Penile length of term newborn infants in multiracial Malaysia

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ABSTRACT

Introduction: Micropenis may be an important sign of underlying hypogonadism or pituitary hypofunction in the neonatal period. Penile lengths of normal newborns have been reported in many Western populations. However, the data may not be applicable in the Asian or the multiracial Malaysian population. Our study aimed to establish the normal penile length and testicular volume in term newborn infants in the major ethnic groups in Malaysia.

Methods: The stretched penile length and testicular volume were measured in 340 normal term newborn infants (195 Malays, 129 Chinese and 16 Indians).

Results: The mean penile length in Malay term newborn infants was 35 +/− 4 mm, which was similar to Chinese infants. The mean testicular volume was 2.5 +/− 0.6 ml in Malay and 2.4 +/− 0.5 ml in Chinese infants. There was no significant difference between the groups. The sample size for the Indian group during the study period was inadequate.

Conclusion: Using −2.5 standard deviations as the cut-off for micropenis, a Malay or Chinese newborn infant in Malaysia with a penile length of less than 25 mm is considered to have a micropenis and further evaluation is warranted.

Keywords: micropenis, penile length, term newborn, race, testes volume

Singapore Med J 2009;50(8):817-821

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INTRODUCTION

Clinical examination of the genitalia is part of the physical examination of all newborn babies. Micropenis is a condition that describes a penis that is abnormally small but otherwise perfectly formed with the urethral opening at the tip of the glans penis.[1] It may be the only outward manifestation of a hypothalamus-pituitary axis disorder with multiple pituitary hormone deficiencies. This may lead to life-threatening events if unrecognised. Clinical evaluation of penile size in male neonates is essential to alert clinicians of this possible potentially life-threatening abnormality, hence the importance of initiating early investigations, diagnosis and treatment. Micropenis can also be due to dysgenetic testes which carry an increased risk of gonadoblastoma. In addition, the growing child may suffer psychosocial trauma from genital inadequacy. More importantly in the neonatal period is the issue of whether the penile size is adequate and will enlarge with hormonal stimulation for male gender assignment. Uncertainty in the gender of the newborn child can have enormous psychosocial impact on the parents and family.

Micropenis is usually defined as a penis that has a stretched length of shorter than 2.5 standard deviations (SD) below the mean.[1] Previous studies showed racial differences in penile length.[2,3] Normative data for healthy term newborn males were mainly derived from Caucasian infants,[4,5] and may not be applicable to our population. Hence, this study aimed to establish the norms in penile length and testicular volume in term newborn infants in the Malaysian population which consists of ethnic Malays, Chinese and Indians.

METHODS

This is a cross-sectional study on all term male newborn infants delivered at Universiti Kebangsaan Malaysia Hospital in Kuala Lumpur, Malaysia over a six-month period from August 2006 to February 2007. This is a university teaching hospital serving a multiracial urban community. All male term newborn infants with a completed gestation of 37–42 weeks were eligible for the study. Term gestation was determined either from the maternal date of the last menstrual period or from dating the ultrasonographic scan in early pregnancy before 20 weeks of gestation. If in doubt, the Ballard score examination was carried out within the first 24 hours of life to determine the gestation. Written informed consent was obtained from the mother. This study was approved by the Ethics Committee of Universiti Kebangsaan Malaysia Hospital. Exclusion criteria were infants with ambiguous genitalia, hypospadia, undescended testes, hydrocoele, dysmorphism, multiple congenital abnormalties or suspected endocrinological disorders; sick neonates admitted to the neonatal intensive care unit;

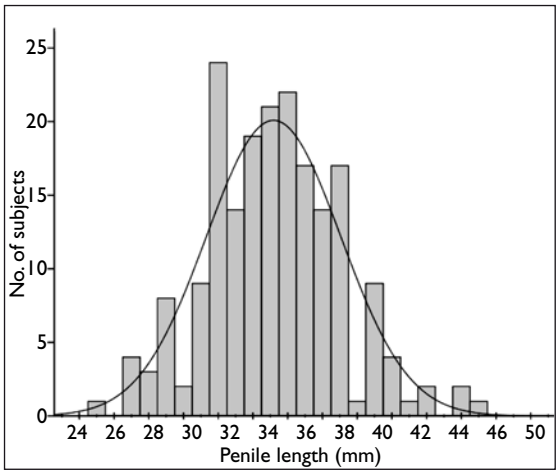

Fig. 1 Histogram shows the distribution of penile length of Malay newborn infants.

