Assessment of the stretched penile length in Sri Lankan newborns

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(Index words: stretched penile length (SPL), Neonates, Sri Lankan new-borns)

Abstract

Introduction Evaluation of the external genitalia is important in the routine neonatal examination, since abnormalities of the genitalia give clues to underlying endocrine disorders or structural malformations.

Objectives The objectives of the study were to document the stretched penile length (SPL) of healthy term neonates born following an uncomplicated delivery at a tertiary care hospital in Sri Lanka, and to establish the normative data for the SPL for Sri Lankan neonates.

Method This was a cross sectional observational study, carried out at post natal wards of the Castle Street Hospital for Women, Sri Lanka. The study was done on 369 stable newborns delivered at the gestational age of 37 to 42 weeks. A complete neonatal examination was performed by the principal investigator and the measurements of the weight, length, head circumference and stretched penile length were obtained. Mean penile length and statistically significant difference of penile length (SD) values were calculated. The correlation of mean penile length, period of gestation, birth weight and length were analysed.

Results The SPL positively correlated with the length of the baby. There is no statistically significant correlation of birth weight, head circumference and gestational age with the SPL. The mean SPL for term Sri Lankan newborns was 3.03cm ± 0.37cm and the -2SD value was 2.29cm.

Conclusion Since the -2SD of SPL was 2.29cm, measurements less than this should be considered as micropenis.

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Introduction

Evaluation of the external genitalia is very important in both boys and girls in the routine neonatal examination. There are abnormalities such as ambiguous genitalia, micropenis, undescended testes, hypospadias/epispadias, hyper pigmented genitalia which give clues to underlying endocrine abnormalities or serious structural malformations.

Development of testes in a male embryo begins around 6-7 weeks of gestation, from the genital tubercle. Differentiation of sertoli cells in an embryo commences around 6-7 weeks of gestation and Leydig cells are visualized by 11 weeks of gestation [1]. Sertoli cells begin to secrete Anti Mullerian Hormone around the 7th week of gestation and Leydig cells start secreting Testosterone around 11th to 12th weeks of gestation [1]. Placental Human Chorionic Gonadotrophin-testes axis stimulates Leydig cells from 8th to 14th weeks, while foetal Hypothalamic-Pituitary-Gonadal axis activation occurs around 15th week of gestation [1,2]. The onset of foetal penile growth which is dependent on the foetal androgen exposure, occurs at 8th to 14th weeks of gestation and a rapid growth is observed at 7mm/week from 14 weeks to term [1, 2]. Following this growth period, another period of rapid growth occurs at mini-puberty, during the first 3 months of life [2, 3]. In the foetus, growth of the penis is due to the action of testosterone and dihydrotestosterone during the second and third trimester, which is regulated by Luteinizing hormone [4].

Micropenis with undescended testes is a feature of underlying congenital hypopituitarism, which is associated with hypogonadotropic hypogonadism [2, 5]. It is also seen in syndromes such as Klinefelter, Prader Willi, Noonan [2, 5]. Ambiguous genitalia in an under virialized male with hypospadias and undescended testes may be the initial presentation of a rare form of congenital adrenal hyperplasia [5]. Micropenis or small phallus with varying degrees of hypospadias may be the only identifiable feature of a Disorder of Sex Development (DSD) in the neonate [5]. Therefore, it is very important to identify the presence of micropenis in neonatal examination to avoid delay in diagnosis of these serious, sometime life-threatening conditions.

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The normal stretched penile lengths (SPL) of new-borns vary depending on the maturity, ethnicity, and race [6- 8]. Normative data used in Caucasian populations may not be applicable to Asian populations [9, 10]. It is therefore important to establish normal values for SPL for Sri Lankan new-borns.

Method

Study group

This was a cross sectional observational study, carried out in the post-natal wards of the Castle Street Hospital for Women, Sri Lanka. The study was done on 369, stable new-borns delivered at the gestational age of 37 to 42 weeks.

Exclusion and inclusion criteria

All the term healthy new-borns delivered by healthy mothers were included. Neonates of mothers with endocrine disorders or on long term medications other than usual antenatal supplements, neonates with gross congenital malformations, sick unstable neonates, small for gestational age babies (birth weight less than 2500g), large for gestational age babies (birth weight more than 3500g) and preterm babies with gestational maturity less than 36 weeks were excluded from the study.

Method of data collection

A complete neonatal examination was performed by the principal investigator and the anthropometric measurements were obtained. Weight was measured with a digital weighing scale and length was measured with an infantometer [6]. Head circumference was measured according to standard protocols, with the standard tape, and three recordings were taken, and the highest value was documented.

