Original Article

A Cross-sectional Study of Stretched Penile Length in Boys from West Bengal, India

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Abstract

Introduction: Short penile length is a commonly encountered problem in clinical practice. Detection of abnormal stretched penile length (SPL) warrants appropriate endocrine evaluation. Ethnicity-specific SPL data are required to detect these abnormalities. There is a dearth of such data in India. This study aims to establish normative values of SPL in boys from West Bengal. **Materials and Methods:** This is a cross-sectional study. SPL, testicular volume (TV), height/length, and weight were measured in 460 boys aged 1 to 13 years from the schools located at urban, suburban, and rural areas in the state of West Bengal, India. Similar data were collected from 36 healthy neonates within 1–3 days of full-term delivery at IPGME and R and SSKM Hospital, Kolkata, West Bengal, India. **Results:** The 5th percentile, median, and 95th percentile of SPL were 1.7, 2.0, and 2.7 cm for neonates; 3.5, 4.4, and 6.4 cm for the children aged 1 Y–2 Y 11 M; 4.0, 5.5, and 7.0 cm for the age group 3 Y–4 Y 11 M; 4.2, 6.0, and 7.2 cm for the age group 5 Y–6 Y 11 M; 4.3, 6.0, and 7.6 cm for the age group 7 Y–8 Y 11 M; 4.4, 6.5, and 9.0 cm for the age group 9 Y–10 Y 11 M; and 4.8, 7.0, and 11.0 cm for the age group 11 Y–12 Y 11 M, respectively. SPL showed significant positive correlation with TV [$r = 0.365$, $P < 0.0005$] and height of the children [$r = 0.516$, $P < 0.0005$], but not with BMI. **Conclusion:** Our study provides normative data of SPL in neonate and children aged 1 to 13 years from the eastern part of India. SPL value correlated positively with TV and height of children.

Keywords: Micropenis, stretched penile length, testicular volume

Introduction

Stretched penile length (SPL) is an important parameter for the evaluation of gonadal and growth hormone axis in neonates, children, and adolescents. "Small" penile size is a commonly encountered complaint in pediatric, urology, and endocrinology practices. Diagnosis of micropenis and inappropriately increased SPL should prompt appropriate clinical and biochemical investigation.[1] To diagnose this condition, a population-specific age-appropriate reference range is needed as penile length can vary with ethnicity.[2-4] Available normative data from India are sparse. No such data are available from the eastern part of India. The objective of this study is to establish a reference standard for SPL in boys from West Bengal.

Materials and Methods

The study was performed as a cross-sectional study. Data of the children aged 1 to 13 years were collected from various schools located at Kolkata, a metro city, suburban towns, and rural areas in the state of West Bengal. The data of newborns were collected from apparently healthy neonates from the post-natal ward of IPGME&R and SSKM Hospital, Kolkata, West Bengal, India, within 1–3 days of full-term delivery. Children and neonates with urogenital anomalies, apparent endocrine problems, and dysmorphic features were excluded. The children with inappropriate testicular volumes (TVs) and secondary sexual characters, which could not be explained, for age were also excluded in the analysis and they were referred for further evaluation and management.

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The study was approved by the institutional ethics committee of IPGME and R and SSKM hospital.

The principal/headmaster of each school was informed regarding the study and their permission was sought. We conducted the study in the schools who agreed to participate. The school authorities informed the children and the parents accordingly. Informed consent was received from the parents who were willing to come with their children for the study. In addition, written assent was received from the children over 7 years of age.

