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Original Research Article

Comparative study of hypospadias morphology with normal age-matched subjects

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ABSTRACT

Background: Hypospadias is the most common congenital malformation of the penis, affecting about 4-6 males per 1000 births, and ranging in severity from a ventrally located urethral meatus that is slightly off-center to tip of penis to up to the perineal area. The current research is intended towards studying the morphology of hypospadias and undertakes a comparison with the age matched population.
Methods: It was an observational, cross-sectional study conducted in the Department of General Surgery, Himalayan institute of medical sciences, Swami Ram Nagar, Dehradun, Uttarakhand, India over the period of 12 months. We included a total of 120 study subjects, consisting of 60 cases and 60 controls. All patients of hypospadias with no other genital pathology visiting the OPD for the 1st time were included. Patients were categorized as having distal (distal to corona), mid (proximal to corona & up to distal shaft), or proximal hypospadias (in the shaft). Mean maximum width, thickness and vertical length of the glans, stretched penile length, diameter and circumference of penile shaft were recorded.
Results: Variables like stretched penile length, width and circumference of mid penile shaft and variables like urethral plate, urethral groove, breadth of dorsal hood, maximum width and thickness of glans were found to be insignificant when compared with controls. However, vertical length of glans among cases was significantly less when compared with controls.
Conclusions: A significant association between vertical length of glans between controls and cases was found.

Keywords: Hypospadias, Morphology, Child, Penile anthropometry

INTRODUCTION

Hypospadias is a congenital disease that causes the urethral opening to originate on the penis underside. Penile curvature and ventrally inadequate hooded foreskin are also symptoms. From the penis to the scrotum, the urethra can open abnormally anywhere.[1]

Hypospadias is usually identified by the opening being in the wrong place.[2] In most situations, a surgical correction is needed to allow the penis to function normally and to move the urethral opening closer to the ventral tip of the organ.[3]

Hypospadias can cause men many issues. Males with this disease often have abnormal urinating. A testicle may not descend properly. In such circumstances, patients may have sexual issues, leading to reproductive complications.[4]

Congenital penile curvature and chordee are connected with hypospadias. Hypospadias is classified by urethral meatus placement as distal, mid, and proximal

hypospadias. Distal hypospadias has an aberrant urethral opening near the penis tip. This is anterior or grandular hypospadias. The midshaft type is connected with the placement of the urethral meatus along the shaft of the penis. In proximal hypospadias, the urethral opening is near the peno-scrotal junction.[5] Distal or subcoronal hypospadias affects 80% of males. In 15% of males with distal hypospadias, the penis curves downward (chordee). Penile curvature occurs more when the urethral entrance is below the shaft.[6] Due to the abnormal location and narrowness of the meatus, a splayed urine stream may create urination problems with other aging-related consequences. Ventral curvature in boys and men causes painful erections.[7]

Embryonal urethral abnormalities can cause epispadias or hypospadias. If the urethra opens on the penis dorsal surface, the condition is called epispadias. Epispadias is caused by a genital tubercle defect and hypospadias by urethral fold defects.[8] The aetiology of this illness is unknown, however most studies thinks it's caused by hormones and genetics.[9] Hypospadias can also occur in men with decreased androgens or less sensitive androgen receptors, which can be caused by pesticides in vegetables, fruits, and plastic linings.[10]

Hypospadias causes are unknown, but risk factors have been discovered. According to the CDC, women 35 and older are at risk of having a kid with hypospadias. Obese women are more likely to have children with this disorder. Fertility treatments and hormone consumption before or during pregnancy are also risk factors.[9] Since surgery is the sole treatment for hypospadias, it's best to do it early. Surgeons patch the hole with foreskin or other bodily tissue. Surgery involves placing the urethral meatus at the penis' tip, treating the skin around the urethral opening, and straightening the penile curve.[6] Penile biometrics in hypospadias is an important study field. Few studies report newborn penile anthropometry. There are few studies about penile nomograms. Current research aims to compare the morphology of hypospadias with an age-matched population.

Aim and objectives

Objectives were to study the detailed penile morphology in hypospadias patients and to compare various anatomical penile parameters in these patients with age-matched controls.

METHODS

The study was conducted in the Department of Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, from April 2020 to April 2021. Subjects were recruited from patients presenting in Paediatric and Plastic Surgery OPD, HIMS, Dehradun. A written informed consent was be taken from parents of all the patients and controls except the major. The study was undertaken after ethical clearance from the ethics committee.

