Curr Pediatr Res2021; 25 (1): 313-318 *ISSN 0971-9032*
www.currentpediatrics.com

To study of stretched penile length and testicular volume in Indian newborns.

Vipul Saneja, Amanpreet Sethi, Harshvardhan Gupta, Gurmeet Kaur Sethi, Seema Rai*, Amarpreet Kaur, Varun Kaul, Shashi Kant Dhir, Akshdeep Kaur

Baba Farid University of health sciences, Faridkot, India

Abstract

Objective: To study the Stretched Penile Length (SPL) and Testicular Volume (TV) in newborns and to analyze their correlation with various anthropometric parameters in newborns with gestational age between 32-42 completed weeks.
Study Design: Descriptive study
Settings: Tertiary care centre in Faridkot, Punjab, India.
Participants: 800 newborns were studied within 72 hours of life.
Methods: Stretched penile length was measured by Schonfeld's Method and Testicular volume was measured by using Prader's orchidometer. The weight of the baby was measured using electronic baby weighing scale with resolution of 10 g. The supine length was measured with an infantometer with a resolution of 1 mm.
Results: Mean SPL in preterm (<37 weeks) newborns in the study was 26.38 ± 4.01 mm (95% CI=26.10-26.66), while in term (>37 weeks) group it was 30.20 ± 3.30 mm (95% CI=29.98-30.43), whereas the Mean TV in preterm group was 0.64 ± 0.18 mm (95% CI=0.63-0.65) and in term group was 0.86 ± 0.16 mm (95% CI=0.84-0.87). There was a strong positive correlation of Mean SPL and Mean TV with various anthropometric parameters
Conclusion: This study is an attempt to set normative data of SPL and TV according to gestational age. We have concluded that a SPL of <22 mm in term newborns and <16 mm in preterm newborns can be considered as micropenis and mean SPL and TV correlates with anthropometric measurements.

Keywords: Stretched penile length, Testicular volume, Micropenis, Endocrinal, Gestation.

Accepted on January 04, 2021

Introduction

The clinical examination of the external genitalia is an essential part of the routine physical examination of all newborns, which is often over looked especially penile size and testicular volume which indicates normal hypothalamic pituitary hormonal balance [1]. Primary hypogonadism is suspected at birth if testis and Penile Length (PL) are abnormally small. Testicular Volume (TV) is largely a reflection of spermatogenesis with over 80% of the testicular mass consisting of seminiferous tubules with Leydig's cells making up the remaining 20% [2-6]. Since testicular size is more closely related to spermatogenic activity than Leydig cell function, TV may reflect sperm production and male fertility in the future [5,7-11]. The androgen production and genital development in the males are closely associated to TV at birth. Hence, TV assessment carries importance in deterf sexual development and disorders of pubery [12-14]. The earliest normative data for penile length were provided by Schonfeld in 2 month old infants and Feldman in term and preterm newborns [2-4].

Micropenis is defined as a normally formed penis that is at least 2.5 SD below the mean in size. Typically, the ratio of the length of penile shaft to its circumference is normal. Macropenis is defined as SPL of more than 2.5 SD [5,15,16].

Studies conducted in various populations across the world have defined different cut-offs which cannot be extrapolated to Indian newborns. [2,6,17-19] Indian studies on SPL and TV are few and from different regions of India showing different cut-offs [11,20-25]. Therefore, we need country specific and region specific data as ethnicity affects SPL. Hence, we conducted the study to assess SPL and TV in male newborns of our region.

This bicentric study was conducted on male neonates having gestational age of 32 completed weeks to 42 completed weeks, admitted at Guru Gobind Singh Medical College and Hospital (GGSMCH), Faridkot and Civil Hospital, Faridkot over a period of one year from March 2017 till February 2018. People from both rural and urban areas do come to these two main medical centers of the district. Parents or guardian giving consent for the study, uncomplicated pregnancy in mother.

