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Clitoral length in female newborns: a new approach to the assessment of clitoromegaly

Hatice Alev KUTLU[1], Fatih AKBIYIK[2]

Aim: The normative data for the newborn clitoral length will enable physicians to avoid overdiagnosing or underdiagnosing disorders related to the condition. This study is the first to investigate clitoris length in newborn females in Turkey.

Materials and methods: A total of 325 newborns with normal gestational age born by uncomplicated spontaneous vaginal delivery were included in the study. The body weight, body length, head circumference, and clitoral size were measured.

Results: A special equation was generated to estimate clitoris length, and clitoral length percentiles were prepared. The 3rd (2.00 mm) and 97th percentile (8.04 mm) values for clitoris length were determined. The best cut-off point for cases where the labia majora covered the clitoris was determined.

Conclusion: The equations and the percentile curves presented herein could be used as guides for expected clitoris length. Further studies, including larger measurement numbers, would enable the development of more sensitive equations and percentiles.

Key words: Clitoris, newborn, clitoromegaly

Yenidoğan kız çocuklarda klitoris boyu: Klitoromegalinin değerlendirilmesinde yeni bir yaklaşım

Amaç: Yenidoğan klitoris boyu ile ilgili normal değerlerin tanımlanması hekimlerin bazı rahatsızlıkları atlamalarını ya da hatalı tanılar koymalarını engelleyecektir. Bu çalışma, yenidoğan kız çocuklarında klitoris boyunu araştıran ilk çalışmadır.

Yöntem ve gereç: Normal gebelik süresi sonunda komplikasyonsuz olarak spontan vajinal yolla doğan 325 yenidoğan kız çocuk çalışmaya alınmıştır. Bu yenidoğan kız çocuklarının vücut ağırlıkları boyları, baş çevreleri ve klitoris boyları ölçülmüştür.

Bulgular: Klitoris boyunu tahmin etmek için özel bir denklem ve klitoris boyuna ilişkin persentil eğrileri hazırlandı. Klitoris uzunluğu için 3. (2,00 mm) ve 97. persentiller (8,04 mm) tanımlandı. Labia major'un klitorisi örttüğü olgularda klitoris uzunluğu için en iyi eşik değer saptandı.

Sonuç: Burada sunulan denklem ve persentil eğrileri beklenen klitoris boyu için yol gösterici olacaktır. Daha geçerli persentil eğrileri ve denklemlerin geliştirilmesi için daha çok sayıda olgu içeren çalışmalara ihtiyaç vardır.

Anahtar sözcükler: Klitoris, yenidoğan, klitoromegali

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[1] Clinics of Pediatric Endocrinology, Dr. Sami Ulus Children's Hospital, Ankara - TURKEY
[2] Clinic of Pediatric Surgery, Dışkapı Children's Hospital, Ankara - TURKEY
Correspondence: *Hatice Alev KUTLU, Clinics of Pediatric Endocrinology, Dr. Sami Ulus Children's Hospital, Ankara - TURKEY*
E-mail: alevkutlu64@yahoo.com.tr

Introduction

The normative data for the newborn clitoral length will enable physicians to avoid overdiagnosing or underdiagnosing the disorders related with clitoromegaly. There are few studies on clitoris length during the newborn period in the literature (1-5).

Clitoromegaly during the newborn period is always accepted as pathological, and indicates the exposure of the female fetus to androgen during the intrauterine period. The clitoris may be prominent in some newborns and premature babies, leading to many unnecessary investigations.

This study, with Turkish girls, is the first to investigate the clitoris length in newborn females in this country. In contrast to penile length measurement, even millimetric inaccuracies during clitoris measurement can influence the result. We also investigated when it would be possible to exclude clitoromegaly, using inspection only, and which cases required detailed evaluation.

Materials and methods

A total of 325 newborns with normal gestational age born by uncomplicated spontaneous vaginal delivery were included in the study in Zubeyde Hanım Maternity Hospital, between January and July 2008.

The mothers had no history of hirsutism or drug use during pregnancy. The gestational age of the patients were calculated from the first day of the last menstrual period to the day of birth, and then verified by the Ballard scoring system; patients premature or small for gestational age, and those with genital anomalies were excluded from the study.

The body weight, body length, head circumference, and clitoral size were recorded by the first author in order to avoid inter-observer variability. All measurements were performed on the second postnatal day. The length of the clitoris of the 325 girls included in the study was then measured twice and the mean recorded.

The clitoral length was measured twice before the study was started with a 1-h interval every 48 girls for reliability analysis.

