Reference Centile Chart for Transverse Cerebellar Diameter (TCD) in Thai Fetuses throughout Gestation

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ABSTRACT

Objective: To create a reference centile chart for transverse cerebellar diameter in Thai fetuses throughout gestation.
Methods: A total of 780 pregnant women between 13-40 weeks gestation, who attended at the antenatal clinic at Siriraj Hospital, Mahidol University, Bangkok, were recruited. Each fetus was measured only once for the purpose of this study. The mean and fitted centiles were estimated at each week of gestation using linear regression modeling.
Results: A total of 752 fetuses were measured for fetal transverse cerebellar diameter. Linear regression models were fitted to estimate the meant 95% confidence interval for transverse cerebellar diameter at each gestational age. The centile chart of this parameter was also presented.
Conclusion: Reference centile chart for fetal transverse cerebellar diameter of Thai fetuses was created.

Keywords: Centile chart; fetal transverse cerebellar diameter

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To assess fetal growth by using common parameter include head circumference (HC), abdominal circumference (AC), biparietal parameter (BPD), femur length (FL) and transverse cerebellar diameter (TCD) have been published in several papers.[1-3] TCD has been one of the most reliable parameters for growth and gestational age estimation.[4] Moreover, the ratios of the TCD to other growth parameters, such as AC or HC are highly suggestive of asymmetrical growth retardation.[3,5-6] The purpose of the study was to establish the reference values for TCD throughout pregnancy from 13-40 weeks of gestation for clinical utilization at Siriraj Hospital.

MATERIALS AND METHODS

A total of 780 pregnant women who attended the antenatal clinic at Siriraj Hospital were recruited in this study. Each pregnancy was in the first trimester, singleton without underlying medical and surgical complication. From all subjects, the following data were obtained:, their last menstrual periods (LMP) and crown rump length (CRL) measurements were performed to confirm the gestational age. If the gestational age from LMP and CRL measurement was different less than 7 days, the gestational age was based on LMP. If the differentiation was up from 7 days, the gestational age was based on the CRL measurement.

Each woman had 3 ultrasonographic measurements at the first visit, 18-20 weeks along with fetal anomaly scan, and randomly assigned gestational age for transverse cerebellar diameter measurement. The other fetal biometric measurements including biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) were also recorded during every scan. If fetal structural abnormality and fetal chromosomal abnormality was detected, the case would be excluded from the analysis. The intraobserver and interobserver variabilities were excluded by 3 times of each measurement.

Measurements of fetal transverse cerebellar diameter

The ultrasonographic measurement of the measurements was made by ALOKA, Dynaview 2, SSD 1700 with 3.5 MHz convex transducer. The transverse cerebellar diameter was obtained from the outer-to-outer margin of cerebellum, after its identification of posterior fossa. (Fig 1)

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TABLE 1. Number of fetuses measured at each week of gestation.

Gestational age (weeks)	Number of fetuses	Percentage	Gestational age (weeks)	Number of fetuses	Percentage
13	9	1.2	28	32	4.2
14	33	4.4	29	34	4.5
15	31	4.1	30	21	2.8
16	30	4.0	31	27	3.6
17	20	2.7	32	32	4.2
18	33	4.4	33	28	3.7
19	22	2.9	34	23	3.1
20	24	3.2	35	32	4.2
21	40	5.3	36	33	4.4
22	27	3.6	37	34	4.5
23	27	3.6	38	23	3.1
24	34	4.5	39	15	2.0
25	29	3.9	40	7	1.0
26	22	2.9	27	30	4.0

Statistical analyses

For each week of gestation, mean, and centiles were calculated. Linear regression analysis and ANOVA to test the regression line was used to estimate the predicted values and their 95% confidence intervals of those measurements for each gestational age. This was based on the assumption that the data in each gestational age are normally distributed.

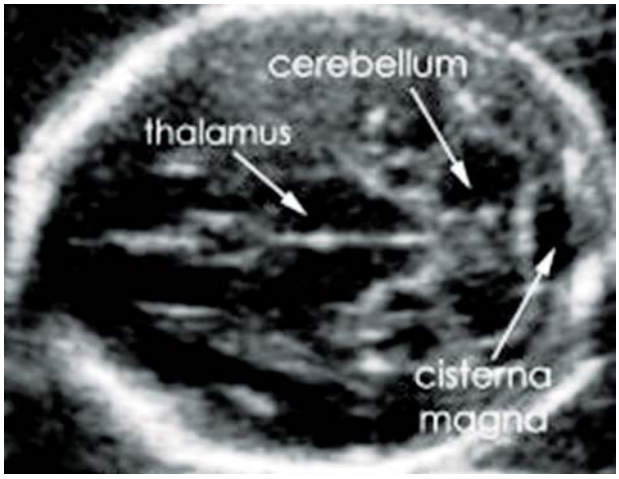


Fig 1. The plane to measure transcerebellar diameter.

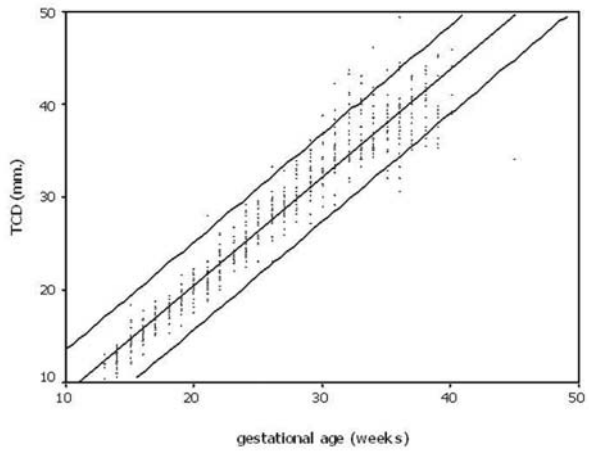


Fig 2. The fetal transverse cerebellar diameter data, predicted value and their 95% confidence interval.