Exclusion criteria was neonates born with genital malformations *viz.* ambiguous genitalia, hypospadias, epispadias, chordee, Unilateral or bilateral undescended testis, Unilateral or bilateral hydrocele, Neonates with dysmorphic features, Major congenital malformations, Maternal drug intake during pregnancy *viz.* synthetic androgens (e.g. Danazol), antiseizure medication (e.g. phenytoin, trimethadione), antiandrogens (e.g. finasteride, spironolactone), estrogens, or progestins, Small for gestational age neonates, Large for

gestational age neonates, Multifetal gestation, Suspected endocrinological disorder in neonate, Sick and admitted to Neonatal Intensive Care Unit, Neonates born to mothers belonging to states other than Punjab

The gestational age was calculated by an early dating ultrasound performed before 20 weeks of gestation, when available. The gestation of each neonate was assessed postnatally within first 24 hours of life, using the New Ballard Score. [16] All measurements were taken after 24 hours. Stretched penile length was measured by Schonfeld's Method [26]. Two readings of stretched penile length were taken and the mean of both was taken to minimize error, the length measured by using a straight edged 15 cm transparent plastic ruler graduated in mm. In this method, with the baby in supine position, the penis was gently stretched to the point of increased resistance and the length measured by using a straight edged 15 cm transparent plastic ruler graduated in mm with the least count of 1 mm; placed alongside the penis, and pressed onto the pubic bone. The SPL was measured from tip of glans penis (excluding the foreskin) to the pubic ramus in flaccid state avoiding erection. The tip of the glans penis was located by palpation. If a reading was found to be between two consecutive millimeter marks, 0.5 mm was added to the lower mm mark to ensure uniformity.

. Testicular volume was measured by principal investigator using Prader's orchidometer with 12 ellipsoid models ranging in volume from 1 ml to 25 ml, Since, the orchidometer had a minimum reading of 1 ml, therefore for measuring smaller volumes plasticine ellipsoid models resembling Prader's orchidometer beads were used [11]. The improvised beads, ranging in volume from 0.2 ml to 0.9 ml, in consecutive increments of 0.1 ml were crafted using water displacement method. Both the left and right testis were measured, testis size that was in-between the two standard ellipsoid volumes was taken as the mean between the larger and the smaller ellipsoidal sizes [11].

The weight of the baby was measured using electronic baby weighing scale with resolution of 10 gram. The Ethical clearance was taken from ethical committee of Guru Gobind Singh Medical College and Hospital.

The data pertaining to socio demographic and clinical details were entered in the form of data matrix in Microsoft® Excel and analyzed using IBM® SPSS® V.20.0.0.

This bicentric study was conducted on male neonates having gestational age of 32 completed weeks to 42 completed weeks, admitted at Guru Gobind Singh Medical College and Hospital (GGSMCH), Faridkot and Civil Hospital, Faridkot over a period of one year from March 2017 till February 2018. People from both rural and urban areas do come to these two main medical centers of the district. Parents or guardian giving consent for the study, uncomplicated pregnancy in mother.

Exclusion criteria was neonates born with genital malformations *viz.* ambiguous genitalia, hypospadias, epispadias, chordee, Unilateral or bilateral undescended testis, Unilateral or bilateral hydrocele, Neonates with dysmorphic features, Major congenital malformations, Maternal drug intake during pregnancy *viz.* synthetic androgens (e.g. Danazol), antiseizure medication (e.g. phenytoin, trimethadione), antiandrogens (e.g. finasteride, spironolactone), estrogens, or progestins, Small for gestational age neonates, Large for gestational age neonates, Multifetal gestation, Suspected endocrinological disorder in neonate, Sick and admitted to Neonatal Intensive Care Unit, Neonates born to mothers belonging to states other than Punjab

