One-year follow-up of penis and testis sizes of healthy Turkish male newborns

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Penile length, penile diameter and testicular volume at birth reflect the activity and normality of the hypothalamus-pituitary-testicular axis. In this prospective longitudinal study, we aimed to measure penis and testicular size in healthy newborns at birth and 6 and 12 months of age.

Seven hundred forty-six term healthy male newborns were enrolled in the study. According to measurements taken within 48 hours after birth, mean penile length (MPL) was 2.81±0.32 cm, mean penile diameter (MPD) 1.04±0.09 cm, right testicular volume (TV) 1.73±0.45 ml, and left TV 1.64±0.48 ml. At 6 months of age, MPL was 3.67±0.35 cm, MPD 1.23±0.08 cm, right TV 2.07±0.31 ml, and left TV 2.00±0.27 ml. At 12 months of age, MPL was 4.47±0.43 cm, MPD 1.25±0.09 cm, right TV 2.01±0.12 ml, and left TV 2.01±0.13 ml. There was a weak albeit statistically significant correlation between weight, length and PL at birth.

In conclusion, the MPL of newborns was shorter than that reported in the published data from other populations. This situation may be related to ethnicity in addition to the lower birth weight and length of our subjects when compared to the newborns in other populations.

We observed a significant increase, more marked during the first six months, in MPL, MPD and TV, which can be explained by the hormonal mechanism during minipuberty.

Key words: penile length, penile diameter, testicular volume, newborn males, micropenis.

Evaluation of the external genitalia is an important part of the neonatal physical examination in newborn males. The genital examination is essential to alert clinicians of some possible potentially life-threatening abnormalities, which can be diagnosed and treated by initiating early investigations. For the parents of a newborn child, ambiguous genitalia, micropenis or malformed undescended testes are a matter of great concern. In addition, the growing child may suffer psychosocial trauma from genital inadequacy. Micropenis is defined as a penile length (PL) of < -2.5 standard deviation (SD) in the absence of hypospadias[1]. Likewise, a PL of > +2.5 SD is considered macropenis (1,2). To identify any abnormality, the normal variations for each measurement in a newborn must be known. Previous studies showed racial differences in PL[2-5]. The mechanisms underlying these differences are unknown but could be due to genetic factors and/or to nutritional modulation of genetic factors[5]. Therefore, it is important to obtain normative data for PL and testicular size according to ethnic origin. This study aimed to establish the norms in PL and testicular volume (TV) in term newborn infants in a Turkish population. In this prospective longitudinal study, we measured PL, penile diameter (PD) and TV at birth and at 6 and 12 months of age. We also evaluated the association between PL and anthropometric measures such as body weight and length.

Material and Methods

This was a longitudinal and prospective study in 746 term male newborn infants

delivered at five different hospital centers in Denizli, Turkey, over a 15-month period from September 2008 to December 2009. All male term newborn infants with a completed gestation of 37-42 weeks were eligible for the study. This study was approved by the Ethics Committee of Pamukkale University Medical School and Denizli Directorship of Health. Written informed consent was obtained from the parents. Exclusion criteria were infants with ambiguous genitalia, hypospadias, undescended testis, hydrocele, dysmorphism, and multiple congenital abnormalities. The antenatal history and the condition of each infant were carefully evaluated. A data sheet was used to document the maternal and paternal demographic data as well as the medical and pregnancy history of the mothers.

To validate the accuracy of the examination, measurements of PL, PD, and TV in 50 newborn infants were done by two observers. One of the observers was a pediatric endocrinologist. Inter-observer differences were tested using kappa analysis. Kappa statistics were 0.92 for PL, 0.94 for PD, 0.83 for right TV, and 0.87 for left TV.

All subjects were examined by the same trained examiner longitudinally at birth (within the first 48 hours) and at 6 and 12 months of age. Length, body weight, PL, PD, and each TV were measured in all subjects. Examinations were carried out in warm conditions with the child supine. PL was measured using Schonfeld's method[6] from the pubic ramus to the tip of the glans penis by placing the end of a straight-edge ruler against the pubic ramus and applying traction along the length of the penis to increased resistance. Three measurements were taken to the nearest millimeter from each infant to minimize errors, and the mean was calculated. None of the newborns was circumcised. TV was measured by the same examiner with 12 solid ellipsoid models constituting the Prader orchidometer, ranging in volume from 1 ml to 25 ml[7]. Their recumbent length was measured with a portable infant-meter and body weight on a digital scale (Seca, Germany).

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) for Windows version 13.0 was used for analyses. Data were used to calculate means, SDs, median, ranges, and percentiles of ages for PL, PD and TV. The correlation between weight and length of subjects and PL was determined by Pearson analysis. A p-value of <0.05 was regarded as significant.