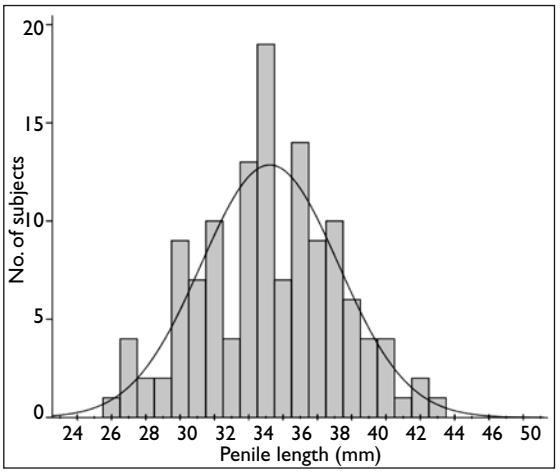

Fig. 2 Histogram shows the distribution of penile length of Chinese newborn infants.

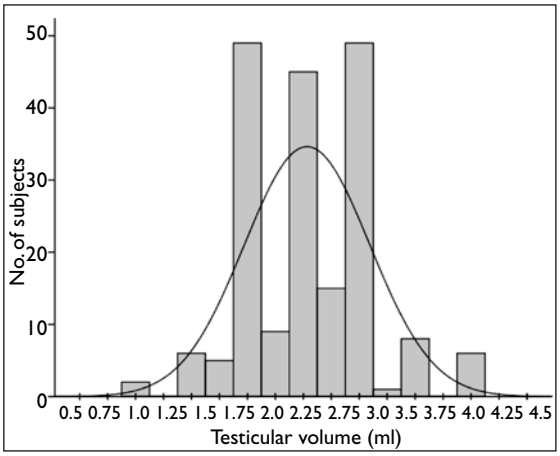

Fig. 3 Histogram shows the distribution of testicular volume of Malay newborn infants.

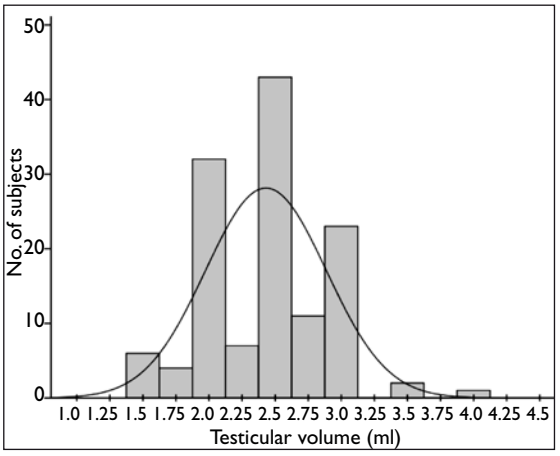

Fig. 4 Histogram shows the distribution of testicular volume of Chinese newborn infants.

infants of mixed parentage and infants whose mothers had received androgenic medication during pregnancy.

A single examiner measured the penile length and testicular volume of the eligible infants within their first three days of life in the postnatal wards. Measurement of stretched penile length was conducted with the baby in supine position. The penis was gently stretched to the point of increased resistance. The stretched penile length was measured by taking a wooden spatula and pressing it alongside the penis onto the pubic bone. A mark was made on the spatula at the level of the top of the glans penis excluding the foreskin, and the length was measured. Three measurements were taken to the nearest millimetre from each infant to minimise errors, and the mean was calculated. Testicular volume was measured by the same examiner using a Prader orchidometer. Both the left and right testes were measured. A testis size that was in between two standard ellipsoid volumes was taken as the mean between the larger and the smaller ellipsoid sizes. The mean value was calculated if the testes were of unequal size.

Sample size (n) was calculated from the following formula giving a 95% confidence interval for the mean:[6] $n \geq (1.96\sigma/\delta)^2$ where σ is the SD, i.e. 4 mm (from a Singapore study which has the most similar ethnic groups to Malaysia), and δ is the precision of the penile length measurement, i.e.1 mm; thus $n \geq 61$.

This gave a sample size of 70 from each of the three major ethnic groups, viz. Malays, Chinese and Indians. The data was analysed using the Statistical Package for Social Sciences version 14 (SPSS Inc, Chicago, IL, USA). The mean and SD for the stretched penile length and testicular volume for each ethnic group were determined. The comparison between the three ethnic groups was made using one-way analysis of variance (ANOVA). Pearson correlation coefficient (r) was used to express the relationship between the penile length and testicular volume, penile length and birth weight, and

Table I. Birth weight, penile length and testicular volume according to ethnicity.