The gestational age was calculated by an early dating ultrasound performed before 20 weeks of gestation, when available. The gestation of each neonate was assessed postnatally within first 24 hours of life, using the New Ballard Score [16]. All measurements were taken after 24 hours. Stretched penile length was measured by Schonfeld's Method [26-29]. Two readings of stretched penile length were taken and the mean of both was taken to minimize error, the length measured by using a straight edged 15 cm transparent plastic ruler graduated in mm. In this method, with the baby in supine position, the penis was gently stretched to the point of increased resistance and the length measured by using a straight edged 15 cm transparent plastic ruler graduated in mm with the least count of 1 mm; placed alongside the penis, and pressed onto the pubic bone. The SPL was measured from tip of glans penis (excluding the foreskin) to the pubic ramus in flaccid state avoiding erection. The tip of the glans penis was located by palpation. If a reading was found to be between two consecutive millimeter marks, 0.5 mm was added to the lower mm mark to ensure uniformity.

Testicular volume was measured by principal investigator using Prader's orchidometer with 12 ellipsoid models ranging in volume from 1 ml to 25 ml, since the orchidometer had a minimum reading of 1 ml, therefore for measuring smaller volumes plasticine ellipsoid models resembling Prader's orchidometer beads were used [11]. The improvised beads, ranging in volume from 0.2 ml to 0.9 ml, in consecutive increments of 0.1 ml were crafted using water displacement method. Both the left and right testis were measured, testis size that was in-between the two standard ellipsoid volumes was taken as the mean between the larger and the smaller ellipsoidal sizes [11]. The weight of the baby was measured using electronic baby weighing scale with resolution of 10 g. The Ethical clearance was taken from ethical committee of Guru Gobind Singh Medical College and Hospital.

The data pertaining to socio demographic and clinical details were entered in the form of data matrix in Microsoft® Excel and analyzed using IBM® SPSS® V.20.0.0.

Statistical analysis

The data pertaining to socio demographic and clinical details were entered in the form of data matrix in Microsoft® Excel® and analyzed using IBM® SPSS® V.20.0.0. The descriptive statistics for categorical variables were represented in the form of frequencies and percentages and as means and standard deviations for continuous variables. The association between categorical variables was explored using Pearson's Chi square

test or Fishers's Exact test wherever appropriate. The difference of continuous variables across two groups was analyzed using Independent sample t test and non-normally distributed data using Mann Whitney U test depending upon the data meeting the assumptions for the applications of these tests. The p value of <0.05 was considered statistically significant for the purpose of this study.

Results

Purposive (Non probability) sampling technique was used and out of 976 male neonates screened, 177 were excluded. Out of the total 800 newborns, there were 391(48.88%) preterm and 409 (51.12%) term newborns.

In the study population, 67.12% were Sikhs, 32.25% were Hindus and only 0.63% were Christians. Out of 800 neonates, majority *i.e.* 414 (51.75%) were born by Normal Vaginal Delivery (NVD), 361 (45.12%) by Lower Segment Caesarian Section (LSCS) and only 25 (3.13%) by Assisted Vaginal Delivery (AVD).

Table 1 shows the baseline characteristics of newborns and their Mean ± SD. The Mean ± SD of maternal age was 24.94 ± 3.60 years; gestational age was 36.48 ± 1.90 weeks; birth weight was 2607.60 ± 380.89 grams; crown heel length was 48.64 ± 1.38 cm; head circumference was 33.57 ± 0.94 cm; mid-arm circumference was 8.49 ± 0.47 cm and chest circumference was 31.49 ± 1.02 cm. Table 2 shows Mean Stretched Penile Length and Testicular Volume in Preterm (<37 weeks) and Term (≥ 37 weeks) newborns of the present study. The Mean ± SD of SPL in Preterm group was 26.38 ± 4.01 mm (95% CI=26.10-26.66), while in Term group it was 30.20 ± 3.30 mm (95% CI=29.98-30.43), whereas the Mean TV in Preterm group was 0.64 ± 0.18 mm (95% CI=0.63-0.65) and in Term group was 0.86 ± 0.16 mm (95% CI=0.84-0.87). Thus on calculation the -2.5 SD. cut off from Micropenis was 16 mm in the Preterm group and 22 mm in the Term group.