Type of study, sample size and sampling method

It is an observational cross-sectional study. Sample size was 120 subjects (60 case and 60 controls) after complete enumeration of patients with hypospadias following the inclusion criteria of the study at department of General Surgery, Himalayan Hospital over a period of 12 months.

Inclusion criteria

Inclusion criteria were; all patients with hypospadias visiting the OPD for the 1st time and patients of similar age with no genital pathology.

Exclusion criteria

Exclusion criteria were; patients who have already been operated, patients with hypospadias associated with genetic and endocrine disorders and patients who had undergone circumcision and genital surgery in the past.

Study tools

Structured study instruments: (formats/case recording form) developed, and used to generate data. Good quality photograph: antero posterior and lateral views. Measuring tape. Vernier Calipers for precise measurements whenever needed

Study protocol

Cases were categorized as having distal (distal to corona), mid (proximal to corona), or proximal hypospadias (in the shaft). We had recorded the following parameters in hypospadias cases: Stretch penile length (in flaccid penis) but In cases of chordee, stretch penile length will be measured after chordee correction (intra operatively). Exact meatal location and its distance from tip of glans. Glans (Shape, maximum width, maximum thickness, vertical length). Urethral plate and urethral groove (either present or absent). Maximum stretched breadth of Dorsal hood. Testes (either descended or undescended). Width of mid penile shaft/Circumference at midpoint of shaft. In control group we had recorded the following parameters: Stretch penile length. Glans (shape, maximum width, maximum thickness, vertical length). Width of mid penile shaft/Circumference at mid-point of shaft.

Data management and statistical analysis

The data was collected and entered into Microsoft Excel 2010. Various statistical analyses were carried out using the SPSS software version 22. Parametric tests were used to assess normally distributed data, while non-normally distributed data was studied using non-parametric tests. Descriptive statistics were computed for quantitative characteristics such as stretch penile length, meatal size,

glans breadth and thickness, penile shaft diameter and circumference, and so on. Frequency and percentages were calculated for qualitative and categorical characteristics such as type of hypospadias, glans shape, specific meatal placement, glans shape, presence or absence of urethral plate and groove, testes location, and so on. To better comprehend the results, a graphical representation of the variable was given, and categorical data was examined using the Chi-square test to test the association between them. The independent t test and ANOVA tests revealed differences in means between groups. If $p \leq 0.05$, then the hypothesis is statistically significant; if $p > 0.05$, then the hypothesis is statistically insignificant.

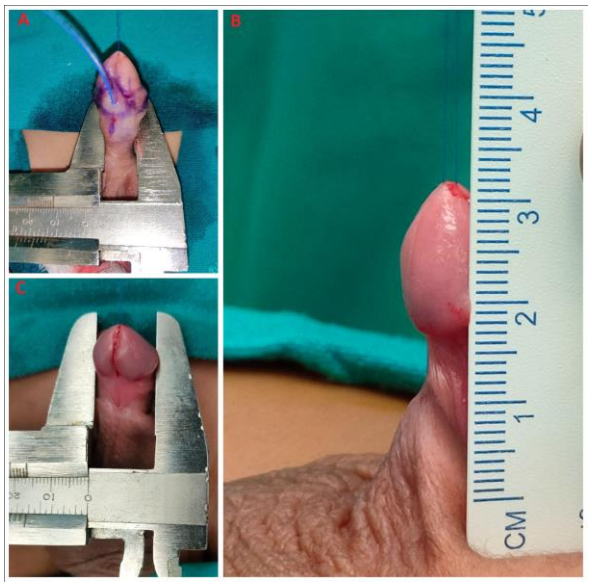

Figure 1: Measurement of various penile parameters: A) Width of mid penile shaft, B) Stretch penile length and C) Maximum width of glans.

RESULTS

The present cross-sectional study was conducted in the Department of Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun, over a period of 12 months. The subjects were recruited from patients presenting in Pediatric and Plastic Surgery OPD, HIMS, Dehradun and following observations were recorded: A total of 120 study subjects were included in the study consisting of 60 cases and 60 controls. Majority of the study subjects were recorded in the age group 1-3 years (46.7%) followed by age group 0-1 years (20%), 3-5 years (10%), 7-9 years (10%), 5-7 years (4%), 9-11 years (3.3%) and 11-13 years (3.3%).

About 80% of study subjects had conical glans followed by 20% study subjects had flat glans. Of the total cases of hypospadias, majority of the study subjects had good urethral plate (majority among distal hypospadias) whereas 4 cases had absence of urethral plate in proximal hypospadias.