Stretched penile length was measured from base of the penis from pubic symphysis to the tip of the glans. Pubic fat pad was maximally depressed when taking the measurement. Tip of the glans was identified by palpation. Measurements were taken with a wooden spatula, which was kept at right angles to the symphysis pubis and the penis was stretched gently to its maximum resistance and measurements were taken along the dorsal aspect of the penis. Two measurements were taken by the principal investigator to nearest millimetre and the mean was calculated [6,7].

Gestational maturity was calculated from the first date of last regular menstruation or by the dating scan done at 11 to 16 weeks of gestation.

Data was gathered during hospital stay following the delivery after obtaining informed, written consent.

Ethical approval to conduct the study was obtained from the ethical review committee of the Sri Lanka College of Paediatricians.

Method of data analysis

Final analysis was done by SPSS statistical software. Mean penile length and statistically significant difference of penile length (SD) values were calculated. In analysis of data mean penile length, period of gestation, birth weight and length were considered. Continuous variables were expressed as mean +/- 2 SD.

The sample size was calculated using the formula given below (Lwanga & Lemeshow, 1990) [9]

Sample size $\mathbf{n = Z^2_{(1-\alpha/2)^*} s^2/d^2}$

Z = Critical value of specified confidence level = 1.96 (95% confidence interval).

s=Estimated standard deviation of the measure being investigated (used an estimate of 0.49 cm from the Tamil Nadu study).

d = Absolute precision = 0.05cm

$N = (1.96)^2 0.49^2 / 0.05^2 =$ **369**

Results

Three hundred and sixty-nine new-borns were studied between gestational age 36 weeks to 41weeks (Table 1). The correlation analysis of SPL with anthropometric measurements (birth weight, length and OFC) and gestational age (GA) showed there is a statistically significant positive correlation only with the length (Pearson r = 0.134, p= 0.01) (Figure 1).

The mean SPL of total sample of 369 neonates was 3.03cm, with a standard deviation (SD) of 0.38cm. There were 329 new-borns who did not have any associated maternal, antenatal or neonatal complications (excluding endocrine related disorders in the mother and neonate).

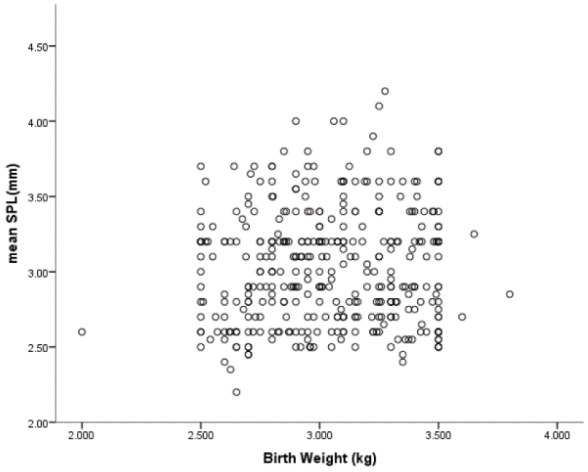
Table 2 shows the comparison of mean SFL values with current study value with recent studies conducted in different countries representing Asia, Africa and Europe. All studies shows significantly higher mean values compared with Sri Lankan mean value including South Indian study [7] other than Japan [12] which is from the same region.

Table 1. Frequency distributions of GA

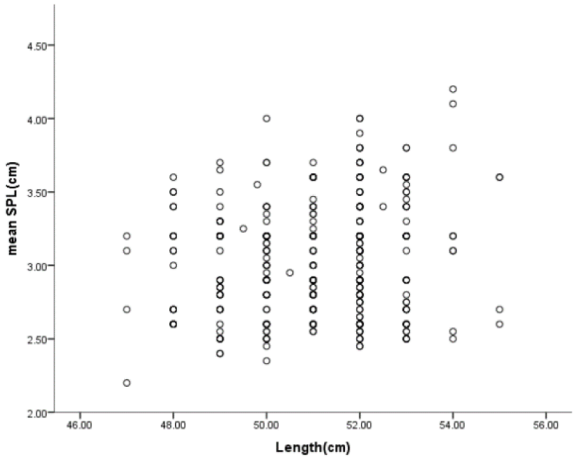
GA	*Frequency*	*Percentage*	*Cumulative Percentage*
36	1	3	3%
37	46	12.4	12.7%
38	93	25	37.9%
39	106	28.5	66.7%
40	115	30.9	97.8%
41	8	2.2	100%
Total	369	100	100%