Ethnicity	Total no. of subjects	Mean ± SD of birth weight (kg)	Mean ± SD of penile length (mm)	Mean ± SD of testicular volume (ml)
Malay	195	3.12 ± 0.41	35.2 ± 3.9	2.5 ± 0.6
Chinese	129	3.13 ± 0.37	35.2 ± 4.0	2.4 ± 0.5
Indian	16	2.98 ± 0.45	37.5 ± 4.5	2.0 ± 0.4*

SD: standard deviation
* $p < 0.05$ compared to the Malay and Chinese groups.
ANOVA: $F = 1.08$, $p = 0.341$ (birth weight); $F = 2.54$, $p = 0.081$ (penile length); $F = 7.144$, $p = 0.001$ (testicular volume)

testicular volume and birth weight. A p-value of < 0.05 was regarded as significant.

RESULTS

A total of 340 term newborn infants were studied. There were 195 (57.4%) Malay, 129 (37.9%) Chinese and 16 (4.7%) Indian infants. Figs. 1–4 show the distributions for the penile length and testicular volume in Malay and Chinese newborn infants. There was an inadequate sample size for the Indian group to determine a meaningful norm for the penile length and testicular volume. The mean and SD of the birth weight, penile length and testicular volume of each ethnic group are shown in Table I. There was no significant difference in the birth weight between the groups. Indian infants had the highest mean penile length, but the difference compared to the Malay and Chinese groups was not statistically significant. Malay and Chinese infants had the same mean penile length. The mean testicular volumes of Malay and Chinese infants were not statistically different. Indian infants had the lowest mean testicular volume and this was statistically different from the other two ethnic groups.

There was a positive correlation between penile length and birth weight in Malay infants (r 0.20, p = 0.005) as shown in Fig. 5, but not in the other two ethnic groups (r 0.086, p = 0.330 for Chinese, r –0.109, p = 0.688 for Indians). There was no significant correlation between the penile length and testicular volume in all races (r 0.105, p = 0.146 for Malays; r –0.014, p = 0.871 for Chinese; r 0.270, p = 0.311 for Indians). There was a significant positive correlation between the testicular volume and birth weight in Malay (r 0.443, p = 0.0) and Chinese infants (r 0.445, p = 0.0) as shown in Fig. 6 and Fig. 7, respectively, but not in Indian infants (r 0.325, p = 0.219).

DISCUSSION

The mean penile length of a term newborn Malay and Chinese infant in this study was 35 mm, with a SD of 4 mm. This mean penile length was similar to the published data from other countries, except Indonesia. Specifically, Feldman and Smith reported a mean penile length of 35 ± 7 mm in 37 Caucasian term newborn infants in the United States of America;[4] Flatau et al reported 35 ± 4 mm in 100 Jewish Israeli infants;[5] Al-Herbish reported 36 ± 6 mm in 379 Saudi Arabian infants;[7] Vasudevan et al reported 36 ± 5 mm in 135 south Indian infants;[8] and Lian et al reported 36 ± 4 mm in 228 infants of Malay, Chinese and Indian ethnicity in Singapore.[2] However, Sutan-Assin et al reported a penile length of 29 ± 2 mm in 336 Indonesian infants.[9]

Using the definition of micropenis as one with a penile length of > 2.5 SD below the mean, this study showed that a Chinese or Malay infant with a penile length of less than 25 mm has a micropenis. The sample size for the Indian group was inadequate to determine a meaningful norm for penile length. Further study needs to be done to establish the norm for the penile length and testes size in the newborn Indian infants in Malaysia. This study shows that penile length is not affected by the racial factor as the Malay and Chinese infants have the same mean penile length of 35 mm. This is in contrast to other studies which showed that ethnicity had a significant effect on penile length. In Singapore, which has very similar ethnic groups to Malaysia, i.e. Malays, Chinese and Indians, Lian et al, who studied a total of 228 infants, found that Indians and Chinese had, respectively, the highest and the lowest mean penile length of 38 mm and 35 mm, and Malays had a mean penile length of 36 mm.[2] Cheng and Chanoine, in their study population of 105 infants in Vancouver, Canada, found that East Indians had the highest mean penile length of 36 mm, followed by Caucasians with 34 mm, and then the Chinese with 31 mm.[3] The absence of a significant difference in penile lengths in the present study may be due to having too few Indian subjects in the study sample, compared to the other two ethnic groups.