Technique

The clitoris measurement was performed using a digital compass device that had a measurement sensitivity of 0.01 cm (Figure 1). First, the genital region was examined, and whether the clitoris was covered by the labia majora or not was recorded. The baby was then placed into the frog-leg position, and the length of the clitoris was measured. During the measurement, the legs were secured by the assisting nurse, while the investigating physician separated the labia majora using the thumb and second finger of the left hand and performed the measurement with the right hand.

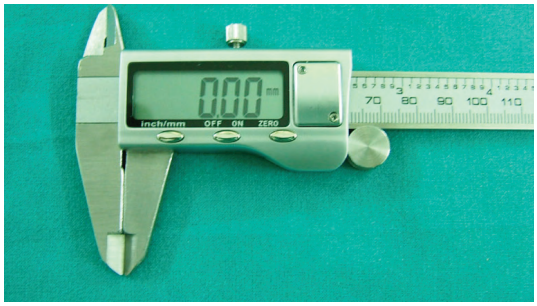

Figure 1. Measurement device.

Any correlation between the head circumference, height, and weight with clitoris length was evaluated. A cut-off value for the length of the clitoris covered by labia majora to exclude to clitoromegaly only by inspection was investigated. A special equation was generated to estimate to length of the clitoris, and clitoris length percentiles were prepared.

Statistical analysis

The data were analyzed with the SPSS 13.0. Continuous variables were expressed as mean ± standard deviation. Categorical variables were expressed as percentages. The Pearson correlation test was used to determine whether a linear relationship was present between clitoris measurements and pregnancy week, height, weight, and head circumference. Multiple linear regression analysis was used to determine variables with the largest effect on clitoris measurements. ROC analysis was performed to determine the effect of the clitoral

length on determining the covered clitoris. The area under the curve, and the 95% confidence interval for this area were determined. The best intersection point for the clitoris length, and the sensitivity and specificity values for this point were also determined. The 3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 97th percentile values for clitoral measurements were calculated. The ±2.5 standard deviation limits of the clitoris measurements by pregnancy week were also determined. The coefficient of variation (CV) and inter-class correlation coefficient (ICC) were calculated for the 1st and 2nd clitoris values of 24 randomly selected cases. A P value < 0.05 was considered to be statistically significant.

Results

The statistical analysis results of the intra-observer show that the reliability of the clitoris measurement was 95.2%, and the coefficient of variation was 6.1.

The mean values for the 325 patients included in the study are presented in Table 1.

There was no correlation between the clitoris length and gestational age (r = -0.054, P = 0.190). No correlation was found between the clitoris length and head circumference (r = -0.29, P = 0.608). A negative correlation was found between the clitoris length and height (r = -0.113, P = 0.044) and weight (r = -0.163, P = 0.004).

A specific equation was generated using these values in order to estimate the expected clitoral length.

Expected Clitoral Length (mm) = 7.826 - 0.021 × (height cm) - 0.575 × (weight kg).

Multiple regression analysis revealed that the clitoris length change was due mostly to weight (P = 0.046). An increase in body weight of 1 kg led to a 0.575 (-1.14; -0.011) mm decrease in the clitoris length.

The 3rd and 97th percentile values for clitoral length were determined (Table 2).

A reference percentile curve for the length of clitoris vs. body weight was prepared (Figure 2).

The labia majora covered the clitoris in 56.3% of the patients, and did not cover it in 43.7%. The mean length of the clitoris covered by labia majora was 3.73 ± 1.14 mm, while the value for the uncovered clitoris was 5.89 ± 1.26 mm and the difference was significant (P < 0.001).

The best cut-off point for cases where the labia majora covered the clitoris was determined as 4.69 mm. (P < 0.001). The ROC analysis to investigate the effectiveness of the clitoris length in estimating the covered clitoris revealed a significant area under the curve value of 0.902 (0.868-0.937).

Table 1. Mean values of the study.

Parameters	Mean
Pregnancy duration (day)	277.60 ± 7.30
Length (cm)	49.23 ± 1.82
Weight (kg)	3.16 ± 0.37
Head circumference (cm)	34.13 ± 2.11
Clitoris length (mm)	4.93 ± 1.61

Table 2. Clitoris length percentiles.

