

## ORIGINAL ARTICLE

**Biometry of Hypospadias in Children: Study From a Tertiary Referral Hospital**

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**ABSTRACT**

**Introduction:** Hypospadias is a common congenital anomaly in boys, characterized by varying degrees of genital abnormalities. Penile biometry determines the severity and outcome of hypospadias. This study aims to describe the penile biometry of a pediatric patient with hypospadias treated in our institution. **Methods:** This descriptive retrospective study focused on patients with hypospadias in Pediatric Surgery Division Hasan Sadikin General Hospital during a 5.5-year period. All penile biometry data were obtained from medical record. The biometrics were measured with caliper, ruler, and protractor intraoperatively and documented. **Results:** A total of 183 patients with hypospadias were treated during the period. Stretched penile length measurement showed micropenis in 52.35% patients. The glans width was <14 mm in 51.43% patients. The length of the urethral plate was  $\geq 10$  mm in 74.08% patients, whereas the width was <8 mm in 75.86% patients. Ventral penile curvature was  $\geq 30^\circ$  in 75.25% patients. **Conclusion:** Most patients had severe hypospadias, characterized by micropenis, narrow glans width, long and narrow urethral plate, and high degree of ventral curvature.

**Keywords:** Penile biometric, Stretched penile length, Glans width, length, and width of urethral plate, Degree of ventral curvature

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**INTRODUCTION**

Hypospadias is a common congenital abnormality of the external genitalia, occurring in approximately 1 in 250 newborns or approximately 1 in 125 live births of male infants (1). Although the treatment for hypospadias produces good results, complications still arise, such as urethrocutaneous fistula, meatal stenosis, and wound dehiscence.

Cimador et al. (2) showed that the rate of urethral fistula after hypospadias repair is 4%–28%, meatal stenosis 14%, wound dehiscence 28%, urethral diverticulum 4%–12%, and urethral stricture 6%–12%. Meanwhile, a study conducted in our institution found that the complication rate is 42% for urethra-cutaneous fistulas, 6% for meatal stenosis, and 7% for wound dehiscence (3). Penile biometry determines the severity of hypospadias and the outcome of surgery in hypospadias, thereby preventing or predicting problems that can arise in patients with hypospadias (4).

Study by Wong et al showed that majority of syndromic type of hypospadias correlated with micropenis. (5)

Studies about glans width has shown that narrower glans width had been shown associated with increased risk of glans dehiscence after hypospadias repair. (6,7) Urethral plate biometry, such as length and width, also play important part in increasing complication risk, longer urethral plate and narrower urethral width associated with neourethral after surgery. (4,8,9) Higher penile ventral curvature also associated with severity of hypospadias. (10)

Studies on the penile biometry of patients with hypospadias are still limited in Asia, especially in Indonesia (11). A specific penile biometric value is needed because this parameter can be influenced by race and ethnicity. This measurement can help determine the management strategies and outcome of patients with hypospadias (12). The present study aims to describe the penile biometry of pediatric patients with hypospadias treated in our institution.

**MATERIALS AND METHODS**

This descriptive retrospective study focused on patients with hypospadias treated in Pediatric Surgery Division Hasan Sadikin General Hospital, Bandung from January 2016 to June 2021. The study was approved by The Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung with document number LB.02.01/X.6.5/287/2021. Our center is a tertiary

provincial hospital, treating pediatric surgical referral cases in West Java. Penile biometry was obtained intraoperatively, including stretched penile length (SPL), glans width, urethral plate length, urethral plate width, and the degree of ventral penile curvature.

The SPL was measured from the edge of the pubic bone to the tip of the glans without measuring the prepuce and then classified into normal or micropenis according to the stretched penile length by age (13,14). The glans width was measured on the maximum width of the glans and then classified into <14 mm and  $\geq$ 14 mm. The urethral plate length was measured from the urethral opening to the distal edge of the urethral plate on the ventral surface of the glans and then classified into <10 mm and  $\geq$ 10 mm. The urethral plate width was measured by the narrowest distance between the edges of the urethral plate and then classified into <8 mm and  $\geq$ 8 mm. All measurements were performed with a caliper and a ruler. The ventral penile curvature was measured with a protractor to identify the degree of penile curvature and then classified into <30° and  $\geq$ 30°.

## RESULTS

A total of 183 patients with hypospadias were treated during the period. Demographics and diagnosis of the patients are described in Table I. Of total number of patients only 160 who had data regarding hypospadias type (80 syndromic and 80 non-syndromic patients). Location of urethral opening documented only in 175 patients (68.57% proximal, 31.43% distal).