Results

Seven hundred and forty-six full-term healthy male newborns were enrolled in the study. At follow-up, the study was undertaken with 370 and 254 subjects at 6 and 12 months, respectively. Means, SDs and ranges for length and body weight according to age are given in Table I.

According to measurements within 48 hours after birth, mean penile length (MPL) was 2.81±0.32 cm, mean penile diameter (MPD) 1.04±0.09 cm, right TV 1.73±0.45 ml, and left TV 1.64±0.48 ml. At 6 months of age, MPL was 3.67±0.35 cm, MPD 1.23±0.08 cm, right TV 2.07±0.31 ml, and left TV 2.00±0.27 ml. At 12 months of age, MPL was 4.47±0.43 cm, MPD 1.25±0.09 cm, right TV 2.01±0.12 ml, and left TV 2.01±0.13 ml. Means, SDs and ranges and percentiles for PL according to age are given in Tables II and III. Means, SDs and ranges according to age for PD are given in Table IV and for TV are given in Table V.

There was a weak albeit statistically significant correlation between weight (r: 0.110, p: 0.003), length (r: 0.179, p: 0.001) and PL at birth, as shown in Figures 1 and 2. PL at 6 months

Table I. Mean, SD, Minimum and Maximum Values for Length and Body Weight at Birth and 6 and 12 Months

		Weight (g)		Length (cm)	
Age	No. of subjects	Mean ± SD	Min-Max	Mean ± SD	Min-Max
0-48 hours	746	3351.81±356.97	2500-4090	49.95±1.37	45-55
6 months	370	8201.24±881.93	6070-10520	69.27±1.74	63-74
12 months	254	9822.87±1010.16	7310-14500	76.17±2.00	69-83

SD: Standard deviation.

Table II. Mean, SD, Minimum and Maximum Values for Penile Length at Birth and 6 and 12 Months

		Penile length (cm)	
Age	No. of subjects	Mean ± SD	Min-Max
0-48 hours	746	2.81±0.32	2.0-3.8
6 months	370	3.67±0.35	2.7-5.0
12 months	254 4.47±0.43	3.4-5.7	

SD: Standard deviation.

was significantly correlated to body length (r: 0.133, p: 0.011). PL was not correlated to weight at 6 months (p: 0.126, r: -0.080). At 12 months, PL was not correlated to weight or height (r: 0.021, p: 0.736; r: 0.088, p: 0.163, respectively).

Discussion

Our results show that there are differences in the mean PL in full-term Turkish newborn males when compared with that reported in the normative data in the published literature. The studies performed on PL in the newborn period in different populations have revealed different normal values, from 2.86 to 3.75 cm[2-10]. In our study, the PL for term newborns was 2.81±0.32 cm. The results from Schonfeld and Beebe[6], Feldman and Smith[2], and Flatau et al.[3], which have been accepted as the standard for PL in term neonates, were 3.75 cm, 3.5 cm and 3.5 cm, respectively. In our study, PL was smaller than measurements in most of the other populations. Our results are similar to those in some studies from Indonesia, Japan and China[4,9,10]. Çamurdan et al.[8] reported PL for term Turkish newborns as 3.65±0.27 cm. The mean age, weight and length were found as 0.5 month, 3.96±0.58 kg and 54.07±2.37 cm, respectively, in that study. Thus, PL reported for newborns in that study was longer than that found in the first 48 hours in our study. There was a wide age range, with respect to other measurements, in the 1-3, 3-6, and 6-12 months groups, etc., and Çamurdan's results were given according to those age groups. Therefore, it is not appropriate to compare those results with our study.

Our data confirm a positive correlation between weight and length at birth and PL. Studies have reported different results concerning the association between PL and growth parameters. There are some reports describing the relationship between ethnicity and penile size in healthy newborns[5,11,12]. A study performed by Fok et al.[4] in China reported a positive correlation between gestational age, length, weight, and PL. Cheng et al.[5] reported PL and PD as slightly smaller in Chinese babies compared to Caucasians and East-Indian babies. They speculated that it could be due to genetic factors. Cases with serious insulin-like growth factor deficiency such as Laron syndrome are good models for the relation between PL and

Table III. Percentiles for Penile Length According to Age in the First Year

	Penile length (cm)						
Age	3p	10p	25p	50p	75p	0p	97p
0-48 hours	2.3	2.4	2.6	2.8	3.0	3.2	3.5
6 months	3.0	3.2	3.4	3.7	3.9	4.1	4.3
12 months	3.7	3.9	4.2	4.5	4.7	5.0	5.3

Table IV. Mean, SD, Minimum and Maximum Values for Penile Diameter at Birth and 6 and 12 Months

		Penile diameter (cm)	
Age	No. of subjects	Mean ± SD	Min-Max
0-48 hours	746	1.04±0.09	0.8-1.4
6 months	370	1.23±0.08	1.0-1.4
12 months	254	1.25±0.09	1.0-1.4

SD: Standard deviation.

