



A STUDY ON FETAL TRANSCEREBELLAR DIAMETER TO ABDOMINAL CIRCUMFERENCE (TCD/AC) AND TO FEMUR LENGTH RATIO (TCD/FL) IN THE ASSESSMENT OF NORMAL FETAL GROWTH

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ABSTRACT

Intrauterine growth retardation (IUGR) is a major risk factor for perinatal mortality and morbidity. Trans-cerebellar diameter to abdominal circumference ratio (TCD/AC) is a gestational age dependent parameter. IUGR due to uteroplacental insufficiency can present as isolated femur length reduction. So, trans-cerebellar diameter to femur length ratio (TCD/FL) can be useful in early detection of IUGR. In this prospective study, 171 patients presenting for routine antenatal check up with cumulative ultrasound age (CUA) between 14-40 weeks were included. TCD/AC and TCD/FL were studied for individual subgroups formed according to CUA.

KEYWORDS

IUGR, Utero-placental insufficiency, Trans-cerebellar diameter, abdominal circumference, femur length TCD/AC, TCD/FL

INTRODUCTION:

Intrauterine growth retardation (IUGR) is a major risk factor for perinatal mortality and morbidity [1,2,3,4]. Early detection of IUGR is useful in deciding frequency of antenatal surveillance, optimal delivery timing and early neonatal management to avoid perinatal mortality and morbidity [2,5]. Most of the ultrasound parameters for detection of IUGR are gestational age dependent.

Trans cerebellar diameter to abdominal circumference ratio (TCD/AC) is a gestational age dependent parameter. IUGR due to uteroplacental insufficiency can present as isolated femur length reduction. So, trans cerebellar diameter to femur length ratio (TCD/FL) can be useful in early detection of IUGR. We intend to introduce a new parameter TCD/FL and observe its reliability throughout the pregnancy. If it remains constant, our objective is to formulate a cut-off value for diagnostic purpose.

Aims And Objective:

1. To evaluate the accuracy of TCD/AC in normal pregnancy at varying periods of gestation for assessment of fetal growth and to derive a cut-off value in our study population.
2. To evaluate utility of TCD/FL for assessment of fetal growth.

MATERIAL AND METHODS:

In this prospective study, 171 patients presenting for routine antenatal check up with cumulative ultrasound age (CUA) between 14-40 weeks were included. All cases with sonological evidence of IUGR are congenital anomaly were excluded. Routine ultrasound growth parameters and trans cerebellar diameter were measured in all patients. TCD/AC and TCD/FL were calculated in all patients. TCD/AC and TCD/FL were studied for individual subgroups formed according to CUA.

RESULT:

In our study, TCD and AC show strong correlation throughout pregnancy. TCD/AC dispersed normally with mean value of 14.06 and SD of 0.69. In our study, cut off value for TCD/AC is 15.44. TCD and FL also show strong correlation. TCD/FL is dispersed normally throughout pregnancy with mean value 64.427 and SD of 4.127. TCD/AC in subgroups also show similar mean and SD as compared to entire study population. TCD/FL in subgroups between 18-40 wks. show similar mean and standard deviation as compared to entire study population.

CONCLUSION:

Our study indicates strong correlation between TCD and AC throughout the pregnancy with constant TCD/AC. A cut off value of mean $\pm$ SD (15.44) could be used as a growth parameter for detection of IUGR. Further, in our study TCD and FL also show strong correlation throughout the pregnancy with constant TCD/FL especially between 18 to 40 wks. TCD/FL may specially be useful in detection of subset IUGR which present as isolated femur length. This may also be useful in detection of severity of IUGR. TCD/FL cut-off value (Mean + 2SD) arrived at 72.681 on the basis of this pilot study warrants validation with larger study populations including foetuses with IUGR.

