Penile length and cord total and free testosterone in full term male Egyptian neonates

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Abstract *Background:* It is inappropriate to use universal reference values to interpret stretched penile length measurements and testosterone concentrations in newborns with variable ethnic backgrounds.

Objective: To establish normal reference values for stretched penile length, free and total testosterone concentrations in fullterm Egyptian newborn and to correlate them with anthropometric parameters.

Methods: 180 fullterm healthy newborn boys to uncomplicated pregnancies and deliveries were enrolled. Penile length, weight, length, occipitofrontal circumference were measured within 24 h of birth. Total and free testosterone concentrations were assayed.

Results: The mean penile length was 3.14 ± 0.38 cm, the mean free testosterone was 13.76 ± 8.67 pg/ml, mean total testosterone was 1.98 ± 1.35 ng/ml. Penile length correlated positively to birth weight, to crown heel length and to penile length/crown heel length ratio. Penile length correlated positively to free and total testosterone. Total testosterone level correlated positively to crown heel length and to free testosterone.

Conclusion: Our study is a step toward achieving accurate reference charts for Egyptian male newborns. A multicenter, larger scale study is needed to establish Egyptian norms.

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Introduction

Evaluation of external genitalia is an important part of the physical examination of the newborn child. A penis of "inadequate" size in a male newborn alerts the clinicians in cases of potentially life-threatening abnormalities and can cause parental anxiety.[1] Consideration of the expected phallic size in the newborn enables the detection and objective definition of

abnormalities such as micropenis and ambiguous genitalia.[2] Micropenis may be the only outward manifestation of a hypothalamus-pituitary axis disorder with multiple pituitary hormone deficiencies.[3]

Penile length may vary in different populations, with race and ethnicity, and may yield different normal values.[3,4] The most established normative data on healthy full-term newborn males come from two widely referenced studies on Caucasian babies.[5,6] These data may not be applicable to our population. Moreover, recent studies from various parts of the world have aimed to establish penile norms representing their own populations.[1,3,7,8]

Not enough data are present about the reference range of penile length in healthy fullterm newborns from Egypt, very few from Arabian populations. There are no available data about the reference range of total and free testosterone in full term Egyptian neonates.

Hence, this study aimed to establish the reference values for penile length, total and free testosterone concentrations in healthy full term Egyptian newborn infants of uncomplicated pregnancies and deliveries and to correlate them with neonatal anthropometric measures.

Methods

Patients

This observational cross-sectional study included 180 liveborn male neonates delivered at the maternity hospital of the Ain Shams University, in the period of June 2014 to November 2014. Written informed consent was obtained from the mothers before recruitment into the study. This study was approved by the Ethics Committee of the Pediatric Department, Ain Shams University.

Full term infants ($37 \leqslant$ to < 42 weeks of gestation), normal birth weight ($2.5 \leqslant$ to < 4 kg), apparently healthy to healthy mother, uncomplicated pregnancy and delivery were included. Preterm or low birth weight infants, infants whose mothers had a history of/or suspected any endocrinal diseases, infants whose mothers were taking any drugs except vitamins and tonics, infants with any external abnormalities of external genitalia, and sick infants were excluded from the study.

Methods

For all neonates complete medical and obstetric history was taken laying stress on maternal age, consanguinity, socio-economic class of the mother, any endocrinal diseases, drugs or hormonal therapy, mode of delivery, Apgar score at 1 and 5 min. The gestational age of an infant was assessed by the mother's last menstrual period and/or early ultrasound dating, and cross-checked with the new Ballard score examination after birth.[9]

Thorough clinical examination and anthropometric measurements including: (a) Birth weight was measured by a calibrated digital scale. (b) Supine crown-heel length. (c) occipitofrontal circumference. Body mass index (BMI): was calculated as birth weight (kilograms)/length^2 (m^2). A thorough examination of the genitalia, including position of the urethral opening, and location and size of the testes, skin of the scrotum was done.

Stretched penile length (SPL): Three measurements were taken to the nearest millimeter from each infant to minimize errors, and the mean value was recorded. Measurement was done by the same person each time, within 24 h of delivery. Penile length was determined by the method described by Schonfeld and Beebe.[10] The stretched penile length was determined by measuring the distance from the penile base under the pubic symphysis to the tip of the glans using a rigid ruler held firmly against the symphysis pubis at a right angle. The shaft of the penis was stretched to the point of increased resistance, as the ruler was placed at the base of the penis while the pubic pad of fat was maximally depressed, and the measurement was taken along the dorsal aspect.

Laboratory investigations

Cord blood samples were withdrawn into plain tubes for clotting, centrifugation and the serum separated and then stored at $-70\,^{\circ}$C until used for total and free testosterone assay.

Total serum testosterone was assayed by enzyme immunoassay by available kits supplied by 'Chemux Bioscience, Inc'. Free serum testosterone was assayed by microplate enzyme immunoassay by available kits supplied by 'Accu-Bind, Monobind Inc'. Procedures were done according to manufacturers' recommendation.

Statistical analysis

Data were analyzed using Statistical Package for Special Science (SPSS) software computer program version 15 (SPSS Inc., Texas, USA). Quantitative data were described using mean ± standard deviation, median and interquartile (IQR) range; qualitative data were described in the form of numbers and percentages. Student t-test of two independent samples was used for comparison of normally distributed quantitative variables while the Mann–Whitney test was used for non-parametric data. Chi-square test was used for comparison of qualitative variables. Correlation between continuous variables was performed using Spearman correlation coefficient (r). The probability of error at or less than 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.

Results

A total of 180 male infants were included. The anthropometric characteristics and total and free testosterone concentrations of studied neonates are listed in Table 1. One hundred and twelve neonates (62.2%) were delivered by cesarean section, 68 neonates (37.8%) were born vaginally. Penile length, total and free testosterone concentrations were comparable in those delivered by cesarean section and those born vaginally ($P > 0.05$). Seventy-four neonates (41.1%) had a gestational age less than 38 weeks, while 106 neonates had a gestational age $\geqslant 38$ weeks. No difference in penile length was found in those < 38 weeks of gestation versus those $\geqslant 38$ weeks, Table 2.

Penile length correlated positively to birth weight (r:0.373, P:0.039), to crown heel length (r:0.376, P:0.034), and to penile length/crown heel length ratio (r:0.918, $P < 0.001$) (Figs. 1 and 2). Penile length correlated positively to free testosterone