Table 2. Comparison of mean SPL with recent studies of different regions

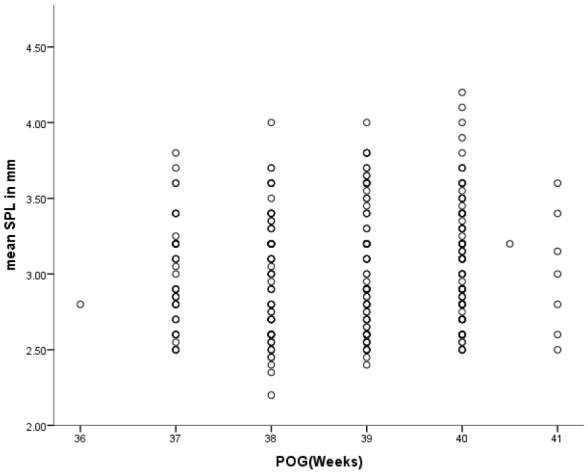
Study	*Region*	*Year*	*Mean (SD)*	*Sample size*	*T value*	*Sig. (p value)*
1. O.O. Jaret *et al*	Nigeria	2014	3.40 ± 0.48	261	-10.33	<0.001
2. S.R. Prabhu *et al*	India (Tamil Nadu)	2014	2.83 ± 0.49	346	-6.13	<0.001
3. S.B. Asafo-Agyei *et al*	Ghana (West Africa)	2014	3.30 ± 0.50	644	-9.63	<0.001
4. M.H. Mohamed *et al*	Egypt	2014	3.14 ± 0.38	180	-3.16	0.0017
5. N. Matsuo *et al*	Japan	2014	3.06 ± 0.26	547	1.25	0.211
6. A.O. Kutlu *et al*	Turkey	2010	3.77 ± 0.35	514	-29.89	<0.001
7. M. Boas *et al*	Denmark, Finland	2003	3.49 ± 0.40	728	-18.68	<0.001
8 T.H. Ting *et al*	Malaysia	2009	3.50 ± 0.40	340	-16.02	<0.001
9. W.B. Lian *et al*	Singapore	2000	3.60 ± 0.40	223	17.08	<0.001



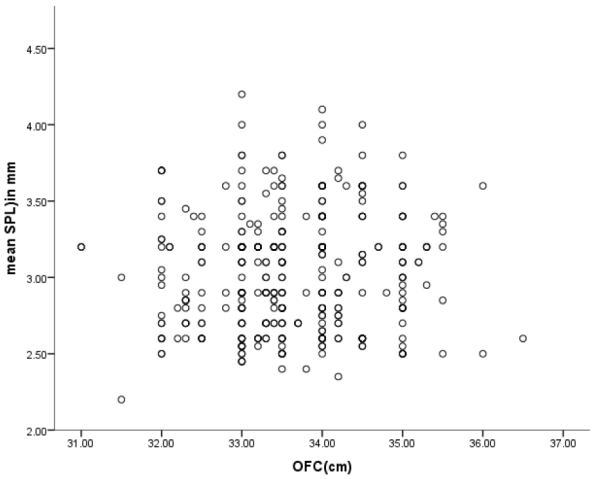
a) r =0.062, p=0.233



b) r = 0.134, p=0.010**



c) r = 0.055, p=0.290



d) r =0.069*, p=0.187

* Spearman correlation coefficient

Figure 1. **Correlation coefficients and their significance SPL with anthropometric data and gestational age.**

Discussion

Micropenis is an important parameter to identify certain endocrine disorders like pan-hypopituitarism and hypo gonadotrophic hypogonadism [5,6]. The definition of micropenis is debatable. In a term infant with normal external and internal genitalia, stretched penile length less than -2.5 SD is defined as micropenis [3,9,13]. In many recent studies, it was suggested to define micropenis as -2 SD or 3rd percentile, in the same way as the definition of short stature [3,14-16]. Measurement of penile length also varied according to room temperature, erect or flaccid penis and interpersonal measurement variability [6,17]. In this study stretched penile length was measured at room temperature (as the wards are not air-conditioned), demonstrating a relatively narrow range of variation due to the tropical climate. Two measurements of SPL were taken and the mean of the two values were taken for the analysis, while all the measurements were taken by the same investigator to avoid interpersonal measurement variability. There were 3 South Indian studies which showed a greater discrepancy in SPL of South Indian new borns as 2.31 ± 0.61 cm, 2.83 ± 0.49 cm and 3.57 ± 0.46 cm, which might be due to intra personal measurement variation and the influences of environmental factors [3, 13, 14].

According to this study, SPL of Sri Lankan neonates was 3.03 ± 0.37 cm, which is compatible with other Asian studies, such as 2.83 cm ± 0.49 cm in Tamil Nadu (7) and 3.00 ± 0.4 cm reported from China [18]. The Asian SPL measurements considered as being shorter than Caucasian and African measurements are also compatible with the findings of this study [6,12,14,18].