We calculated the sample size assuming a standard deviation (SD) of SPL as 0.55 (took the middle value of SD according to Teckchandani and Bajpai[5] to make appropriate no of sample size). We used a value 0.05 as a margin of error (as used in the standard calculation) and used *Z,* value from the standard normal distribution reflecting the confidence level that will be used (e.g., $Z = 1.96$ for 95%). The formula used is $N = (Z\sigma/E)^2$. Thus, a number of 464 were obtained. Dividing it into 7 groups, we targeted an average of 65–70 children in each group. However, in the group aged 1 Y–2 Y 11 M, we were able to sample only 20 boys as school-going boys at this age were less in numbers in the school we conducted. Data from 36 neonates and 460 children were analyzed. 134, 179, and 147 (29, 39, and 32%) children were from urban, rural, and semi-urban areas, respectively. We selected the children by systematic random sampling by selecting alternate child as per school register. Those not giving consent were skipped and the boy with the next roll was examined. The children were divided according to age groups: 1 Y–2 Y 11 M [$n = 20$], 3 Y–4 Y 11 M [$n = 59$], 5 Y–6 Y 11 M [99], 7 Y–8 Y 11 M [$n = 104$], 9 Y–10 Y 11 M [$n = 108$], and 11 Y–12 Y 11 M [$n = 70$].

SPL of the children was measured in standing position maintaining appropriate privacy. Subcutaneous fat at peno-pubic junction was compressed and the penis was stretched till comfortably tolerated by the child. Stretching was done by holding the penis just behind the corona with the thumb and index of the observer. Measurements were taken from base of the penis to the tip of the glans (excluding the prepuce) with a hard plastic ruler with a graduation of 1 mm. SPL of neonates was measured in the supine position by stretching the penis gently [Figure 1]. All the measurements were taken by trained endocrinologists. The inter-observer bias was minimal. The maximum difference in measurement was 2 mm. Whenever the measurements differed, the mean value was recorded.

TVs were measured by orchidometer (1–25 ml) [Endocrine Society, USA]. In the cases of discrepancies between TVs, a higher value was taken for analysis. Weight and height of each child (length in the case of neonates) were recorded.

The statistical analyses were performed with SPSS Statistics for Mackintosh, Version 21.0. Armonk, NY: IBM Corp. Correlations were calculated using Spearman's correlation coefficient.

Results

Age-wise 5% trimmed mean, SD, median, 5th percentile, and 95th percentile of SPL are described in Table 1. The 5th percentile, median, and 95th percentile of SPL were 1.7, 2.5, and 2.7 cm for neonates; 3.5, 4.4, and 6.4 cm for the children aged 1 Y–2 Y 11 M; 4.0, 5.5, and 7.0 cm for the age group 3 Y–4 Y 11 M; 4.2, 6.0, and 7.2 cm for the age group 5 Y–6 Y 11 M; 4.3, 6.0, and 7.6 cm for the age group 7 Y–8 Y 11 M; 4.4, 6.5, and 9.0 cm for the age group 9 Y–10 Y 11 M; and 4.8, 7.0, and 11.0 cm for the age group 11 Y–12 Y 11 M, respectively. As SPL in our population was not normally distributed, we thought it was prudent to report the SPL values based on percentile cut-offs. We considered values less than 5th centile as a micropenis.

The data from children are graphically represented in Figure 2. SPL showed significant positive correlation with the TV [$r = 0.365$, $P < 0.0005$] and height of the children [$r = 0.516$, $P < 0.0005$]. Correlation of TV with SPL in children remained significant even after adjustment for age [$P < 0.0005$]. SPL did not show any significant correlation with BMI in the children.

There was no correlation of penile length with birth weight, length, or BMI in neonates.

As expected, TV increased with age throughout childhood [Figure 2]. A TV of 3 ml was achieved by most of the boys

Figure 1: Measurement of SPL in a neonate

Table 1: SPL of Neonates and children from West Bengal, India, stratified by age group

Age (*n*)	5% Trimmed Mean (SD), cm	Median, cm	5th–95th Percentile, cm
Neonates (36)	2.4 (0.4)	2.5	1.7–2.7
1 Y to 2 Y 11 M (20)	4.5 (0.8)	4.4	3.5–6.4
3 Y to 4 Y 11 M (59)	5.6 (0.8)	5.5	4.0–7.0
5 Y to 6 Y 11 M (99)	5.8 (0.9)	6.0	4.2–7.2
7 Y to 8 Y 11 M (104)	6.2 (1.0)	6.0	4.3–7.6
9 Y to 10 Y 11 M (108)	6.5 (1.2)	6.5	4.4–9.0
11 Y to 12 Y 11 M (70)	7.3 (1.8)	7.0	4.8–11

