate hypospadias. Notably, the G score is also employed to evaluate the grade of the urethral plate and the size of the glans [(5)].

Many years have passed since the inception of hypospadias surgery, during which reported outcomes have progressively improved [(6)]. The surgical purpose of hypospadias reform is for the boy to have a functionally and cosmetically normal penis [(7)].

With a documented complication rate of at least 50%. However, hypospadias surgery continues to produce frequently unfavorable outcomes [(1)].

Although, the literature describes a vast array of repair techniques, a limited number of systems evaluate the findings of surgical procedures [(7)]. Hypospadias objective scoring evaluation (HOSE) is one of the standardized mechanisms utilized to assess postoperative outcomes. The evaluation includes an analysis of the urinary stream, the erection's straightness, the meatal location & shape, the appearance & severity of any complicating urethral fistula, & a five-point scoring system [(8)].

Several studies have investigated the GMS score of boys with hypospadias & associated with the incidence of postoperative complications. However, and based on our current understanding, no prior research assessed the correlation amongst the GMS score and their postoperative HOSE score. Therefore, we conducted this study in order to estimate the association among the pre-operative GMS score of boys with hypospadias and their postoperative HOSE Score.

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PATIENTS AND METHODS

This was analytical cross-sectional research performed on 21 patients with hypospadias at the Pediatric Surgery Outpatient Clinic of Suez Canal University (SCU) Hospital, Ismailia, Egypt.

Inclusion criteria: All boys with hypospadias aged between 6 months and 14 years, who went to the Pediatric Surgery Outpatient Clinic of Suez Canal University Hospital were enrolled.

Exclusion criteria: Patients with disorders of sexual differentiation.

Study Procedure: The current study was conducted in 3 phases; pre-operative, operative & post-operative.

Pre-operative phase: History was obtained from the parents, regarding the natal history of the fetal age and weight at delivery time, family history of a first degree relative with the same complain, the presence of any other congenital anomalies, and history of consanguinity between the parents.

Clinical examination: Clinical examination of penis and scrotum was performed, and GMS score was calculated. The determination of the G score involved evaluation of the urethral plate and glans. If observed, scrotal and perineal hypospadias were included in the maximum M score. Standardized methods for determining the S score involved gently pressing down from above on the peno-pubic junction and gently pushing down from below on the peno-scrotal junction at the same time. Furthermore, we assessed the anthropometric measurements, general condition of the boy, the presence of multiple congenital anomalies.

Laboratory tests:

Complete blood picture (CBC) and bleeding profile was requested to all patients.

Operative phase:

Tubularized incised plate (TIP) urethroplasty was performed to correct hypospadias in the current study. Sterilization was done from the umbilicus to both knees. An intermittent tourniquet was used for intraoperative hemostasis. The preputial attachments to the glans were taken down and traction stitches were placed in glans. Then, a circumferential subcoronal incision and incisions on either side of the urethral plate were made. The present urethral aperture was used to form a vertical midline incision of the urethral plate that extended distally to the glans, the site of the neo-meatus. A 6/0 polyglactin suture was utilized to seal the urethral plate in 2 layers after the urethral stent was inserted into the bladder. Spongioplasty was done. Then, the reformation was covered with preputial dartos layer. Circumcision was done. Finally, a compressive dressing was applied.

Post-operative phase:

Following the operation, every patient was hospitalized for a day postoperative and then was discharged on prophylactic antibiotic and analgesics. Urinary catheter was removed at the seventh day post-operatively and dressing was changed at the fourth day post-operatively if not soiled and was removed after 7 days. Catheter irrigation was done three times daily. All patients resumed normal diet post-operatively. The urine stream was evaluated by the parents during voiding. Surgical outcomes were assessed using the HOSE score.