Parameter	Mean ± Standard Deviation (Mean ± SD)
Maternal age (years)	24.94 ± 3.60
Gestational age(weeks)	36.48 ± 1.90
Birth weight (gm)	2607.60 ± 380.89
Crown heel length (cm)	48.64 ± 1.38
Head circumference (cm)	33.57 ± 0.94
Mid-arm circumference (cm)	8.49 ± 0.47
Chest circumference (cm)	31.49 ± 1.02

Table 1. Baseline characteristics of newborns.

Parameters	Preterm (N=391) Mean ± SD	95% CI of Mean	Term (N=409) Mean ± SD	95% CI of Mean
Stretched Penile Length (cm)	26.38 ± 4.01	26.10-26.66	30.20 ± 3.30	29.98-30.43
Mean testicular volume (ml)	0.64 ± 0.18	0.63-0.65	0.86 ± 0.16	0.84-0.87

Table 2. Mean Stretched Penile Length and Testicular Volume in preterm (<37 weeks) and term (≥ 37 weeks) newborns.

Anthropometric parameters	Mean Stretched Penile Length (mm)	
	Correlation coefficient	P-value
Birth weight (gm)	0.747	<0.001
Head circumference (cm)	0.656	<0.001
Mid-arm circumference (cm)	0.772	<0.001
Crown heel length (cm)	0.701	<0.001
Chest circumference (cm)	0.697	<0.001
Mean testicular volume (ml)	0.768	<0.001

Table 3. Correlation of Mean SPL with various anthropometric parameters.

Anthropometric Parameters	Mean Testicular Volume (ml)	
	Correlation coefficient	P- value
Birth weight (gm)	0.806	<0.001
Head circumference (cm)	0.749	<0.001
Mid-arm circumference (cm)	0.744	<0.001
Crown heel length (cm)	0.742	<0.001
Chest circumference (cm)	0.710	<0.001

Table 4. Correlation of Mean Testicular Volume with Anthropometric Parameters.

Figure 1 depicts a scatter diagram showing the correlation between Mean SPL and gestational age. A moderate but significant positive correlation between the two variables was observed(r=0.521, p<0.001, R2 Linear=0.315). Regression equation between two variables was calculated as y=-1.68+0.12x (y=Mean SPL (cm); x= Gestational age (weeks)

Figure 2 depicts a scatter diagram showing the correlation between Mean TV and gestational age. A moderately significant positive correlation between the two variables was observed(r=0.521, p<0.001, R2 Linear =0.345). Regression equation between two variables was calculated as y=-1.55+0.06x (y=Mean TV (ml); x=Gestational age (weeks). Table 3 shows that there was a strong positive correlation of Mean SPL with various anthropometric parameters *viz.* Birth weight (r=0.747, p<0.001); Head circumference (r=0.656, p<0.001); Mid-arm circumference (r=0.772, p<0.001); Crown heel length (r= 0.701, p<0.001); Chest circumference (r=0.697,

p<0.001) and Mean testicular volume (r=0.768, p<0.001). Table 4 shows that there was a strong positive correlation of Mean TV with various anthropometric parameters *viz.* Birth weight (r=0.806, p<0.001); Head circumference (r=0.749, p<0.001); Mid-arm circumference (r=0.744, p<0.001); Crown heel length (r= 0.742, p<0.001) and Chest circumference (r=0.710, p<0.001).

Purposive (Non probability) sampling technique was used and out of 976 male neonates screened, 177 were excluded. Out of the total 800 newborns, there were 391(48.88%) preterm and 409 (51.12%) term newborns.

In the study population, 67.12% were Sikhs, 32.25% were Hindus and only 0.63% were Christians. Out of 800 neonates, majority *i.e.* 414(51.75%) were born by Normal Vaginal Delivery (NVD), 361(45.12%) by Lower Segment Caesarian Section (LSCS) and only 25(3.13%) by Assisted Vaginal Delivery (AVD).