DISCUSSION:

Trans-cerebellar diameter to abdominal circumference ratio:

IUGR due to uteroplacental insufficiency or asphyxia leads to centralisation of fetal blood flow with sparing of brain at the expense of other body parts [6]. Various primate models have proven that the blood flow to cerebellum even in acute asphyxia [7]. In IUGR, cerebellum is least affected and TCD remains one of the most reliable parameters for measurement of true gestational age [5,7].

IUGR leads to early depletion of hepatic glycogen and subcutaneous fat. This leads to early decrease in abdominal circumference [8]. Hence, abdominal circumference is considered ideal parameter for early detection of IUGR [8, 9, 10,11]. However, accurate date of LMP or prior 1st trimester dating scan is necessary for prediction of IUGR [12].

TCD/AC takes into account both least and most affected growth parameter, so even hypothetically TCD/AC is an ideal parameter for detection of IUGR. In their study of 700 patient Meyer et al concluded that correlation between TCD and AC is high between 14 to 40wks [7]. The study also concluded that TCD/AC remains constant between 14 to 40 weeks and has high sensitivity in detection of IUGR. TCD/AC has been confirmed as good age independent parameter for detection of IUGR by several other studies.

In our study, TCD and AC show strong correlation. TCD/AC dispersed normally with mean value of 14.06 with SD of 0.69. TCD/AC values of other studies with their SD is displayed in Table-1.

Table 1: Mean and standard deviation of TCD/AC in other studies

Study	Mean TCD/AC	SD
Dhumale et al [6]	13.56	1.21
Meyer et al [7]	13.68	0.96
Haller et al [9]	14.4	1.2
Dilmen et al [11]	14.36	1.06
Malik et al [113]	14.06	0.59

Mean and standard deviation of TCD/AC in our study population are comparable to earlier studies. Further, TCD/AC of subgroups also remains constant & mean and standard deviation are similar to entire study population.

Review of earlier studies reveals high sensitivity of cut off value of two SD above mean for detection of IUGR [6, 7 and 9]. In our study two SD above mean of TCD/AC is 15.44.

Cut off values of TCD/AC for IUGR in other studies displayed in Table-2.

Table 2: Cut off values TCD/AC in present study and earlier studies

Study	Cut off value for IUGR
Dhumale et al [6]	15.98
Tongsong T et al [13]	15.4
Campbell WA et al [114]	15.9
Present study	15.44

There is no significant difference in cut off value for TCD/AC of our study and earlier studies seen. Meyer et al in their study have represented 10th, 50th and 90th percentile of study population and by each week from 14 to 40 wks. [7]. In our study, difference in distribution may be attributed to difference in racial profile of study population.

Transcerebellar Diameter To Femur Length Ratio:

FL is the most commonly used growth parameter among all long bone. Villar et al concluded in early asymmetrical IUGR, which is usually caused by uteroplacental insufficiency is associated with sparing of head and CRL [13]. However, later Weisz et al associated isolated short femur length with IUGR and SGA [14]. Tardos et al and Zalel et al also described association between isolated short femur lengths with SGA likely caused by uteroplacental insufficiency [15,16].

Since, TCD is least affected parameter in IUGR, TCD/FL may be useful in detection of IUGR presenting initially as isolated FL reduction.

AC is affected early in IUGR due to utero-placental insufficiency, FL is affected later and TCD is least affected. So, TCD/FL may be used to assess the severity of IUGR along with TCD/AC.

In our study, TCD and FL show strong correlation. TCD/FL is distributed normally in entire study population with mean (+/- 2SD) measuring 64.427 (+/- 2x4.127). Among subgroups between 18-40wks mean and standard deviation remain comparable. Between CUA of 14 wks to 17wk 16d, mean (+/-) is 67.2(+/- 2x5.28). Higher dispersion of values is seen at this CUA range.

So, TCD/FL needs to be evaluated further in larger population with inclusion of participant with IUGR for its utility as a parameter for detection and assessment of severity of IUGR.

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