Original Research Article

Correlation of glans-urethral meatus-shaft scoring system for hypospadias with post-operative outcome

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Abstract

Background: There are numerous techniques for hypospadias repair and the outcome of urethroplasty depends on patient related factors and surgeon related factors. Currently there is no widely accepted scoring system for assessing the severity of hypospadias. **Objective:** Present study was aimed to classify the severity of hypospadias according to GMS score and correlate the score with post-operative complications. **Methods:**100 males with distal to mid-shaft hypospadias consecutively selected for Urethroplasty were included in this prospective study during September 2015 to March 2017. The Glans size/groove , Urethral plate width, location of meatus and severity of chordee were evaluated individually before reconstruction. After surgery and during follow-up visits, the subsequent transient and persistent complications were recorded. **Results:**The mean GMS score in group A, B and C was 4.78 (± 0.69), 8.19 (± 0.90) and 10.43 (± 0.51) respectively. In Group A, UC fistula was seen in 7.4% of patients whereas In Group B and Group C, UC Fistula was seen in 46.9% and 92.9% patients respectively. Meatalstenosis was not seen in patients in Group A and Group C patients. In Group B, meatal stenosis was seen in 15.6% patients. Glans Dehiscence was not seen in patients in Group A and Group C. In Group B, Glans Dehiscence was seen in 6.2% patients. Stricture Urethra was seen in 9.3% patients in group A . In Group B and Group C, Stricture Urethra was seen in 43.8% and 92.9% patients respectively. **Conclusion:** The Glans-Urethral Meatus-Shaft (GMS) classification provides a means by which hypospadias severity and reporting can be standardized, which may improve inter-study comparison of reconstructive outcomes. There is a strong correlation between complication risk and total GMS score.

Keywords: Hypospadias, Urethroplasty, GMS score, outcomes, postoperative complications

Introduction

Hypospadias occurs due to abnormal development of the penis. The urethral meatus in hypospadias is proximal to its normal glanular position anywhere along the penile shaft, scrotum, or perineum. A spectrum of abnormalities including ventral curvature of the penis (chordee), a hooded prepuce, and incomplete corpora spongiosum are commonly associated with hypospadias. Though hypospadias is prevalent across the globe, recent reports have shown that there has been an increase in its incidence in the western world over the last decade.[1]The 1996 Committee for the American Academy of Paediatrics Section on Urology reviewed psychological factors, anaesthetic considerations, and technical aspects of repair before recommending surgery be performed between 6 and 12 months, assuming the surgeon, anaesthesiologist, and facility were experienced in care of infants. [2]Though various postoperative scoring systems like HOSE, PPS have been described in literature so as to allow more objective assessment of the outcome of the repair, there is paucity of such objective scoring system in preoperative assessment.[3,4]Merriman *et al* described the Glans-Urethral Meatus-Shaft (GMS) hypospadias classification as a means of preoperative qualitatively scoring of the severity ofhypospadias. [5]Currently there is no widely accepted scoring system for assessing the severity of hypospadias. Present study wasaimed to classify the severity of hypospadias according to GMS score and correlate the score with post-operative complications.

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Methods: TheProspective study was conducted in Department of Paediatric Surgery, Chacha Nehru Bal Chikistalaya, Geeta colony, Delhi.

Study Population

All patients of hypospadias admitted in paediatric surgery through out-patient department were considered for inclusion in the study after obtaining informed consent/ assent.

Inclusion Criteria

1.Hypospadias for which primary single stage urethroplasty is done.

Exclusion Criteria

1.Patients who have been circumcised.

Sample size calculation

Assuming the prevalence of hypospadias as 1% from previous studies, sample size for this study was calculated by following formula-

$$\text{Sample size} = \frac{Z\ 1\text{-}\alpha/2^2\ p\ (1\text{-}p)}{d^2}$$

Where, Z 1-α/2 is standard normal variate, at 5% type I error ($p<0.05$) it is 1.96. α is level of significance and it is fixed at 5%. P is expected proportion in population based on from previous studies, and d is absolute error or precision. Assuming the prevalence at 1%, α at 5% and d of 3%, sample size calculated was 100.

Methodology

All patients meeting the inclusion criteria were enrolled for the studyafter the ethical clearance from Institutional Ethical Committee CNBC and MAMC was taken. A pre-designed working proforma was used to collect information from parents/ guardians. Careful history was taken and physical examination was done.