Sample size calculation:

The sample size measured utilizing the following formula: [9]

$$n = \left[\frac{Z_{\alpha/2}}{E}\right]^2 * P(1-P)$$

Where:

- **n** means sample size.
- $\mathbf{Z_{\alpha/2}}$ equal 1.96 (The critical value that divides the central ninety-five percent of the Z distribution from the five percent in the tail).
- **E** = Margin of error/Width of confidence interval = ten percent
- **P** = Prevalence/proportion in the study group = five-point nine percent [2].
- So, according to these calculations, the estimated sample size was: n = 21.

Ethical consideration: The Medical Ethical Committee of the Faculty of Medicine at Suez Canal University gave its approval to participate in the research before it had even started. When it came to the parents of all male participants, their informed consent was established. The purpose of this research was to perform research on humans in compliance with the Declaration of Helsinki, the code of ethics of the World Medical Association.

RESULTS

Our study indicated that there was no significant variation among preoperative hypospadias GMS score and baseline characteristics of the study sample (Table 1).

Table (1): Baseline characteristics of the study sample according to preoperative hypospadias GMS score (n=21)

Variables	Total GMS score		
	GMS score ≤ 6 (accepted) n=14	GMS score > 6 (bad) n=7	
Age (years)			**p-value**
months – 2 years 6	(71.4) 10	(100) 7	
years – 6 years 2	(21.4) 3	(0) 0	0.29
years – 14 years 6	(7.1) 1	(0) 0	
Weight at birth (grams)			
Normal (2500 – 4200(LBW	0 (100) 14	(85.7) 6	0.33
(2500>)	(0)	(14.3) 1	
History of prematurity	(0) 0	(14.3) 1	0.14
History of NICU admission	(7.1) 1	(14.3) 1	0.56
History of consanguinity	(21.4) 3	(28.6) 2	0.71
History of congenital anomalies	(7.1) 1	(28.6) 2	0.24
Weight according to age			
Normal	1 (92.9) 13	0 (100) 7	0.66
Underweight	(7.1)	(0)	
Height according to age			
Normal	(100) 14	(100) 7	
Short stature	-	-	-
Tall stature	-	-	

Variables: GMS score ≤ 6 (accepted) GMS score > 6 (bad).

P-values are based on Fisher's Exact test. Statistical significance at $P < 0.05$

Our research showed that there was no significant distinction among patients' different age groups regarding post-operative HOSE score (p=0.97) (Table 2).

Table (2): Comparison between age groups and total GMS and HOSE scores (n=21)

Variable	n (%)	HOSE score	
		Mean ± SD	p-value
Age (years)			
6 months – 2 years	17 (81)	13.88 ± 1.6	
2 years – 6 years	3 (14.3)	13.67 ± 1.5	0.97
6 years – 14 years	1 (4.8)	14 ± 0	

P-values are based on Kruskall Wallis test.

HOSE score (≥ 14), those with adequate glans size (G2) had accepted HOSE score ≥ 14 were 66.6%. Moreover, there were no patients had accepted HOSE score ≥ 14 with small sized glans (G3 or G4) (Table 3).

Table (3): Comparison between Glans (G) item of GMS and post-operative HOSE score (Total HOSE score)

Variable	N (%)	HOSE score ≥ 14 (accepted) N (%)	HOSE score < 14 (bad) N (%)
Glans (G) score Glans good size; healthy urethral plate, deeply groove (G1)	10 (47.6)	8 (80)	2 (20)
Glans adequate size; adequate urethral plate, grooved (G2)	9 (42.9)	6 (66.6)	3 (33.3)
Glans small in size; urethral plate narrow, some fibrosis or flat (G3)	2 (9.5)	0	2 (100)
Glans very small; urethral plate indistinct, very narrow or flat (G4)	0 (0)	0	0

Our study revealed that 100% of patients with glanular meatus (M1) accepted HOSE score ≥ 14, while those with coronal meatus (M2) who accepted HOSE score ≥ 14 were 80%. Patients who had their meatus at mid or distal shaft (M3) were 55%. Moreover, there were no patients had accepted HOSE score ≥ 14 with their meatus at proximal shaft or penoscrotal (M4) (Table 4).