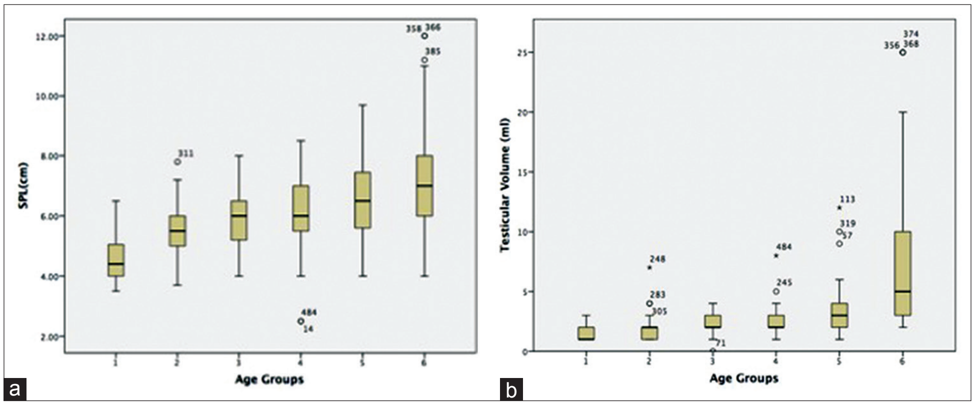

Figure 2: (a) Stretched penile length (SPL) and (b) testicular volume in children of different age groups
1: 1 Y–2 Y 11 M. 2: 3 Y–4 Y 11 M. 3: 5 Y–6 Y 11 M. 4: 7 Y–8 Y 11 M. 5: 9 Y–10 Y 11 M. 6: 11 Y–12 Y 11 M

by 7 years of age (Sensitivity 77%, Specificity 54%, AUC 0.724, $P < 0.0005$).

Discussion

Inappropriate small penile length (micropenis) in neonates and children can be an important indicator of underlying endocrine dysfunction (e.g., growth hormone deficiency, hypogonadism). Inappropriately increased penile length in prepubertal children may indicate precocious puberty. Moreover, disproportionately increased penile length in comparison to TV may point toward GnRH independent precocity.[6]

Like other anthropometric parameters, SPL varies with ethnicity. To diagnose micropenis and inappropriately increased penile length in children, population-specific normative data are required. Unfortunately, there is a dearth of such data in India. On literature search, we found two studies from India where penile length was measured in children beyond the neonatal age.[5,7] Both of the studies were from the northern parts of India.

The median SPL in neonates was 2.5 cm in our study, which was comparable with the average SPL in term neonates found by Kulkarni and Rajendran from Karnataka (2.3 cm ± 0.6 cm),[3] and Prabhu *et al*. from Chennai (2.8 ± 0.49 cm).[8] Higher average neonatal SPL value (3.57 cm) was described by Vasudevan *et al*. from Puducherry.[4] Higher neonatal SPL values were also found in studies by Feldman and Smith,[9] Flatau *et al*.,[10] and Ting and Wu[11] (3.5 ± 0.7 cm, 3.5 ± 0.4 cm, and 35.2 ± 3.9 cm, respectively). The ethnic differences between populations and difference in sample size possibly explain the differences seen in penile lengths.