Table 1 shows the baseline characteristics of newborns and their Mean ± SD. The Mean ± SD of maternal age was 24.94 ± 3.60 years; gestational age was 36.48 ± 1.90 weeks; birth weight was 2607.60 ± 380.89 g; crown heel length was 48.64 ± 1.38 cm; head circumference was 33.57 ± 0.94 cm; mid-arm circumference was 8.49 ± 0.47 cm and chest circumference was 31.49 ± 1.02 cm. Table 2 shows Mean Stretched Penile Length and Testicular Volume in Preterm (<37 weeks) and Term (≥ 37 weeks) newborns of the present study. The Mean ± SD of SPL in Preterm group was 26.38 ± 4.01 mm (95% CI=26.10-26.66), while in Term group it was 30.20 ± 3.30 mm (95% CI=29.98-30.43), whereas the Mean TV in Preterm group was 0.64 ± 0.18 mm (95% CI=0.63-0.65) and in Term group was 0.86 ± 0.16 mm (95% CI=0.84-0.87). Thus on calculation the -2.5 SD. cut off from Micropenis was 16 mm in the Preterm group and 22 mm in the Term group.

Figure 1 depicts a scatter diagram showing the correlation between Mean SPL and gestational age. A moderate but significant positive correlation between the two variables was observed(r=0.521, p<0.001, R2 Linear=0.315). Regression equation between two variables was calculated as y = -1.68+0.12x (y=Mean SPL (cm); x=Gestational age (weeks)

Figure 2 depicts a scatter diagram showing the correlation between Mean TV and gestational age. A moderately significant positive correlation between the two variables was observed(r=0.521, p<0.001, R2 Linear=0.345). Regression equation between two variables was calculated as

y=-1.55+0.06x (y=Mean TV (ml); x=Gestational age (weeks). Table 3 shows that there was a strong positive correlation of Mean SPL with various anthropometric parameters *viz.* Birth weight (r=0.747, p<0.001); Head circumference (r=0.656, p<0.001); Mid-arm circumference (r=0.772, p<0.001); Crown heel length (r=0.701, p<0.001); Chest circumference (r=0.697, p<0.001) and Mean testicular volume (r=0.768, p<0.001). Table 4 shows that there was a strong positive correlation of Mean TV with various anthropometric parameters *viz.* Birth weight (r=0.806, p<0.001); Head circumference (r=0.749, p<0.001); Mid-arm circumference (r=0.744, p<0.001); Crown heel length (r=0.742, p<0.001) and Chest circumference (r=0.710, p<0.001).

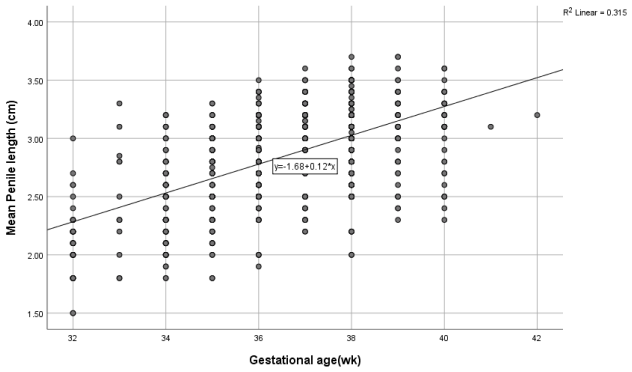

Figure 1. Scatter diagram showing the correlation of mean SPL with gestational age.