RESULTS

A total of 780 pregnant women participated in this study. The measurements included fetal transverse cerebellar diameter which could be obtained in 752 pregnant women. Twenty-eight cases were excluded due to fetal malposition and the measurement plane could not be obtained. The anomaly fetuses described above were also excluded from the study. The number of the fetuses measured at each gestational age is presented in Table 1. The mean and fitted centiles were estimated at each week of gestation using linear regression modeling and presented in Table 2.

Predictive values from the regression analysis and their 95% confidence intervals were estimated and plotted against the actual data as shown in Fig 2.

DISCUSSION

The report represented that transcerebellar diameter showed linear growth throughout gestation. The cerebellum is well protected in the fetal head and it is the last organ to be affected by a decrease in blood flow. The cerebellum, as a part of the brain, was spared along with the rest of brain in asphyxiated primates. The report revealed that in the present of acute asphyxia, cerebellar blood flow remains unchanged as a consequence of redis-

TABLE 2. Fitted centiles of Thai fetal transverse cerebellar diameter.

GA (weeks)	Mean	5th centile	50th centile	95th centile
13	11.86	10.5	12	13
14	12.46	10.74	12.5	13.97
15	14.3	12.18	14.2	17.66
16	15.57	13.46	15.6	17.48
17	16.56	15.2	16.7	18.8
18	17.66	15.94	17.8	19.16
19	18.95	16.28	19	21.55
20	20.09	17.65	20.2	22.13
21	21	19.0	20.8	23.1
22	22.46	20.16	22.0	26.12
23	24	22.0	23.9	26.6
24	25.36	22.82	25.1	28.75
25	26.87	23.9	27.0	30.3
26	28.35	23.24	28.8	32.95
27	28.96	26.25	29.0	31.9
28	30.31	27.86	29.95	33.64
29	32.19	27.7	32	35.44
30	33.72	29.05	33.55	38.62
31	35.30	29.59	35	41.9
32	36.51	31.7	36.1	43.47
33	37.22	33.2	36.8	42.68
34	37.47	32.32	36.2	45.76
35	37.3	32.38	37.2	42.6
36	38.27	31.51	38.0	46.46
37	39.23	35	38.9	43
38	40.02	35.64	40.55	43.98
39	39.19	35.3	38.8	45.4
40	41.61	38.9	41.1	46

tribution of cardiac output.[3,7] In the human fetus, cerebellar growth may be least affected by intrauterine growth retardation (IUGR), and the measurement of the TCD appears to be the most reliable biometric parameter in predicting true gestational age.[7]

The inability to ascertain gestational age by ultrasound parameters in the third trimester has proved to be a major cause of undiagnosed fetal IUGR. Fetal transcerebellar diameter is independent of the fetal head shape and can be performed in most fetuses. This was found to be a reliable predictor of gestational age in the third trimester.[4]

Many applications in clinical practice were reported including the combination of TCD and AC measurements to predict fetal IUGR. Many reports found that TCD/AC ratio is an accurate, gestational age-independent method for detecting small for gestational age (SGA) but not large for gestational age (LGA) infant.[8]

According to the racial differences between populations, specific biometry charts for each population are needed. The represented data is the reference centile chart of TCD in Thai fetus at Siriraj Hospital. This report would be the preliminary study for the future applied study of TCD with other parameters including TCD/AC to predict IUGR in Thai fetuses.

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บทคัดย่อ

ตารางอ้างอิงสำหรับทารกในครรภ์: ขนาดเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลัง

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วัตถุประสงค์: ได้ทำการศึกษาแบบตัดขวางเพื่อสร้างตารางอ้างอิงสำหรับขนาดเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลัง (transcerebellar diameter) ของทารกไทย

วิธีการ: ทำการศึกษาสตรีตั้งครรภ์ปกติจำนวน 780 ราย อายุครรภ์ระหว่าง 13-40 สัปดาห์ ทำการวัดความยาวของเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังของทารกในครรภ์ด้วยคลื่นเสียงความถี่สูงในแต่ละรายที่อายุครรภ์ต่างกัน โดยการสุ่มเพื่อการศึกษาครั้งนี้โดยเฉพาะ ทำการวิเคราะห์ข้อมูลโดยการหาค่าเฉลี่ยของเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังในช่วงอายุครรภ์ต่าง ๆ

ผลการศึกษา: สามารถวัดความยาวของเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังได้ทั้งหมด 752 ราย จากนั้นจึงทำการหาค่าเฉลี่ยและส่วนเบี่ยงเบนมาตรฐานของเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังในช่วงอายุครรภ์ต่าง ๆ กราฟและตารางอ้างอิง ในตารางนี้ได้นำเสนอตารางอ้างอิงสำหรับขนาดเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังของทารกไทยในครรภ์

สรุป: ตารางอ้างอิงสำหรับทารกในครรภ์: ขนาดเส้นผ่าศูนย์กลางของสมองน้อยส่วนหลังได้แสดงในงานวิจัยนี้