There was no correlation of penile length with birth weight, length, and BMI in neonates in our study. Çamurdan *et al*. from Turkey found penile length had a strong correlation with the weight and height and a weak correlation with the BMI of the infant.[12] Ting and Wu from Malayasia found a weak positive correlation between SPL and birth weight.[11] Another study performed by Fok *et al*. in Hong Kong Chinese newborn reported a positive correlation between penile length and gestational age, height, and weight.[13] Our findings are not unexpected as penile length and fetal growth are largely regulated by independent growth factors. For instance, studies in patients with androgen insensitivity show that testosterone is a major determinant of penile length but plays a minor role in fetal weight gain.[14]

SPL increased with age throughout childhood like other studies.[5,7] SPL showed significant correlation with TV and height of the children, but not with BMI. A TV also increased with age. There are no published Indian data looking at TV in prepubertal children barring one study from Chennai evaluated TV in the children aged 8–17 years.[15]

There are several strengths in our study. A major strength is that it was conducted mostly at the community level rather than in tertiary care center exclusively. Data were collected from children with different socio-economic backgrounds, which makes this study more relevant in clinical practice. Each measurement was taken by two different observers, thereby reducing bias. One apparent weakness of our study is that it was a cross-sectional one.

Conclusion

Our study provides normative data of SPL in neonate and the children aged 1 to 13 years from the eastern part of India. Penile length in neonates in West Bengal was found to be smaller than most other countries around the world. There was no correlation of penile length with birth weight, length, and BMI in neonates. SPL values were positively correlated with TV and height of children.

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Conflicts of interest

There are no conflicts of interest.

References

1. Hatipoğlu N, Kurtoğlu S. Micropenis: Etiology, diagnosis and treatment approaches. J Clin Res Pediatr Endocrinol 2013;5:217-23.
2. Cheng PS, Chanoine JP. Should the definition of micropenis vary according to ethnicity? Horm Res 2001;55:278-81.
3. Kulkarni ML, Rajendran NK. Normal values for penile standards in newborns. Indian Pediatr 2014;28:1341-3.
4. Vasudevan G, Manivarmane, Bhat BV, Bhatia BD, Kumar S. Genital standards for south Indian male newborns. Indian J Pediatr 1995;62:593-6.
5. Teckchandani N, Bajpai M. Penile length nomogram for Asian Indian prepubertal boys. J Pediatr Urol 2014;10:352-4.
6. Styne DM, Grumbach MM. Physiology and disorders of puberty. In: Melmed S, Polonsky KS, Larsen PR, Kronenberg HM, editors. Williams Textbook of Endocrinology. 13th ed. Philadelphia: Elsevier Ltd.; 2016. p. 1074-218.
7. Bhat A, Upadhyay R, Bhat M, Sabharwal K, Singla M, Kumar V. Penile anthropometry in North Indian children. Indian J Urol 2015;31:106-10.
8. Prabhu S, Mahadevan S, Bharath R, Jagadeesh S, Kumutha J, Suresh S. Normative data for stretched penile length in term neonates born in Tamil Nadu. Indian J Endocrinol Metab 2014;18:585-6.
9. Feldman KW, Smith DW. Fetal phallic growth and penile standards for newborn male infants. J Pediatr 1975;86:395-8.
10. Flatau E, Josefsberg Z, Reisner SH, Bialik O, Laron Z. Penile size in the newborn infant. J Pediatr 1975;87:663-4.
11. Ting TH, Wu LL. Penile length of term newborn infants in multiracial Malaysia. Singapore Med J 2009;50:817-21.
12. Çamurdan AD, Öz MÖ, Ilhan MN, Çamurdan OM, Şahin F, Beyazova U. Current stretched penile length: Cross-sectional study of 1040 healthy Turkish children aged 0 to 5 years. Urology 2007;70:572-5.
13. Fok TF, Hon KL, So HK, Wong E, Ng PC, Chang A, *et al*. Normative data of penile length for term Chinese newborns. Neonatology 2005;87:242-5.
14. de Zegher F, Francois I, Boehmer ALM, Saggese G, Müller J, Hiort O, *et al*. Androgens and fetal growth. Horm Res 1998;50:243-4.
15. Boben GE, Umapathy P, Ravichandran L, Godfrey DA, Ramani G, Srinivasan V. Evaluation of testicular volume in children aged 8-17 years in south India. Indian J Child Health 2016;3:208-11.