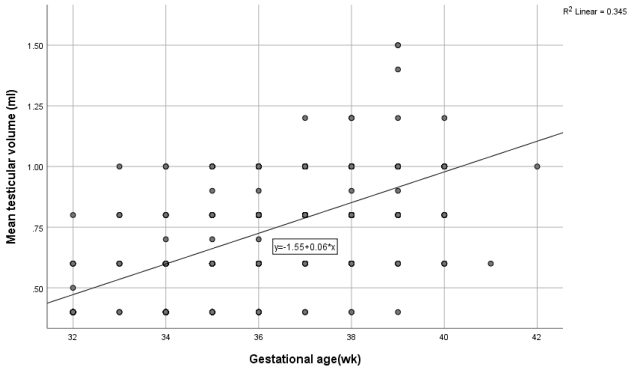

Figure 2. Scatter diagram showing correlation of mean TV with Gestational Age.

Discussion

Various studies have shown wide variation in length of penis and testicular volume with race and ethnicity making it essential to establish standard values of penile sizes in normal healthy neonates in each country and in its different regions [2,20,21,30]. This study is an attempt to obtain normative data for SPL in neonates born in South-western region of Punjab and to establish cut-offs for micropenis.

In this study we determined the mean SPL and TV for preterms and term newborns as volume of testes is indirect indicator of spermatogenesis and abnormal values can depict that normal testicular function has not been established.

The mean SPL in the term newborns was found to be 30.2 ± 3.30 whereas Prabhu et al. [24] reported a mean SPL of 28.3 (± 4 mm) in 346 term newborns of Tamil Nadu, India which was smaller than our results. A study from Karnataka region observed a mean SPL of 23.1 ± 6.1 mm [20]. A study from Kolkata, India by Mondal et al. (n=365) has reported a mean SPL of 35 ± (4.2 mm). The mean SPL of the preterm (n=391) newborns recorded in the present study was 26.38 mm (± 4.03). Very few studies have been done on SPL of preterm newborns as compared to term newborns. The results of our study are in concordance with the results obtained by Bhakhri et al.[23], who reported mean SPL of 249 preterm neonates in

the 32 to 36 weeks gestational group to be 26.2 (± 5.4) mm while our results were greater than those reported by Soheilipour et al. In their study the mean SPL was 20.66 (± 2.5) mm in 389 preterm neonates from Iran [31]. These differences can be due to interregional variations as in north Indian the population is mostly Aryan descendent and south Indian population Dravidarian descendent in Indian context and racial and geographic variation in population outside India [5]. Authors cannot firmly rule out that differences might be due to measurement error. In the present study, mean TV in term and preterm was 0.86 ± 0.16 and 0.64 ± 0.18, We found larger TV values of our cohort as compared to study conducted in Kolkata by Mondal et al, who reported 0.6 (± 0.2) ml in there cohort (N=480) [11]. In contrast, few studies have found greater mean TV than our study. These differences can be due lack sensitivity and precision with the use of prader's orchiodemeter. It has also been seen that accuracy of using orchidometer is questable as it measures epidydmis and scrotal skin so patients who have small testes will be wrongly measured as normal [32]. We also correlated the mean SPL with mean TV of the whole cohort and observed that there was a strongly significant positive correlation between the two ($r=0.768$, $p<0.001$). Our results were in concordance with the results obtained by Sutan et al from Indonesia [33] who also reported a significant correlation between mean SPL and mean TV ($r=0.218$, $p<0.001$). Similarly a moderately positive correlation ($r=0.412$, $p<0.001$) was also reported by Mondal et al. from Kolkata, India [11].

In the present study we correlated mean SPL and TV with various anthropometric parameters and found a strongly positive correlation of mean SPL and TV with various anthropometric parameters, similar positive correlation were shown by another study conducted by Ting et al in multiracial newborns in Malaysia [18], between SPL and birth weight in Malaysian infants (r 0.20, $p=0.005$), but not in the other two ethnic groups ($r=0.086$, $p=0.330$ for Chinese, $r=-0.109$, $p=0.688$ for Indians). A Study conducted by Ogundoyin et al. [30] in Nigerian newborns also showed a significant correlation between birth weight and TV ($r=0.146$, $p<0.003$)

The strength of our study is that we took a large sample size and measurements were done by single observer to prevent bias and measurements were taken as accurately as possible. Our limitations are that to make nomogram more precise we need different districts of a state as this is done only in two centers of a district so we need more studies in future taking whole samples from each district. There are various studies comparing different formula for measuring testicular volume like we used ellipsoid orchidometere but lambert's formula has been proven to be most acciurate [34].