Table (4): Comparison between Meatus (M) item of GMS and post-operative HOSE score Total HOSE score

Variable	**N (%)**	**HOSE score ≥ 14 (accepted) N (%)**	**HOSE score < 14 (bad) N (%)**
Meatus (M) Score Glanular (M1)	1 (4.8)	1 (100)	0
Coronal Sulcus (M2)	10 (47.6)	8 (80)	2 (20)
Mid or Distal Shaft (M3)	9 (42.9)	5 (55.5)	4 (44.4)
Proximal shaft, penoscrotal (M4)	1 (4.8)	0 (0)	1 (100)

Our study revealed that all patients with no chordee (S1) accepted HOSE score ≥ 14. Only 66.6% of patients with mild chordee (S2) accepted HOSE score ≥ 14 and 42.8% of patients with moderate chordee (S3) accepted HOSE score ≥ 14. Meanwhile, there were no patients accepted HOSE score ≥ 14 with severe chordee (S4) (Table 5).

Table (5): Comparison between Shaft (S) item of GMS and post-operative HOSE score (Total HOSE score)

Shaft (S) Score			
No chordee (S1)	5 (23.8)	5 (100)	0
Mild (< 30°) chordee (S2)	9 (42.9)	6 (66.6)	3 (33.3)
Moderate (30 - 60°) chordee (S3)	7 (33.3)	3 (42.8)	4 (57.1)
Severe (> 60°) chordee (S4)	0 (0)	0	0

Variable N (%) HOSE score ≥ 14 (Accepted) HOSE score < 14 (Bad)

Our study revealed that there was a significant association among GMS score & HOSE score where accepted preoperative GMS score (≤ 6) was associated with accepted postoperative HOSE score (≥ 14) (p=0.017) (Table 6).

Table (6): Relationship between postoperative HOSE score and preoperative GMS score

	Preoperative GMS score ≤ 6 (accepted) >6 (bad) (n=7)	**Postoperative HOSE score ≥14 (accepted) < 14 (bad) (n= 14)**	**P value**
Accepted, N (%)	2(28.6%)	2 (14.3%)	**0.017***
Bad, N (%)	5(71.4%)	12 (85.7%)	

DISCUSSION

Hypospadias is among the most prevalent congenital disorders, and it is identified as the presence of the urethral opening on the ventral side of the penis [(1)]. The GMS hypospadias scale was developed in response to the requirement for standardized principles to categorize the degree of hypospadias [(5)].

In our study, we included 21 patients with hypospadias who presented to Pediatric Surgery Clinic at SCU Hospital. The condition of the enrolled patients was assessed preoperatively by the GMS score and their postoperative outcomes were assessed by HOSE score.

The enrolled patients were predominantly less than two years of age, living in rural regions, of normal birth weight, and normal current height and weight according to their age. History of prematurity, history of NICU admission, and associated congenital anomalies were uncommon, and approximately, only one-fourth of them had consanguineous parents.

Regarding the preoperative hypospadias GMS score, almost half of our individuals had good glans size, healthy urethral plate and deep groove in the glans score and coronal sulcus in the meatus score. Moreover, most of the patients had mild-to moderate chordee in the shaft score. Overall, the majority of the patients had accepted GMS score. The reported GMS scores in previous studies varied according to the severity of the condition among the enrolled patients. For example, a study included 262 boys with hypospadias and reported a mean GMS score of 7 ± 2.5 [(10)].

Moreover, GMS scores of our patients were not associated with any of their baseline characteristics including their age, birth weight, current weight or height, history of prematurity, history of NICU admission and associated congenital anomalies, or having consanguineous parents. The associations between hypospadias and patients' characteristics have been constituting an ongoing debate. Nevertheless,

none of the reviewed studies investigated the association between patients' characteristics and the severity of hypospadias as assessed by their GMS scores.