Table V. Mean, SD, Minimum and Maximum Values for Testicular Volume at Birth and 6 and 12 Months

		Right testicular volume (ml)		Left testicular volume (ml)	
Age	No. of subjects	Mean ± SD	Min-Max	Mean ±	SD Min-Max
0-48 hours	746	1.73±0.45	1-3	1.64±0.48	1-3
6 months	370	2.07±0.31	1-3	2.00±0.27	1-3
12 months	254	2.01±0.12	2-3	2.01±0.13	2-3

SD: Standard deviation.

fetal growth. Severe insulin-like growth factor 1 deficiency causes a significant intrauterine growth retardation and a decrease in PL[13].

There are some studies in the literature reporting PD from different populations (2,5,10,14). MPD values were documented as 1.10 cm by Feldman and Smith[2], as 1.07 cm by Cheng and Chanoine[5], as 1.04 cm by Vasudevan[14], and as 0.82 cm by Sutan-Assin[10]. Our MPD values are similar to those reported in these studies. No report is available in the literature regarding MPD at 6 and 12 months of age.

There are a few studies in the literature performed in newborns related to TV. Ting and Wu[15] measured TV in term newborn infants in the major ethnic groups in Malaysia. They reported that the mean TV was 2.5±0.6 ml in Malay, 2.4±0.5 ml in Chinese and 2.0±0.4 ml Indian infants. In another study, Chin et al[16]. found TV as 1.3±0.3 ml in Taiwanese neonates. The mean TV found in our study is greater than that reported in the study of Chin[16], but smaller than that reported by Ting and Wu[15].

Very few studies have been done on PL after the neonatal period. In our study, the most rapid increase in PL, PD and TV was observed in the first 6 months after birth. These alterations can be explained by the hormonal mechanism during minipuberty. Shortly after birth, gonadotropin and testosterone production decrease. Beginning at about the age of 1 week, gonadotropin and testosterone levels begin to rise again to pubertal levels, peaking at age 1-3 months, and then decreasing to prepubertal levels by the age of 6 months[17]. After the age of 6 months, the little subsequent penile growth that occurs parallels general somatic growth.

Independent of somatic growth, PL and TV values in our study caught the reference values reported in the literature at 6 and 12 months, which is thought to be due to hormonal effects in minipuberty. The postnatal surge in reproductive hormones appears to be important for genital growth.

The significance of this finding is that micropenis would be overdiagnosed in Turkish newborns if non-Turkish reference standards

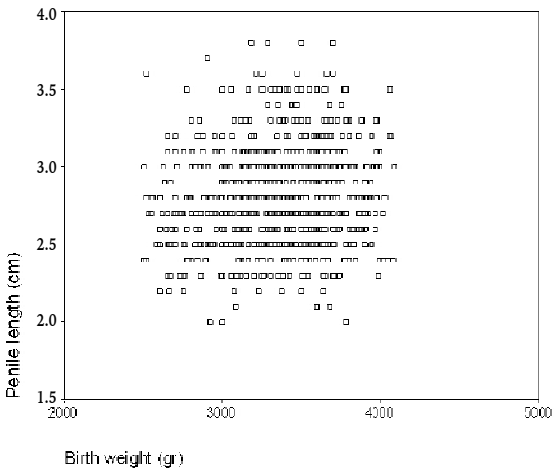

Fig. 1. Correlation between penile length and weight in the first 48 hours (r: 0.110, p: 0.003).

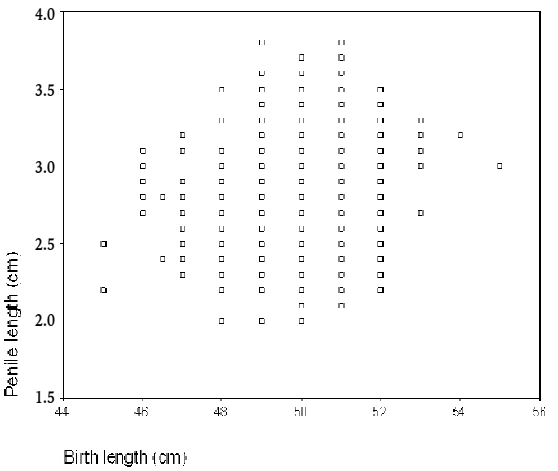

Fig. 2. Correlation between penile length and birth length in the first 48 hours (r: 0.179, p: 0.001).

were used for comparison. Overdiagnosis of micropenis results in unnecessary investigations or treatments, as well as parental anxiety. From the point of clinical practice in our country, our findings should be useful to pediatricians caring for Turkish newborns.

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