In our study, new-borns with Small for Gestational Age (SGA), Large for Gestational Age (LGA), Pre-maturity, congenital anomalies and maternal endocrine disorders were excluded. The correlation analysis of SPL with anthropometric measurements of birth weight, length and OFC and gestational age (GA) showed there is no statistically significant correlation with birth weight, POA and OFC. The only statistically significant positive correlation with the length (Pearson r = 0.134, p= 0.01) is compatible with established data. Fok *et al* reported statistically significant positive correlation with length and SPL, while Kutlu *et al* found statistically significant positive correlation of SPL with the length, weight and head circumference [6,18].

In conclusion, the findings from our study conform with the recent suggestions for the definition of micropenis to be a SPL below the 3rd percentile or -2SD, similar to the definition of short stature. SPL positively correlates with the length of the baby. This is the first study of the SPL of new-borns from Sri Lanka. According to this study, the mean SPL for the Sri Lankan new-born is 3.03cm ± 0.37cm, and since the -2SD measurement of SPL is 2.29cm, a length less than this value should be considered as micropenis.

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Conflict of interests

Financial and non-financial: None

Declaration

The authors declare that, this research paper was not published or not under consideration in part or as a whole in any other journal or a proceeding.

References

1. Boas M, Boisen KA, Virtanen HE, *et al*. Postnatal penile length and growth rate correlate to serum testosterone levels: a longitudinal study of 1962 normal boys. *Eur J Endocrinol* 2006; **154**(1): 125-9.
2. Bhakhri BK, Meena SS, Rawat M, Datta V. Neonatal stretched penile length: relationship with gestational maturity and anthropometric parameters at birth. *Paediatr Int Child Health* 2015; **35**(1): 53-5.
3. Bin-Abbas B, Conte FA, Grumbach MM, Kaplan SL. Congenital hypogonadotropic hypogonadism and micropenis: effect of testosterone treatment on adult penile size why sex reversal is not indicated. *J Pediatr* 1999; **134**(5): 579-83.
4. Brook's Clinical Pediatric Endocrinology, 6th Edition [Internet]. Wiley.com. Available from: https://www.wiley.com/en-us/Brook%27s+Clinical+Pediatric+Endocrinology%2C+6th+Edition-p-9781405180801
5. Lian WB, Lee WR, Ho LY. Penile Length of New-borns in Singapore. *J Pediatr Endocrinol Metab* 2011; **13**(1): 55-62.
6. Kutlu AO. Normative Data for Penile Length in Turkish New-borns. *J Clin Res Pediatr Endocrinol* 2010; **2**(3): 107-10.
7. Prabhu SR, 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**(4): 585-6.
8. Mohamed MH, Abdou RM, Hamza MT, Hussein MMS. Penile length and cord total and free testosterone in full term male Egyptian neonates. *Egypt Pediatr Assoc Gaz* 2015; **63**(2): 58-62.
9. Feldman KW, Smith DW. Fetal phallic growth and penile standards for newborn male infants. *J Pediatr* 1975; **86**(3): 395-8.

10. Lee JH, Ji YH, Lee SK, Hwang HH, Ryu DS, Kim KS, *et al.* Change in Penile Length in Children: Preliminary Study. *Korean J Urol* 2012; **53**(12): 870.

11. Lemeshow S, World Health Organization, editors. Adequacy of sample size in health studies. Chichester [England]; New York: New York, NY, USA: Published on behalf of the World Health Organization by Wiley; Distributed in the U.S.A., Canada, and Japan by Liss; 1990. 239 p.

12. Matsuo N, Ishii T, Takayama JI, Miwa M, Hasegawa T. Reference standard of penile size and prevalence of buried penis in Japanese new-born male infants. *Endocr J* 2014; **61**(9): 849-53.

13. Zbey HO, Temiz A, Salman T. A simple method for measuring penile length in new-borns and infants. *BJU Int* 1999; **84**: 1093-4.

14. Vasudevan G, Manivarmane null, Bhat BV, Bhatia BD, Kumar S. Genital standards for south Indian male newborns. *Indian J Pediatr* 1995; **62**(5): 593-6.

15. Kulkarni ML, Rajendran NK. Normal values for penile standards in new-borns. *Indian Pediatr* 1991; **28**(11): 1341-3.

16. Cheng PK, Chanoine JP. Should the definition of micropenis vary according to ethnicity? *Horm Res* 2001; **55**(6): 278-81.

17. Hatipoglu N, Kurtoglu S. Micropenis: Etiology, Diagnosis and Treatment Approaches. *J Clin Res Pediatr Endocrinol* 2013; **5**(4): 217-23.

18. Fok TF, Hon KL, So HK, *et al.* Normative Data of Penile Length for Term Chinese New-borns. *Biol Neonate* 2005; **87**(4): 242-5.