Glans-urethral meatus-shaft score was calculated in pre-operative room and was assigned as follows :

G (Glans score)

1. Above average glans size ; healthy urethral plate ; deeply grooved
2. Average size glans ; adequate urethral plate ; grooved.
3. Small glans; urethral plate narrow with some fibrosis
4. Very small glans ; urethral plate indistinct ; very narrow or flat.

M (Urethral meatus score)

1. Glanular
2. Coronal sulcus
3. Distal or mid-shaft (figure 3)
4. Proximal shaft, penoscrotal or perineal

S (Shaft score)

1. No chordee
2. Mild (< 30 degree) chordee
3. Moderate (30-60 degree) chordee
4. Severe (>60 degree) chordee

The minimum score was three and maximum score of 12. The patients were divided into 3 groups on the basis of total GMS score calculated by adding three G,M and S scores as follows:

- Group A(mild) score 3-6
- Group B (moderate) score 7-9
- Group C (severe) score 10 or more

Surgery was conducted as per routine protocol and single stage urethroplasty was done. After the operation antibiotics were given according to departmental protocol (Ceftriaxone 50-75mg/kg/day for 48 hours followed by oral Amoxicillin 40-50mg/kg/day for 5 days). In post-operative period patients were kept in Pediatric surgery ward. Dressing was removed after 5 days and catheter was kept for 5-10 days. Patients were monitored for any complications during the stay in hospital and during subsequent follow-up period of 3 months and it was recorded on a proforma. The type of repair and complications (urethrocutaneous fistula, meatal stenosis, glans dehiscence, phimosis, recurrent chordee and stricture) were assessed.

- Meatal stenosis was defined as failure to pass appropriate size infant feeding tube through the external meatus.
- Urethral stricture was defined by history of passage of thin urinary stream or straining at micturition associated with inability to pass appropriate size Infant Feeding tube into the proximal urethra.
- Urethrocutaneous fistula was defined as the passage of urine from any abnormal opening after correction of hypospadias.

Statistical testing was conducted SPSS version17.0. Continuous variables were presented as mean ± SD, and categorical variables are presented as absolute numbers and percentage. The comparison of normally distributed continuous variables between the groups was performed using Student's t test. Nominal categorical data between the groups were compared using Chi-square test or Fisher's exact test as appropriate. P<0.05 was considered statistically significant. The outcome of urethroplasty was assessed by the complications observed.

Results

This study was conducted in the Department of Pediatric Surgery, Chacha Nehru Bal Chikitsalaya, Geeta Colony. 100 patients were included in this prospective study during September 2015 to March 2017. Most number of patients were in group A (n=54) accounting for 54% of cases followed by group B (32%) and group C (14%) (Table 1).

Table 1: Frequency of cases in different groups (n=100)

	Frequency	%
Group A	54	54.0%
Group B	32	32.0%
Group C	14	14.0%
Total	100	100%

The differences in G,M and S scores in different groups were found to be statistically significant (p <0.001) (Table 2)

Table 2: Mean G, M and S scores in different groups

	Group A	Group B	Group C
	Mean ± SD	**Mean ± SD**	**Mean ± SD**
G Score	1.87 ± 0.65	2.56 ± 0.56	3.29 ± 0.47
M Score	1.93 ± 0.26	3.50 ± 0.51	4.00 ± 0.00
S Score	1.00 ± 0.00	2.06 ± 0.56	3.14 ± 0.86

TIP urethroplasty was performed in all the patients of Group A. In group B the most commonly performed procedure was TIP in 62.5% cases followed by TIP and Onlay Flap (31.2%) and Koyanagiurethroplasty (6.2%). In Group C, the most commonly performed procedure was TIP and Onlay Flap in 57.1 % cases followed by ThierschDuplay procedure in 28.6% cases and Koyanagi procedure in 28.6% of cases (Table 3).