**Table I: Demography and classification of hypospadias patients**

| Demography and classification | Frequency | Proportion (%) |
|-------------------------------|-----------|----------------|
| Age groups                    |           |                |
| 0 – 1 year                    | 6         | 3.27 %         |
| 1 – 3 year                    | 35        | 19.12 %        |
| 3 – 5 year                    | 33        | 17.74 %        |
| 5 – 7 year                    | 33        | 17.74 %        |
| 7 – 12 year                   | 46        | 25.13 %        |
| > 12 year                     | 30        | 16.39%         |
| Type                          |           |                |
| Isolated                      | 80        | 50 %           |
| Syndromic                     | 80        | 50 %           |
| Location of urethral opening  |           |                |
| Proximal                      | 120       | 68.57 %        |
| Distal                        | 55        | 31.43 %        |

Table II shows the penile biometric profiles of the patients. Not all variables of penile biometry were documented. The SPL and degree of penile curvature were usually documented (170 and 101 patients, respectively), whereas the glans width and the urethral plate length and width were the less documented (35, 27, and 29 patients, respectively). Based on penile biometric measurements, mean penile length was 4.49 cm (SD  $\pm$  1.29 cm). Mean glans width was 14,5 mm (SD  $\pm$  5,4 mm). Mean urethral plate length was 16,5 mm (SD  $\pm$  9,9 mm). Mean urethral plate width was 4,9 mm (SD  $\pm$  4,1 mm). Mean degree of ventral curvature was 38.5° (SD  $\pm$  19.74°).

**Table II: Penile biometry profiles**

| Profiles                    | Frequency | Mean    | Standard deviation |
|-----------------------------|-----------|---------|--------------------|
| SPL                         | 170       | 4.49 cm | 1.29               |
| Glans width                 | 35        | 14.5 mm | 5.4                |
| Urethral plate length       | 27        | 16.5 mm | 9.9                |
| Urethral plate width        | 29        | 4.9 mm  | 4.1                |
| Degree of ventral curvature | 101       | 38.5°   | 19.74              |

The proportions of penile biometry variables, such as SPL (micropenis vs. normal), glans width (<14 mm vs.  $\geq$ 14 mm), urethral plate length (<10 mm vs.  $\geq$ 10 mm), urethral plate width (<8 mm vs.  $\geq$ 8 mm), and ventral penile curvature degree (<30° vs.  $\geq$ 30°), are described in Table III. We found 52,35 % (89/170 patients) had micropenis, 51,43% (18/35 patients) had glans width <14 mm, 74,08% (20/27 patients) had urethral plate  $\geq$ 10 mm, 75,86% (22/29 patients) had urethral plate < 8 mm, and 75,25% (76/101 patients) had penile ventral curvature  $\geq$ 30°.

**Table III: Proportion of penile biometry variables**

| Penile biometry variables | Frequency | Proportion (%) |
|---------------------------|-----------|----------------|
| SPL                       |           |                |
| Micropenis                | 89        | 52,35 %        |
| Normal                    | 81        | 47,65 %        |
| Glans width               |           |                |
| <14 mm                    | 18        | 51,43 %        |
| $\geq$ 14 mm              | 17        | 48,57 %        |
| Urethral plate length     |           |                |
| <10 mm                    | 7         | 25,92 %        |
| $\geq$ 10 mm              | 20        | 74,08 %        |
| Urethral plate width      |           |                |
| <8 mm                     | 22        | 75,86 %        |
| $\geq$ 8 mm               | 7         | 24,14 %        |
| Penile curvature degree   |           |                |
| <30°                      | 25        | 24,75 %        |
| $\geq$ 30°                | 76        | 75,25 %        |

## DISCUSSION

Studies about the penile biometry of patients with hypospadias are still limited in Asia, especially in Indonesia. To the best of our knowledge, this study is the first to report complete penile biometric parameters, such as SPL, glans width, length, and width of urethral plate, and ventral penile curvature. Race and ethnicity may influence the penile biometry profiles in Indonesia relative to other studies in western countries. The results of this study can be useful for planning the surgical management and predicting the outcome of patients with hypospadias.