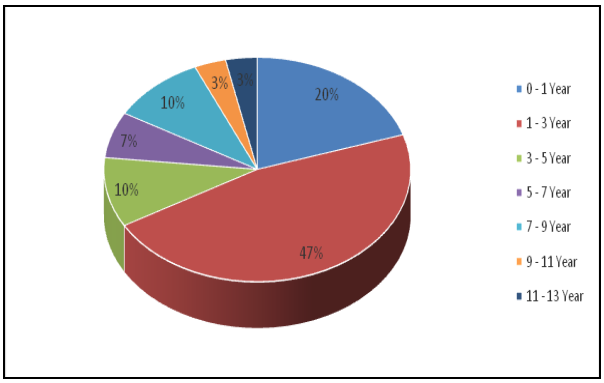

Figure 2: Distribution of study subjects according to age.

Table 1: Comparison of presence of urethral plate and groove among different hypospadias cases.

Parameters		Type of hypospadias, N (%)			Total	P value*
		Distal	Mid	Proximal		
Urethral Plate	Present	28 (100.0)	14 (100.0)	14 (77.8)	56 (93.3)	0.131
	Absent	0 (0.0)	0 (0.0)	4 (22.2)	4 (6.7)	
Urethral groove	Present	28 (100.0)	14 (100.0)	16 (88.9)	58 (96.7)	0.533
	Absent	0 (0.00)	0 (0.00)	2 (11.1)	2 (3.3)	

Table 2: Comparison of vertical length of glans in hypospadias cases and controls.

Vertical length (mm)		P value
Mean±SD		
Cases	9.73±1.507	0.016
Control	10.73±1.617	
Total	10.23±1.630	

Distribution of the study subjects according to severity of hypospadias among the cases showed that majority of the cases (46.7%) had distal hypospadias followed by 30% had proximal hypospadias. Only 14 cases had mid hypospadias. The distribution of the study subjects according to meatal location showed that majority of the study subjects had the meatal location at penoscrotal and subcoronal accounting for 26.7% each among cases.

Mean maximum width of glans among the cases was recorded as 14.33 mm whereas in controls it was 15.83 mm. However, the difference was statistically insignificant. Among the cases, mean thickness of glans was recorded to be 12.07 mm while in controls, it was 13.6

mm. This too was an insignificant difference. Moreover, other variables like stretch penile length, width and circumference of mid penile shaft was found to be insignificant when compared with controls. Variables like urethral plate, urethral groove, breadth of dorsal hood, maximum width and thickness of glans, and shape of the glans were found to be statistically insignificant with type of hypospadias (p value>0.05). However, vertical length of glans among cases was statistically significant when compared with controls.

Table 3: Comparison of various penile anthropometrical parameters among hypospadias cases and controls.

Parameters	Type of hypospadias				P value
	Control	Distal	Mid	Proximal	
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Stretched penile length (mm)	45.33±10.949	45.50±7.481	42.71±12.065	33.11±13.679	0.498
Maximum width of glans (mm)	15.83±5.796	13.64±3.522	16.29±6.237	13.89±5.465	0.519
Maximum thickness of glans (mm)	13.60±4.987	11.57±2.98	13.29±6.211	11.89±4.167	0.088
Width of mid penile shaft (mm)	12.13±2.862	11.86±2.961	11.43±4.077	10.78±2.863	0.728
Circumference of mid penile shaft (mm)	39.47±8.780	39.71±8.516	39.00±10.344	35.78±9.628	0.030

Table 4: Comparison of glans shape among hypospadias cases and controls.

Parameters		Type of hypospadias					
		Control	Distal	Mid	Proximal	Total	P value
Glans shape	Conical	56 (76.7)	24 (85.7)	10 (71.4)	16 (88.9)	96 (80.0)	0.756
	Flat	14 (23.3)	4 (14.3)	4 (28.6)	2 (11.1)	24 (20.0)	
	Total	60 (100)	28 (100)	14 (100)	18 (100)	120 (100)	

DISCUSSION

Hypospadias is one of the most frequent congenital abnormalities affecting the external male genitalia, with an estimated prevalence of 1 in 250 male infants, however this figure appears to be rising.[10,11] Hypospadias is characterised by a lack of development of the urethral folds and ventral foreskin, with or without penile curvature. Anywhere between the tip of the penis and the perineum is a more proximal location for the urethral opening. The position of the meatus determines the classification of hypospadias, which is divided into three categories: distal or anterior hypospadias, mid hypospadias, and proximal hypospadias.

