



Research Article

EVALUATION OF FOETAL TRANSCEREBELLAR DIAMETER/ABDOMINAL CIRCUMFERENCE RATIO AS A GESTATIONAL AGE INDEPENDENT PARAMETER

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ABSTRACT

Background: Ultrasound biometry of the foetus is now the gold standard for assessing foetal growth and wellbeing. Biparietal diameter, head circumference, femur length, and abdominal circumference are commonly employed; also transverse cerebellar diameter is currently being used in assessment of the gestational age. Ratio of some of these foetal biometry such as HC/AC, BPD/AC, and FL/AC has been used to evaluate foetal growth and well being. TCD/AC ratio has been shown to be an accurate gestational age independent parameter in detecting small for gestational age or intrauterine growth restriction. Studies on normal TCD/AC ratio across the gestational age are scanty in Nigeria.

Aim: To derive population specific TCD/AC ratio for the assessment of normal foetal growth.

Matrrial and Method: This was a prospective observational study of 450 healthy singleton pregnant women between 13-42 weeks gestation referred to the Radiology Department of University of Benin Teaching Hospital Benin City. A 3.5 MHz curvilinear transducer of SONOACE X6 machine was used to measure the foetal TCD and Abdominal circumference. GA was determined using the foetal biometric parameters such as BPD, FL, and AC. The TCD/AC ratio was calculated by dividing the TCD by the AC and then multiplying by 100.

Result: The TCD/AC ratio assessed in this studied population is from gestational age of 13weeks to 42weeks. The TCD/AC ratio was fairly constant across the GA with a mean of 13.54 ± 0.58 . In the first trimester mean ratio was 13.22 ± 0.39 , while 13.36 ± 0.66 and 13.71 ± 0.44 were recorded for the second and third trimester respectively.

Conclusion: A population specific normal standard value is required for proper assessment of foetal growth which can be compared with those foetuses with intrauterine growth restriction (IUGR). The TCD/AC ratio in this study was fairly constant across gestational age with a mean value of 13.54 ± 0.58 .

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INTRODUCTION

Foetal biometry by ultrasound scanning provides the most reliable and important information about the foetal growth and wellbeing. Multiple foetal biometric charts are available for prediction of gestational age, which include CRL, BPD, FL, AC, and HC among others.¹ TCD is emerging as a new parameter and has been claimed to be more accurate in certain situations such as abnormal foetal head shape, extremes of growth (IUGR, big for gestational age), and long bone dysplasia.² The assessment of gestational age in early pregnancy is valuable in detection of growth aberration in later stage of pregnancy and also in distinguishing normal from abnormal foetal growth and development.³

accurate knowledge of gestational age.⁴ In most cases a serial evaluation is required to detect abnormal foetal growth when these standard normogram are used and thus this may delay appropriate foetal surveillance and/or intervention.⁵ Abdominal circumference (AC) is a widely used parameter in predicting early disturbance of foetal growth, but as it is obtained from a single examination, it is of limited value. Therefore a gestational age independent method for foetal growth assessment would be useful in managing patients with uncertain gestational age.⁵

While all foetal biometric parameters are affected by intrauterine growth restriction, the effect on the size of the cerebellar is very minimal.^{4,6} This is accounted for by the redistribution of foetal blood flow to the vital organs like brain, resulting in asymmetrical growth of the brain and the growth of the rest of the body which lags behind.⁷ Hence deviation of TCD/AC ratios and their sensitivities in determining IUGR in different studies could be due to

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different population types studies. Thus there is need to develop population specific TCD/AC ratio since foetal biometric parameters may be influenced by genetic and racial factors.

MATERIALS AND METHODS

This is a prospective observational ultrasound study of 450 healthy pregnant women in the Department of Radiology at University of Benin Teaching Hospital, Benin City, Nigeria from September 2011 to March 2012. Approval of the hospital’s Ethics and Research Committee was obtained. The subjects were those referred from antenatal clinic and were within 13 to 42 weeks gestation.

Only those who were certain of their last menstrual period (LMP) and had normal singleton pregnancy were included. Those with maternal conditions like diabetes, sickle cell haemoglobinopathy and pregnancy induced hypertension were excluded.

The scanograms were obtained with 3.5 MHz curvilinear transducer of SONOACE X6 machine (Medison Inc, Korea 2010). The foetal cerebellum was located by first using the horizontal plane of the foetal head to identify the cavum septum pellucidum and the thalamus as landmarks, similar to the plane for the biparietal diameter (BPD). The transducer was then slightly rotated caudally to bring the “butterfly” appearance of the cerebellum into view according to Meyer et al.⁴ The TCD was measured in the outer to outer fashion using the electronic callipers. The AC was measured from a transaxial view of the abdomen at the level of the junction of the umbilical vein with the left portal vein. The GA was calculated by measuring the BPD, FL, and AC. The TCD/AC ratio was calculated by dividing the TCD by the AC and multiplying by 100.⁴