Table 3: Operative procedures performed in different groups (n=100)

Procedure	Groups		
	Group A	Group B	Group C
	Frequency (%)	Frequency (%)	Frequency (%)
Koyanagi	0 (0.0%)	2 (6.2%)	2 (14.3%)
ThierschDuplay	0 (0.0%)	0 (0.0%)	4 (28.6%)
TIP	54 (100%)	20 (62.5%)	0 (0.0%)
TIP+FLAP	0 (0.0%)	10 (31.2%)	8 (57.1%
Total	54 (100%)	32 (100%)	14 (100%)

Table 4: post Operative procedures complications in different group

Variables	Group A Frequency (%)	Group B Frequency (%)	Group C Frequency (%)
U.C Fistula	4 (7.4%)	15 (46.9%)	13 (92.9%)
Meatal Stenosis	0 (0.0%)	5 (15.6%)	0 (0.0%)
Glans Dehiscence	0 (0.0%)	2 (6.2%)	0 (0.0%)
Stricture Urethra	5 (9.3%)	14 (43.8%)	13 (92.9%)

UC fistula was seen in 4 out of 54 patients in Group A (7.4%) In Group B, UC Fistula was seen in 6 out of 32 patients at the time of discharge (18.8%) , which increased to 34.4% patients at 2 weeks and 46.9% patients at 3 months. In Group C, UC Fistula was seen in 13 out of 14 patients at the time of discharge (92.9%), which remained same at 3 months. These values are statistically significant (P <0.001). Meatal stenosis was not seen in patients in Group A. In Group B, meatal stenosis was seen in 5 out of 32 patients at the time

of discharge (15.6%) which remained same at 3 months. In Group C, meatal stenosis was not seen in any patient. These values are statistically significant (P <0.001).Glans Dehiscence was not seen in patients in Group A. In Group B, Glans Dehiscence was seen in 2 out of 32 patients at the time of discharge (6.2%) which remained same at 3 months. In Group C, Glans Dehiscence was not seen in any patient. These values are statistically not significant (P =0.11). Stricture Urethra was seen in 5 out of 54 patients in Group A at 2 weeks (9.3%). In Group B, Stricture Urethra was seen in 5 out of 32 patients at 2 weeks (15.6%), which increased to 43.8% patients at 3 months. In Group C, Stricture Urethra was seen in 13 out of 14 patients at 2 weeks (92.9%), which remained same at 3 months. These values are statistically significant (P <0.001) (Table 4).

Discussion:

The most reliable and reproducible way to classify the anomaly in hypospadias is based on the position of the urethral opening [6] and in most studies related to outcome, patients are grouped according to meatal position (i.e. distal, proximal) [7-10] However, it is very likely that other factors may have as much impact on surgical outcomes as the position of the urethral meatus. There is no universally accepted method for classifying the severity of the hypospadias complex in a standardized fashion. As severity of chordee, size of the glans, and the quality of the urethral plate impact surgical outcome, it becomes difficult to compare one study to another using only meatal position for stratifying patients. Castagnetti *et al* [7]and Snodgrass *et al* [11] emphasized the need for criteria for patient stratification in their 20-year review of the management of severe hypospadias They pointed out that a clear definition of severe hypospadias is lacking and highlighted the difficulties encountered when trying to compare one study to another without a standardized classification scheme.[7,11] As with anyscoring tool, the ideal classification for hypospadias severity should be both objective and easily reproducible.

In response to the need for a uniformly accepted classificationsystem for hypospadias, GMS was developed by Jonathan *et al* (2012) to standardize the classification of the severity of the hypospadias complex. The criteria chosen were based on the anatomic features of hypospadias felt most likely to impact complication rates aswell as the cosmetic and functional outcomes of surgical repair. [12] This classification scheme was developed with theintent that it would be easy to use, reproducible, asobjective as possible, and directly reflect the risk of asurgical complication. The results of their study suggested thatthe GMS scoring method has high inter-observer reliability. Merriman *et al* (2013) did a similar study regarding the GMSscore, based on anatomic features, which impact functional and cosmetic outcomes (i.e. glans size/urethral plate quality, location of meatus, and degree of chordee). They also demonstrated high inter-observer reliability in their study. [5]

Complication rates following hypospadias repair aredependent upon a host of factors. While several validated scores exist for assessing cosmetic outcomes followinghypospadias repair, such as Hypospadias Objective Scoring Evaluation (HOSE), Pediatric Penile Perception Score (PPPS), and Hypospadias Objective Penile Evaluation (HOPE), theneed for standardized hypospadias reporting remains. [13] The GMS is assigned preoperatively and that makes it different from other scoring systems.

