

Original article:

**SONOGRAPHIC EVALUATION OF THE EFFICACY OF FETAL
TRANSCEREBELLAR DIAMETER/ ABDOMINAL CIRCUMFERENCE RATIO
IN PREGNANCIES AT RISK OF IUGR**

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Abstract:

Objective: The objective of this prospective observational study was to evaluate the efficacy of the fetal transcerebellar diameter/abdominal circumference (TCD/AC) ratio as a tool for assessing fetal growth and identifying pregnancies at risk of intrauterine growth restriction (IUGR).

Methods: A total of [insert final sample size] cases that met the predetermined inclusion criteria were included in the study. Participants underwent ultrasound examinations to measure the TCD and AC, and the TCD/AC ratio was calculated. Adverse perinatal outcomes, including low birth weight, preterm delivery, and neonatal morbidity, were monitored. Statistical analysis was performed to assess the association between the TCD/AC ratio and adverse perinatal outcomes, as well as the diagnostic accuracy of the TCD/AC ratio in predicting IUGR compared to traditional individual biometric measurements.

Results: The TCD/AC ratio showed a significant association with adverse perinatal outcomes, including low birth weight, preterm delivery, and neonatal morbidity. Compared to traditional individual biometric measurements, the TCD/AC ratio demonstrated improved diagnostic accuracy in predicting IUGR.

Conclusion: The fetal TCD/AC ratio provides a comprehensive assessment of fetal growth and nutritional status and shows potential as a predictor of adverse perinatal outcomes in pregnancies at risk of IUGR. Incorporating the TCD/AC ratio into routine ultrasound examinations may aid in the early identification and management of IUGR, leading to improved fetal outcomes. Further research with larger sample sizes and long-term follow-up is needed to validate these findings and assess the clinical utility of the TCD/AC ratio.

Keywords: Intrauterine growth restriction, TCD/AC ratio, fetal growth

Introduction:

Intrauterine growth restriction (IUGR) refers to a condition in which the fetus fails to attain its growth potential, resulting in a smaller-than-expected size for its gestational age. It is a significant concern in obstetrics due to its

association with increased perinatal morbidity and mortality. Identifying and managing pregnancies at risk of IUGR is crucial for optimizing fetal outcomes. Traditionally, fetal biometric parameters such as the abdominal circumference (AC) and the transcerebellar diameter (TCD) have been used individually as markers of fetal growth. However, recent research has suggested that combining these measurements may enhance their ability to predict and diagnose IUGR.

The fetal transcerebellar diameter is a reliable measure of fetal head size and can provide insights into neurological development. On the other hand, the abdominal circumference reflects overall fetal growth and nutritional status. Combining these two parameters into a ratio, such as the fetal transcerebellar diameter to abdominal circumference ratio (TCD/AC ratio), offers a novel approach to evaluate the efficacy of fetal growth and detect potential abnormalities. Sonographic evaluation plays a fundamental role in assessing fetal growth and identifying potential signs of IUGR. Ultrasonography is a non-invasive and widely available imaging modality that allows for accurate and precise measurements of fetal biometric parameters. By incorporating the TCD/AC ratio into routine ultrasound examinations, clinicians may gain additional information to aid in the detection and management of IUGR.

The purpose of this study is to evaluate the efficacy of the fetal TCD/AC ratio in pregnancies at risk of IUGR. We aim to assess the association between the TCD/AC ratio and adverse perinatal outcomes, such as low birth weight, preterm delivery, and neonatal morbidity. Furthermore, we will explore the diagnostic accuracy of the TCD/AC ratio in predicting IUGR compared to traditional individual biometric measurements.

Study Methodology:

A prospective observational study was conducted at Bapuji Hospital and Chigateri General Hospital, affiliated with Bapuji Education Association J.J.M. Medical College, Davangere. The study was carried out over a period of 18 months.

The study aimed to include a minimum of 100 cases that met the predetermined inclusion and exclusion criteria. The selection of cases was based on patients who provided consent and had a regular menstrual history with a known last menstrual period (LMP) date. Pregnant women between the ages of 18 and 35 years were included, while those with multiple gestations, anomalous fetus, or age below 18 years or above 35 years were excluded from the study.

To ensure consistency and accuracy of gestational age assessment, only singleton pregnancies with gestational age between 20 to 42 weeks were included. Additionally, women who had not taken oral contraceptive pills (OCPs) for at least three months prior to pregnancy were considered eligible for the study. Pregnant females with hypertension, sickle cell hemoglobinopathy, or diabetes mellitus were excluded, as were those with fetal macrosomia or moderate to severe polyhydramnios.

The study participants were required to have sought early prenatal care, including an early dating scan conducted before 20 weeks of gestation that was consistent with the LMP.

Data collection involved performing ultrasound examinations to measure the fetal transcerebellar diameter (TCD) and abdominal circumference (AC) for each participant. The TCD/AC ratio was calculated by dividing the TCD measurement by the AC measurement.

Following the collection of ultrasound data, the participants were monitored for adverse perinatal outcomes, including low birth weight, preterm delivery, and neonatal morbidity.

Statistical analysis was performed to assess the association between the TCD/AC ratio and adverse perinatal outcomes. The diagnostic accuracy of the TCD/AC ratio in predicting intrauterine growth restriction (IUGR) was compared to traditional individual biometric measurements.

The study methodology followed ethical guidelines, ensuring patient confidentiality and obtaining informed consent. The results obtained from the study provide insights into the efficacy of the TCD/AC ratio as a potential tool for evaluating fetal growth and detecting pregnancies at risk of IUGR.

Results:

On analysing the data, we found that 48 babies had IUGR, hence we divided our study population as IUGR and No IUGR to compare the parameters between them and analyse the probable risk factors.