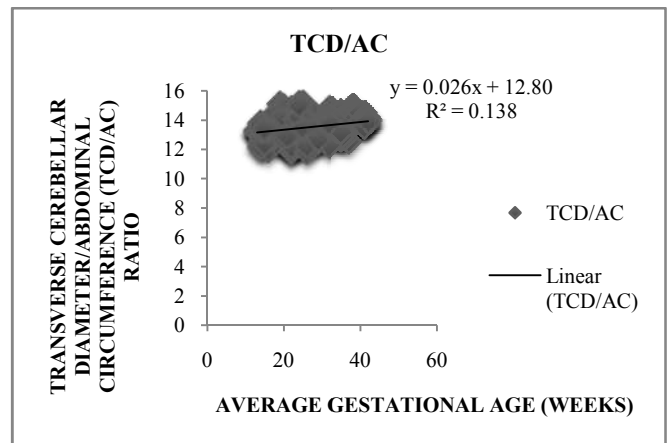
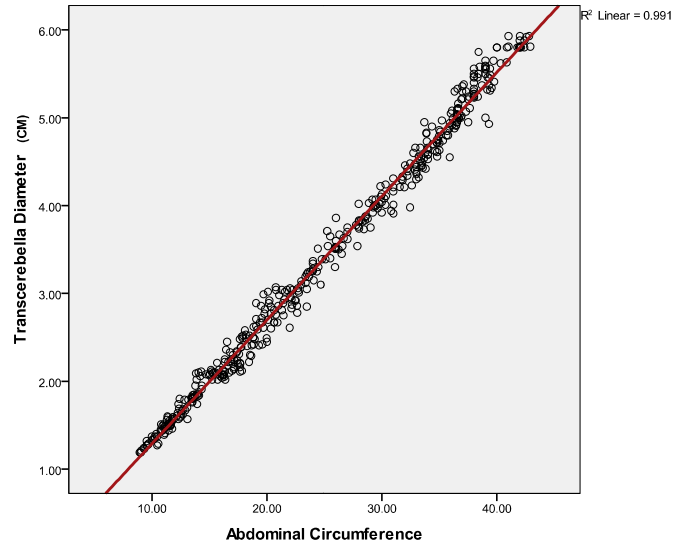
Data analysis was done using statistical Package for Social Science (SPSS) version 16.0. The TCD values and foetal biometric indices were tested for significance with analysis of variance (ANOVA) and Pearson’s correlation coefficients were used in analysis.

RESULTS

Four hundred and fifty healthy pregnant women with singleton intrauterine foetuses and gestational age range from 13-42 weeks who met the inclusion criteria were evaluated. The age range of the women was 15-45 years with a mean of 30.8 ± 4.4 years. The mean ± standard deviation (SD) menstrual age was 27.59 ± 8.12 weeks (range 13-42), the mean ultrasound gestational age (AGA) was 27.73 ± 8.03 weeks (range 13-42); there was a good correlation between the menstrual age and ultrasound dates (AGA) with r = 0.97. The GA group 33-37 weeks was the modal group scanned (111 women or 24.2%); followed by 23-27 weeks (81 women or 18.0%) and 14-22 weeks (78 women or 17.3%). Their parity ranged from 0 – 7. One hundred and seventy five subjects (38.9%) were nulliparous.

The TCD of the foetuses studied ranged from 11.9mm to 59.3mm with a mean value of 34.19 ± 14.07mm. There was significant correlation between TCD and gestational age (r=0.984, p < 0.000). Also FL, BPD, and AC all showed good correlation with gestational age (r = 0.974, 0.969 and 0.963) respectively. There was significant correlation between TCD and AC, r = 0.991. Although the TCD/AC ratio showed poor

correlation with GA (R² =.0138), it remained stable or fairly constant across the gestational age. The mean TCD/AC ratio was 13.54 ± 0.58% and the fifth and 95th percentile were 12.5 and 14.5% respectively, while the median value was 13.56%. Across the trimesters 13.23 ± 0.39%, 13.36 ± 0.66% and 13.71 ± 0.44% were recorded as the mean values of TCD/AC ratio for the first, second and third trimesters respectively.



DISCUSSION

Accurate and easily reproducible sonographic foetal biometric parameters for gestational dating are clinically important for optimal obstetric management of pregnancies. This is especially true in determining of variety of gestational tests, assessing adequacy of growth and timing of delivery for optimal obstetric outcome.⁸ It has been observed that the cortical blood flow is decreased in hypoxic foetus but cerebellar blood flow remained unchanged. Therefore, TCD/AC ratio is a good parameter for detecting IUGR in cases of uncertain dates because it utilizes parameters like abdominal circumference, which is the most sensitive parameter of the growth and TCD which is not affected or minimally affected from growth restriction resulting in an increased ratio reflecting IUGR regardless of GA.⁴

In this study TCD has a better correlation and predictive value (98.7% ± 5days) than the commonly used routine foetal biometric parameters which include FL(94.9 ± 13days), BPD(93.8% ± 14days), and AC(92.7% ± 15days). The superiority of TCD over other parameters as found in this study has been previously reported by some studies.^{2,4,9}

This study showed normal distribution of TCD/AC ratio with a mean \pm SD of 13.54 ± 0.58 , which was fairly constant between gestational ages of 13 – 42 weeks. This finding corroborated earlier finding by other studies.^{4,6,8,10} Meyer et al¹⁰ evaluated the relationship between foetal TCD/AC of 700 well dated normal pregnancies between 14 – 42 weeks in a prospective cross sectional analysis and also in 30 known SGA infants. They concluded that a strong correlation exist between TCD and AC. The mean TCD/AC ratio with 2SD was 13.69 ± 0.94 and the 10th and 90th percentile were 12.5 and 14.86% respectively. They also noted that TCD/AC ratio greater than the 90th percentile was present in 87% of the known SGA infants. Their finding especially in the normal infant is similar to that of this study.

The result of this study will help in developing a population specific TCD/AC ratio normogram and to detect IUGR particularly in women who present in the third trimester of pregnancy with unknown dates or no previous antenatal ultrasonography evaluation.

CONCLUSION

This study has produced population specific TCD/AC ratio with a mean \pm SD of 13.54 ± 0.58 which will help in assessing normal foetal growth.

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