Distal hypospadias with the meatus on the glans penis, the corona, or below the corona. Mid hypospadias having urethral openings positioned on the distal and mid proximal penile shafts. The penoscrotal, scrotal, or perineal urethral meatus is located in proximal or posterior hypospadias. The most prevalent finding in the Western world is distal hypospadias. More proximal versions are seen throughout Asia.[12]

The current cross-sectional study was carried out over a 12-month period at the Department of Surgery, Himalayan institute of medical sciences (HIMS), Swami Ram Nagar, Dehradun. Patients presenting to the Pediatric and Plastic Surgery OPD at HIMS Dehradun were enrolled as participants. The goals of hypospadias surgery are to create a phallus that is both visually and functionally acceptable, with an orthotopic slit-like meatus and a conical glans. However, the severity of hypospadias is still being debated.[13-15] As a result, we carried out this study to examine thorough penile morphology in hypospadias patients and compare various morphological anatomical features with age-matched controls.

The current study enrolled a total of 120 participants, including 60 cases and 60 age-matched controls. According to the study subjects age distribution, the majority of instances were recorded between the ages of one and three years, accounting for 46.3 percent of all study subjects. However, the age range between 9 and 13 years old had the fewest research subjects. Puri et al found that the majority of the study individuals were between the ages of 0 and 1 year, which can be related to early presentation and all deliveries being institutional.[16] Gohil et al found that 44 percent of hypospadias patients were under the age of five, with a mean age of presentation of 7.56 years.[17] In a study of 94 hypospadias children at BMC Hospital in Quetta, 61 percent were under the age of five, with a mean age of presentation of 6.7 years, and in another study of 304 hypospadias patients at Asopa Hospital in Agra, 62.5 percent were under the age of five.[18]

According to the degree of hypospadias among the patients (N=60) in our study, the majority (46.7 percent) had distal hypospadias, followed by 30% with proximal hypospadias and 23% with mid hypospadias. However, the distribution of cases by meatal location revealed that subcoronal and penoscrotal locations accounted for 26.7 percent of all instances. There was only two case where the meatal position was recorded as Proximal Penile. In contrast, Gohil et al discovered that 6 (19%) of hypospadias patients had meatus in the mid-penile region. Furthermore, in a Quetta study, 49 (52%) of hypospadias patients had

meatus in the subcoronal/distal penile region, whereas 35 (37.4%) of hypospadias patients had meatus at the midpenile/proximal penile region. The current study also found that the mean maximal width of the glans (mm) among cases was 14.33, which was slightly lower than the 15.83 seen in controls. Future research is needed to assess glans anthropometry in hypospadias and investigate its impact on postoperative outcomes such as glans dehiscence. Preoperative hormonal stimulation is frequently used in hypospadias for small looking penis or small glans penis with a maximum glans diameter of 14 mm.[19] Many studies have been conducted to describe penile length variations in neonates of various ethnicities (20,21).

In our study, however, the mean stretched penile length (SPL) among cases was lower than that of controls (40.66 mm among cases vs. 45.33 mm among controls), but this difference was statistically insignificant (p=0.59). Similarly, the mean breadth and circumference of the penile shaft were lower in the cases than in the controls. Penile length differences are known to occur in hypospadias due to moderate hypogonadism during foetal development.[13] The current study also found a difference in vertical glans length between controls and cases which is statistically significant. Other variables, such as the shape of the glans, the width and circumference of the mid penile shaft (mm), the maximum thickness (mm) and maximum width of the glans (mm), the stretched penile length (mm), the dorsal hood breadth, the uretheral groove, and the urethral Plate, were found to be statistically insignificant with the type of hypospadias.

Limitations

Limitations of the study were; Small cohort size and non-availability of comprehensive international nomograms for penile anthropometry

CONCLUSION

The current cross-sectional study included 120 participants (60 cases and 60 controls). The majority of the study volunteers enrolled in this study were under the age of five. The majority of the cases enrolled had distal hypospadias. The urethral groove and urethral plate were present in the majority of the cases. Meatal site was determined to be subcoronal and penoscrotal in the majority of instances. The mean maximum width, thickness, and vertical length of the glans, stretch penile length, diameter, and circumference of the penile shaft were all lower in the cases than in the controls. Variables such as the urethral plate, the urethral groove, the breadth of the dorsal hood, and the shape of the glans were found to be statistically insignificant with the type of hypospadias (p>0.05). However, when comparing cases to controls, the vertical length of the glans was statistically significant.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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