Percentile	Clitoris length (mm)
3	2.00
10	2.76
50	5.03
90	6.84
97	8.04

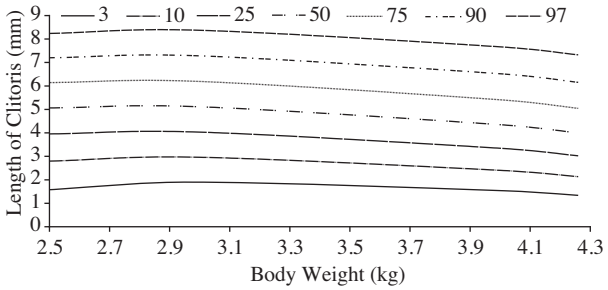

Figure 2. Reference percentile curve for length of clitoris vs. body weight.

We found that for each 100 children where the clitoris measurement was above 4.69 mm the labia majora did not cover the clitoris in 88.8% (sensitivity), while the clitoris was covered by the labia majora in 80.9% (specificity) of every 100 children with a clitoris measurement of 4.69 mm and below.

Discussion

External genitalia abnormalities in the first 2 days of life in the male or female newborn may indicate a serious endocrine or genetic disease. The organ differentiation of them is completed at the 12th week of the intrauterine period in a female fetus. Minimal clitoris enlargement continues until the 20th week of pregnancy (2). However, if the clitoris is exposed to the effect of testosterone during the intrauterine and postnatal periods it may enlarge. The clitoromegaly in newborns always brings to mind significant intrauterine exposure to androgens. It has been reported that endocrine or genetic disease may appear during the follow-up of females with small genitalia as well (5). It is quite important to know the normative data for clitoral length in the newborn period.

The few clitoral measurement studies in the literature have investigated whether this value varies by ethnic group. Phillip et al. have determined the clitoris length as 5.87 ± 1.48 mm and 6.61 ± 1.72 mm, respectively in Jewish and Bedouin babies (3). Riley et al. have reported a clitoris length of 3.27 ± 0.11 mm in white and 3.66 ± 0.13 mm in black term and preterm babies. These studies indicate that the clitoris length may vary by ethnic group just like penile length (5,6). Each ethnic group or race, therefore, has to determine its own normative data. In the presented study, the mean clitoral length of Turkish newborns was 4.93 ± 1.61 mm.

There is currently no consensus among authors as to which clitoral measurement parameter confirms the diagnosis of clitoromegaly. Some authors use the clitoral index or the clitoris width, while others prefer the clitoris length (4). It is also interesting that studies in the literature have usually employed multiple examiners. In contrast to penile measurements, millimetric inaccuracies can modify the data in clitoral measurements. Our measurements were all performed by the same investigator, in the same examination room with a constant temperature, and 24 h after birth. In addition, the number of cases was very high when compared to other articles. All these factors increase our study's reliability.

The clitoris is known to be prominent in the newborn. However, we found that the clitoris length was less than 5 mm when it appeared to be covered by the labia majora. A suspicion of clitoromegaly is first made on the personal judgment of the clinician on inspection. Clitoris measurement is also difficult and time-consuming. Clitoromegaly is currently defined as a clitoris longer than 1 cm, and we could therefore say that there is no need to measure the clitoris if it is covered by the labia majora on inspection.

Studies report that the newborn standards can be used throughout infancy as the clitoris length shows little or no change during this period (5). The adrenogenital syndrome is a hereditary disorder that exposes the female fetus to androgen during the intrauterine period. Clitoromegaly may be missed during the newborn period in mild cases, but the patient can present clitoromegaly during infancy, as virilization continues in untreated patients. The clitoral data of the newborns are therefore very important.

Our study on term newborns did not find a correlation between clitoral length, gestational age, and head circumference. Height has a slightly negative correlation. However, there was a strong negative correlation between birth weight and clitoral length, also reported by Litwin et al. (7).

The definition of clitoromegaly is indefinite, as with the various suggestions to define micropenis. A clitoris length above 1 cm has traditionally been defined as clitoromegaly. The ± 2 SD values for clitoral length were 4.93 ± 1.61 mm, and the 97th percentile was 8.04 mm in our study. We therefore feel that cases with a clitoris length of over 8 mm must be monitored, and those over 10 mm are accepted as pathological as a result of this study.

In conclusion, there may be racial differences between clitoral length values, and we suggest that each country define its own normative data. The normative data produced for the newborn period can also be used for infancy, and represent an important

diagnostic tool for conditions that produce late clinical signs. We would finally like to emphasize that a clitoris covered by labia majora is less than 5 mm in length, and no extra measurements are required.

The equations and the percentile curves presented herein could be used as guides in the expected length of a clitoris. Further studies, including larger measurement numbers, would enable the development of more sensitive equations and percentiles.

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