A study reported that glans width was not correlated with the patient's age [11]. Another study reported that ex-premature boys with hypospadias were younger and had lower weight and height percentiles compared to their non-hypospadias counterparts. However, gestational age and birth weight weren't significantly varied among both groups [12]. On the contrary, other studies documented a significant connotation among low birth weight and hypospadias [13, 14]. It's suggested that this could be possibly related to maternal androgen insufficiency. One research found that the levels of testosterone in the mother were significantly lower among the ages of six and fourteen weeks of gestation in pregnancies that caused growth limitation & male genital abnormalities [15].

Furthermore, it is believed that fetal testosterone concentrations decline concurrently with HCG lack in cases of placental insufficiency, genital anomalies might occur due to androgen deficiency that occurs within the first and second trimesters. The degree of placental failure may have an impact on testosterone levels and, consequently, the severity of genital anomalies [16]. Hypospadias was shown to be more common in infants went to the neonatal intensive care unit (NICU) at small for gestational age in contrast to the general population, according to certain reports [17]. Furthermore, a significant difference between men with hypospadias and those without regarding the correlated malformations and being born preterm was observed [18].

In the current study, the majority of our patients had distal granular meatus, of vertical slit shape, single urinary stream and straight-to-mildly angulated erection without fistula. Overall, the majority had accepted HOSE score. According to Holland, a total score of fourteen indicates an agreeable result after hypospadias repair [8]. **Liu *et al.*** stated that a better outcome is expected to be achieved with good experience [19].

HOSE score of our patients was not associated with any of their baseline characteristics; including their age, birth weight, current weight or height, history of prematurity, history of NICU admission and associated congenital anomalies, or having consanguineous parents. **Arlen *et al.*** [10] reported that age of cases at the time of the operation wasn't significantly associated with likelihood of complication. Surprisingly, in terms of functional outcomes, a retrospective investigation discovered a highly positive correlation among the individual's age at the time of hypospadias surgery & the extent to which they were sexually repressed afterwards. Individuals who had the repair performed at an older age were found to have a significant amount of inhibition when it came to finding girlfriends or sexual encounters, as described by the **Liu *et al.*** [19].

We discovered a significant positive association among preoperative GMS score and postoperative HOSE score, where accepted preoperative GMS score was associated mostly with accepted postoperative HOSE score. Previous studies have evaluated the association between postoperative outcomes and GMS. For example, regarding the glans or the urethral plate item, **Dokter *et al.*** [20] reported that a urethral plate width of below eight-millimeter was correlated to the risk of a surgical complication. **Holland *et al.*** [21] indicated that fistula formation was associated with a narrow urethral plate, while meatal stenosis was linked to a shallow urethral fissure depth. In contrast, **Nguyen *et al.*** [22] found that the characteristics of the urethral plate do not correlate with the risk of postoperative complications.

Meanwhile, more recent studies reported an association between total GMS scores and postoperative complications. A study observed a significantly higher average GMS score (bad GMS score) in boys who developed a complication when compared to those who did not. When the total GMS score was above 6, it was also determined that the likelihood of surgical complications increased [5].

Another study reported that boys with mild hypospadias (accepted GMS score) had about six times lower complication rate compared to those with severe hypospadias [10]. Although, none of these previous studies assessed the relation between preoperative GMS score and postoperative outcome in the light of HOSE score, however the findings of that studies can possibly explain the observed significant correlation in the current study.

CONCLUSION

Our study concluded that pre-operative S score was positively associated with postoperative HOSE score. Regarding S score, we found that it was positively associated with postoperative HOSE score. So, we could improve penile chordee (S score) to improve postoperative outcomes by prescribing human chorionic gonadotropins.

DECLARATIONS

- **Consent for publication:** All author has granted permission for the work to be submitted.
- **Funding:** None.
- **Availability of data and material:** Available.
- **Conflicts of interest:** None.
- **Competing interests:** None.

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