In the present study, the most common form of hypospadias was distal type in which meatus was located in glans, coronal sulcus and distal penile position which constituted 70 % of patients. Duckett observed that meatus is located on the glans or distalshaft of the penis in approximately 70–80% of all boys with hypospadias. In 20–30% of boys with hypospadias the meatus is located in the middle of the shaft of the penis and the remainder of the boys withhypospadias have more severe defects, with the urethralmeatus located in the scrotum or even moreproximally on the perineum.[14]

Our study demonstrated a statisticallysignificant increase in the likelihood of any postoperativecomplication with every unit increase in totalGMS score. GMS scoring may, therefore, assist with operativeplanning, as well as parental counselling. Factors other than meatal locationaffect hypospadias repair and outcomes depend on degree of ventral curvature and urethral plate quality. [15,16]Optimal management of chordee remains debatable among paediatric urologists, although most advocate a stepwise approach. [17,18]

The most commonly performed procedure in distal and mid-penile hypospadias in our study was TIP urethroplasty (86%) followed by TIP and Onlay Flap in 12 % of cases. This percentage is similar to the studies of Cook *et al*[17] who found that the preferred technique for the repair of distal and mid shaft hypospadias was tabularized incised urethral plate (TIP) whereas the common technique for repair of proximal hypospadias without chordee was TIP and transverse island flap (TVIF) Onlay. Alexendar*et al* [18]also found that tabularized incised plate (TIP) repair was preferred by 52.9–71.0% of the participants in distal hypospadias (subcoronal to midshaft). TIP repair in proximal hypospadias was used by 0.9–16.7% and Onlay flaps and tubes were used by 11.3–29.5% participants.

In our study, UC fistula was seen in 4 out of 54 patients in Group A (7.4%) In Group B, UC Fistula was seen in 6 out of 32 patients at the time of discharge (18.8%), which increased to 34.4% patients at 2 weeks and 46.9% patients at 3 months. In Group C, UC Fistula was seen in 13 out of 14 patients at the time of discharge (92.9%), which remained same at 3 months. As the severity of hypospadias increases the incidence of UC fistula also increases. This finding was similar to the study by Pfistermuller*et al* who had 5.7% UC fistula rates in primary distal repair.[19]Several factors may influence fistula formation: surgical technique, delicate tissue handling, patient age, type of hypospadias defect, surgeon experience, waterproof urethroplasty coverage, and concomitant foreskin reconstruction, among others. [20] The increase in UC fistula in follow up of patients was probably linked to increased rate of infections or delayed clinical manifestations of ischemia. In a study by Feng *et al* postoperative infection was statistically related with the outcome of surgery.[21] The fistula rate ranges from 0 to 16% (mean = 5.9%) in various studies. [22-29]

Meatal stenosis can result from a tight closure of the glans wings or ischemia at the meatus. While meatalstenosis itself can be troublesome, it can also contribute to the pathogenesis of additional complications,such as urethral diverticulum and urethra cutaneous fistula. Meatal stenosismay be amenable to simple calibration at home. If the stenosis is refractory to gentle dilation, ameatoplasty may be required. In our study meatal stenosis was seen in 5 % of patients. The meatal stenosis rate varied from 0 to 17% in various studies. [30-39]

Symptoms associated with postoperative strictures include straining to void, inadequate urinarystream, dysuria, urinary retention, and urinary tract infections (UTIs). Astricture may be associated with urethra cutaneous fistula. Factors implicated instricture formation include infection, trauma from instrumentation, tissue ischemia, and errorsin technique. The rate of stricture formation varies depending on the type of repair. In our study stricture rates increased progressively from Group A to Group C. Stricture rates vary in different studies from 0 to 15 %. [40,41]

In the present study, the incidence of complications increased from Group A to Group C. Single stage urethroplasty has a good outcome in group A and Group B with lower incidence of complications. However, in Group C, the incidence of complications is very high with single stage repair and it might be preferable to do a two stage repair in severe cases of hypospadias which could decrease the morbidity.

Conclusion

- It is better to do a two stage repair in severe cases of hypospadias which results in fewer complication rates.

- Preoperative GMS classification may allow for improved clinical decision making, operative planning and parental counselling.
- A study with a larger number of patients, a longer follow-up period, and more detailed statistical analysis is needed which may enable the identification of specific characteristics that correlate to the risk of a surgical complication.

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