In this study, most patients presented at older age. The late presentation may be ascribed to socioeconomic problems, difficulties accessing the provincial referral hospital that covers a wide geographic region, and health insurance problems. Half of our patients had syndromic hypospadias with other associated genital

anomalies, and most of them had proximal urethral opening, indicating the severe type of the disease. In the study by Huang et al. (15), only 21.9% patients had severe hypospadias. Bergman et al. (16) reported 88.5% patients with isolated hypospadias and only 11.5% with syndromic hypospadias. Canon et al. (17) reported 60.7% patients with proximal urethral opening. Meanwhile, Kurahasi et al. (18) showed that proximal hypospadias is common with a proportion of 56.7%.

Most patients (52.35%) in the present study had micropenis. Wu et al. (19) reported 1.7% patients with micropenis, which is associated with proximal hypospadias. Wong et al. (5) reported 79% syndromic-type patients with micropenis. Hormonal stimulation can significantly increase penile length, increase the vascularity and thickness of the corpus spongiosum, and decrease the severity of hypospadias (20). Our institution uses testosterone enanthate 25–50 mg intramuscular for treating patients with micropenis.

In the present study, 51.43% of the patients had narrow glans width (<14 mm) with a mean value of 14.5 mm (SD  $\pm$  5.4 mm). Bush et al. (6) reported 61.5% patients with glans width <14 mm. Snodgrass et al. (7) reported 63% patients with glans width <14 mm, which is associated with glans dehiscence after hypospadias repair.

Urethral plate quality has been associated with the outcome of patients with hypospadias. Sarhan et al. (8,21) reported 50% patients with urethral plate length  $\geq$ 10 mm, which had a higher complication rate than urethral plate length <10 mm. da Silva et al. (4) reported 59% patients with urethral plate length  $\geq$ 10 mm. In the present study, 74.08% patients had long urethral plate,  $\geq$ 10 mm (mean 16.5 mm (SD  $\pm$  9.9 mm)).

Urethral plate width <8 mm has also been associated with complications, such as narrow neourethra and meatal stenosis (6,7,21). In the present study, 22 patients (75.86%) had a urethral plate width <8 mm (mean 4.9 mm (SD  $\pm$  4.1 mm)). Holland et al. (8) reported 22.9% patients with urethral plate width <8 mm, which is associated with high meatal stenosis. Meanwhile, Sarhan et al. (9) reported 48.75% patients with urethral plate width <8 mm, which caused more complications than urethral plate  $\geq$ 8 mm.

In the present study, the mean degree of ventral penile curvature was 38.5° (SD  $\pm$  19.74°). The degree of ventral penile curvature  $\geq$ 30° was measured in 75.25% patients. Snodgrass et al. reported 50% patients with ventral penile curvature  $\geq$ 30°, which is associated with a more severe type of hypospadias than ventral penile curvature <30° (22). Ventral penile curvature  $\geq$ 30° affects the selection of operation technique (23). Bandini et al. reported 78.6% patients with degree of curvature  $\geq$ 30°, which is related to complications, such as urethra-cutaneous fistula (10).

The results of penile biometry measurements in this study indicate the severity of hypospadias in our patients, which was more severe compared to other studies. Based on these findings, it is interesting for further exploration, both on basic scientific aspects, such as the genetic and environmental factors that play role in phenotypic characteristic of hypospadias in our patients, and on clinical aspects. The data are useful in planning the treatment of hypospadias such as considering surgical technique, the use of hormone therapy, etc. For patients presented with micropenis and narrow glans width, hormonal therapy before surgery can help to minimize the complication. It may be better to perform two-stage repair hypospadias in patients with poor quality of urethral plate, longer urethral plate dan narrower urethral plate. Severe ventral penile curvature  $\geq$ 30° were performed by two-stage repair. In contrast, mild ventral curvature <30° can be done by one-stage repair of hypospadias. These data are also useful for further research on the effect of penile biometry on postoperative hypospadias outcomes. Finally, the results of this study is important for counselling to the patient's parents.

A limitation of this study was that the biometric data were not documented well in some patients. In addition, our patients were from different age groups. Thus, the range of the measurement was wide. In the future, we suggest ensuring well-documented data with an improved penile biometry registry protocol for patients with hypospadias. This study was carried out in a provincial referral hospital, so that the result only describes the local population of hypospadias patients in West Java. Multi-center study can be done to better describe the penile biometry in wider population.

## CONCLUSION

Most patients in our institution had severe hypospadias, which is characterized by micropenis, narrow glans width, long and narrow urethral plate, and high degree of ventral penile curvature.

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