From the present study we have derived cut-offs for defining micropenis in our population using the definition of micropenis as SPL<2.5 SD. In the term group this cut-off is 22 mm and in preterm group it is 16 mm. Any SPL less than this value need detailed endocrinological evaluation and there is coorelation of mean SPL and TV with anthropometric measurements.

Conclusions

This study is an attempt to define norms of SPL and TV according to gestational age. We have calculated the means of SPL and TV from 32-40 weeks and found a strongly significant positive correlation between the two variables.

We have concluded that a SPL of <22 mm in term newborns and <16 mm in preterm newborns should be considered as micropenis and the newborn be fully evaluated for any endocrinal/ chromosomal/ testicular disorders.

Acknowledgements

We are grateful to the Can Tho Psychiatric Hospital and Can Tho Children's Hospital for creating appropriate conditions for the study to be conducted. Especially, we would like to thank the children and their parents who participated in the study.

References

1. Soheilipour F, Rohani F, Dehkordi EH, et al. The nomogram of penile length and circumference in iranian term and preterm neonates. Front Endocrinol 2018; 9: 126.
2. Takihara H, Cosentino MJ, Sakatoku J, et al. Significance of testicular size measurement in andrology: II. Correlation of testicular size with testicular function. J Urol 1987; 137: 416-9.
3. Lenz S, Giwercman A, Elsborg A, et al. Ultrasonic testicular texture and size in 444 men from the general population: Correlation to semen quality. Eur Urol 1993; 24: 231-8.
4. Arai T, Kitahara S, Horiuchi S, et al. Relationship of testicular volume to semen profiles and serum hormone concentrations in infertile Japanese males. Int J FertilWomens Med 1998; 43: 40-7.
5. Mondal R, Ray S, Chatterjee K, et al. Penile Length and Testicular Volume in Newborns. Indian J Pediatr 2016; 83: 1398-1404.
6. Feldman KW, Smith DW. Fetal phallic growth and penile standards for newborn male infants. J Pediatr 1975; 86: 395–8.
7. Cheng PK, Chanoine JP. Should the definition of micropenis vary according to ethnicity? Horm Res 2001; 55: 278–81.
8. Kallmann FJ, Schoenfeld WA, Barera SE. The genetic aspects of primary eunuchoidism. Am J Ment Defic 1944; 48: 203–36.
9. Nelson. Textbook of pediatrics. Volume 3. Kliegman, Stanton, St Geme, Schor. India, Elsevier, 2016.
10. Stoll BJ, Kliegman RM. The newborn infant. In: Behrman RE, Kliegman MD, Hal BJ, editors. Nelson Text Book of Pediatrics. 17th ed. Philadelphia: Saunders, Elsevier 2004; 523-4.
11. Lenz S, Giwercman A, Elsborg A, et al. Ultrasonic testicular texture and size in 444 men from the general population: Correlation to semen quality. Eur Urol 1993; 24: 231-8.