Interestingly, Fok at el reported a mean penile length of 30 mm in a large study of 4,628 Hong Kong Chinese term infants.[10] This is shorter than the mean penile length in the Chinese infants in Singapore and Malaysia. The difference might be due to differences in the method

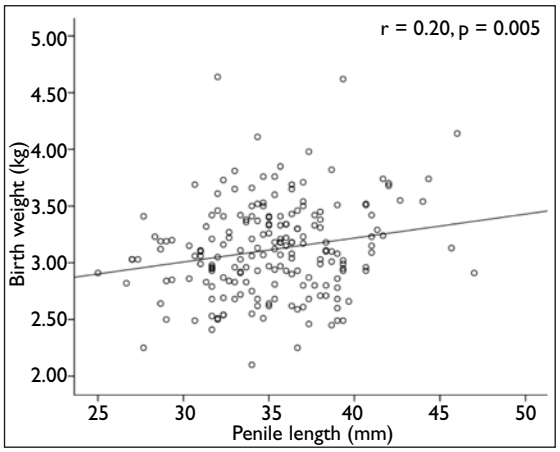

Fig. 5 Scatterplot shows the correlation between penile length and birth weight in Malay newborn infants.

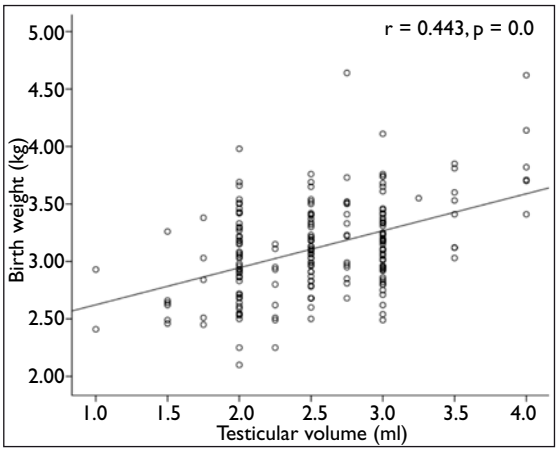

Fig. 6 Scatterplot shows the correlation between testicular volume and birth weight in Malay newborn infants.

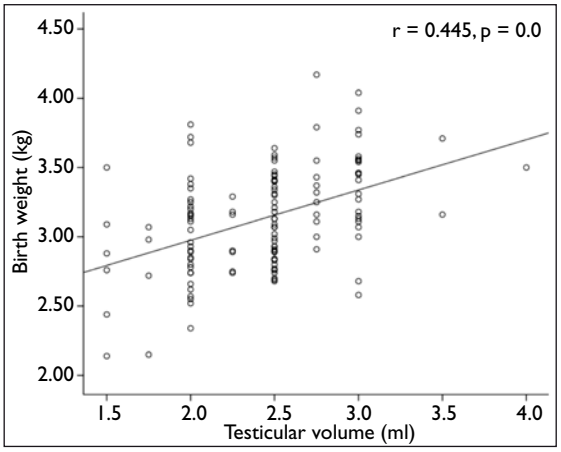

Fig. 7 Scatterplot shows the correlation between testicular volume and birth weight in Chinese newborn infants.

and technique of measurement. Malaysia and Singapore share very similar environmental factors in terms of climate, diet, culture and lifestyle. It would be interesting to know if this could explain, in part, the difference in the penile lengths in the population, as the size of the penis and testes are likely determined by an interplay of genetic and environmental factors.

Prenatal normal male sex development requires normal genetics, hypothalamus-pituitary-testicular axis, 5α-reductase enzyme activity and tissue response.[11] Defects occurring at any level will result in an abnormal male sex development. The clinical manifestation of the abnormality depends on the timing of the occurrence during embryonic and foetal development.[1] Abnormality occurring before 12 weeks of gestation results in ambiguous genitalia in a genetically male infant. However, abnormality beyond week 14 of gestation is likely to result in micropenis.[1] Micropenis is an important clinical clue to prompt further investigation and early diagnosis and treatment of an underlying disorder.

Newborn male infants have an active hypothalamus-pituitary-testicular axis that occurs up to six months of postnatal age.[11,12] Penile length and testicular volume at birth reflect the activity and normality of this hormonal axis. Therefore, normal external genitalia with an adequate size of the penis and testes in a male baby at birth imply normality in the male sex development. It helps to predict the normal development of puberty and reproductive function later in life provided there is no disruption to the hypothalamus-pituitary-testicular axis postnatally.

In conclusion, a Malay or Chinese newborn infant in Malaysia with a penile length of less than 25 mm has a micropenis, and this warrants further evaluation for a possible hypothalamus-pituitary-testicular disorder in the neonatal period. There may also be an association with other pituitary hormone deficiencies, which could lead to life-threatening events if left unrecognised. On the other hand, a penile length of greater than 35 mm and a testicular volume greater than 2.5 ml in a Malay or Chinese neonate are likely to suggest normality of the hypothalamus-pituitary-testicular axis. This provides reassurance to concerned parents.

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