12. Arai T, Kitahara S, Horiuchi S, et al. Relationship of testicular volume to semen profiles and serum hormone concentrations in infertile Japanese males. Int J FertilWomens Med 1998; 43: 40-7.
13. Mondal R, Ray S, Chatterjee K, et al. Penile Length and Testicular Volume in Newborns. Indian J Pediatr 2016; 83: 1398-1404.
14. Sharpe RM. Perinatal determinants of adult testis size and function. J Clin Endocrinol Metab 2006; 91: 2503-5.
15. Main KM, Toppari J, Suomi AM, et al. Larger testes and higher inhibin B levels in Finnish than in Danish newborn boys. J Clin Endocrinol Metab 2006; 91: 2732-7.
16. Low LC, Wang C. Disorders of sexual development in the Paediatric and adolescent male. In: Lavin N, editor. Manual of Endocrinology and Metabolism. 4th ed. New Delhi: Lippincott Williams and Wilkins; 2009.
17. Fok TF, Hon KL, So HK, et al. Hong Kong Neonatal Measurements Working Group. Normative data of penile length for term Chinese newborns. Biol Neonate. 2005; 87: 242–245.
18. Ballard JL, Khoury JC, Wedig K, et al. New Ballard Score, expanded to include extremely premature infants. J Pediatr 1991; 119: 417-23.
19. Kutlu AO. Normative data for penile length in Turkish newborns. J Clin Res Pediatr Endocrinol 2010; 2: 107-10.
20. Ting TH, Wu LL. Penile length of term newborn infants in multiracial Malaysia. Singapore Med J 2009; 50: 817–821.
21. Kulkarni ML, Rajendran NK. Normal values for penile standards in newborns. Indian J Pediatr 1991; 28: 1341–3
22. Vasudevan G, Manivarmane, Bhat BV, et al. Genital standards for south Indian male newborns. Indian J Pediatr 1995; 62: 593-6.
23. Tuladhar R, Davis PG, Batch J, et al. Establishment of a normal range of penile length in preterm infants. J Paediatr Child Health 1998; 34: 471-3.
24. Bhakhri BK, Meena SS, Rawat M, et al. Neonatal stretched penile length: relationship with gestational maturity and anthropometric parameters at birth. Paediatr Int Child Health 2015; 35: 53-5.
25. Prabhu SR, Mahadevan S, Bharath R, et al. Normative data for stretched penile length in term neonates born in Tamil Nadu. Indian J Endocr Metab 2014; 18: 585-6.
26. Jirasek JE. Development of the genital system and male pseudohermaphroditism, Baltimore, 1971, Johns Hopkins Press, 28.
27. Reyes FK, Boroditsky RS, Winter JSD, et al. Studies on human sexual development. ii. fetal and maternal serum gonadotropin and sex steroid concentrations. J Clinic Endocrin Metabol 1974; 4: 612–7.
28. Schonfeld WA, Beebe GW. Normal growth and variation in the male genitalia from birth to maturity. J Urol 1942; 48: 759–77.
29. Soheilipour F, Rohani R, Dehkordi EH, et al. The Nomogram of Penile Length and Circumference in Iranian Term and Preterm Neonates Front Endocrinol (Lausanne). 2018; 9: 126.
30. Sutan-Assin M, Rukman J, Dahlan A. Penile dimensions of newborn infants. Paediatr Indones 1988; 29:146–50.
31. Chikani U N, Ibekwe M U, Chinawa J M, et al. Testicular volume of healthy term neonates: Determination of normative values among Igbo babies in South-Eastern Nigeria. Niger J ClinPract 2016; 19: 85-90
32. Ogundoyin OO, Ogunlana DI, Lawal TA, et al. Measurement of testicular volume in healthy nigerian newborns at ibadan, nigeria using the prader Orchidometer. Journal of the West African College of Surgeons 2016; 6: 39-48.
33. Kuijper EA, van Kooten J, Verbeke JI, et al. Ultrasonographically measured testicular volumes in 0- to 6-year-old boys. Hum Reprod 2008; 23: 792-6.14.
34. Bhat S, Sathyanarayan Prasad M, Giridhar A, et al. Testicular volume measurement: Comparison of prader's orchidometry,ultrasonography and actual volume by water displacement. J Integr Nephrol Androl 2016; 3: 92-5.

*Correspondence to

Seema Rai,

Department of Pediatrics

Can Tho University of Medicine and Pharmacy

Guru Gobind Singh Medical College

Faridkot, India

Tel: +9655565893

E-mail: nthang@ctump.edu.vns