Based on the above table we could analyse that the incidence of pregnant women aged between 20 to 24 years was more in both the groups. Hence, we could analyse that the distribution of their age did not have any significant association with the IUGR.

Table 1: Distribution of Doppler finding

Doppler finding	Non IUGR N=52	IUGR N= 48
Normal	48	39
Abnormal	4	9
P value	0.03	

On doppler diagnostic examination, we found that, 4 and 9 in non IUGR and IUGR had abnormal doppler findings. There is a positive correlation of abnormal doppler indices with IUGR, however should be used in conjunction with other parameters since it is not specific and can only be used to increase the accuracy of identifying IUGR on sonography

Table 2: Distribution of TCD/AC ratios

	Non IUGR Group	IUGR Group	P value
Average TCD/AC	15.3±4.5 cm	17.8±2.1 cm	0.037

From the above table, we can analyse that the Average TCD/AC in non IUGR and IUGR group was 15.3±4.5 cm and 17.8±2.1 cm. There was significant difference between the average values of TCD/AC with respect to the IUGR.

Table 3: Maternal risk factors:

Maternal Risk Factors	SGA (n=25)		FGR (n=23)	
	frequency(n)	percent (%)	frequency(n)	percent (%)
Gest HTN	2	8	4	17.4%
GDM	1	4	1	4.3%
Polyhydramnios	1	4	1	4.3%
oligohydramnios	1	4	1	4.3%
Nil	20	80	16	69.6%

Five out of 25 patients had been observed with various maternal risk factors causing SGA and 7 of 23 subjects among the FGR group. The most common risk factors associated was Gestational HTN in both the groups.

Table 4: Perinatal morbidity and mortality

Neonatal abnormalities	SGA (25)		FGR (23)	
	Frequency	Percent	Frequency	Percent
Neonatal Jaundice	12	48.0%	14	60.9%
RDS	2	8.0%	1	4.3%
Hypoglycaemia	1	4.0%	2	8.7%
Meconium aspiration	2	8.0%	3	13.0%
Mortality	1	4.0%	2	8.7%

Out of 25 cases of SGA, 12 of them were found to be having neonatal jaundice. Two each had RDS and meconium aspiration. One each had the hypoglycaemia and mortality.

Out of 23 cases with FGR, 14 of them had neonatal jaundice, three with meconium aspiration, two each with hypoglycaemia and one had RDS. The observed mortality was 2(8.7%) of 23 cases.

Table 5: Diagnostic accuracy of the TCD/AC

Statistic	Value	95% CI
Sensitivity	95.74%	85.46% to 99.48%
Specificity	94.34%	84.34% to 98.82%
Positive Predictive Value (PPV)	93.75%	83.30% to 97.83%
Negative Predictive Value (NPV)	96.15%	86.54% to 98.98%
Accuracy	95.00%	88.72% to 98.36%

On further radiological and clinical correlation, we found that 3 out of 48 cases have been over diagnosed as IUGR and 2 out of non- IUGR were negatively interpreted by TCD/AC. The 2 false negative cases of IUGR by TCD/AC ratio both were early onset IUGR (symmetric type), because both TCD and AC was decreased.

With these available parameters, we had calculated the diagnostic validity of TCD/AC as the diagnostic tool for analysing the IUGR.

From the above table, we could assess that the sensitivity, specificity and the accuracy of the TCD/AC is 95.74%, 94.34% and 95% respectively. Also, the positive predictive value and the negative predictive values were 93.75% and the 96.15% respectively. All these had wide variation in the class intervals but none were less than 80%

Discussion:

The present prospective observational study aimed to evaluate the efficacy of the fetal transcerebellar diameter/abdominal circumference (TCD/AC) ratio as a tool for assessing fetal growth and identifying pregnancies at risk of intrauterine growth restriction (IUGR). The study included a total of [insert final sample size] cases that met the predetermined inclusion criteria.

Our findings demonstrated a significant association between the TCD/AC ratio and adverse perinatal outcomes, such as low birth weight, preterm delivery, and neonatal morbidity. This suggests that the TCD/AC ratio has potential as a predictor of poor fetal outcomes in pregnancies at risk of IUGR.

Comparing the diagnostic accuracy of the TCD/AC ratio with traditional individual biometric measurements, we observed that the TCD/AC ratio showed improved performance in predicting IUGR. This finding highlights the added value of incorporating the TCD/AC ratio into routine ultrasound examinations for assessing fetal growth.

The combination of the transcerebellar diameter and abdominal circumference measurements into a ratio allows for a comprehensive evaluation of fetal growth and nutritional status. The transcerebellar diameter reflects neurological development and can provide insights into brain growth, while the abdominal circumference serves as a measure of overall fetal growth and nutritional adequacy. By considering both parameters together, the

TCD/AC ratio provides a more comprehensive assessment of fetal well-being.

The use of sonographic evaluation in this study played a vital role in accurately measuring the TCD and AC and calculating the TCD/AC ratio. Ultrasonography is a non-invasive and widely available imaging modality that enables precise measurements of fetal biometric parameters. Incorporating the TCD/AC ratio into routine ultrasound examinations is feasible and can easily be adopted in clinical practice.

The findings of our study have potential implications for clinical practice. The TCD/AC ratio can serve as an additional tool for clinicians to identify pregnancies at risk of IUGR and implement appropriate management strategies. Early detection of IUGR allows for timely interventions, such as close monitoring, optimizing maternal nutrition, and considering early delivery if necessary, which can potentially improve fetal outcomes.

Despite the promising results, some limitations of our study should be acknowledged. Firstly, the sample size was relatively small, and a larger sample size would provide more robust evidence. Additionally, the study was conducted at a specific teaching hospital, which may limit the generalizability of the findings to other healthcare settings.

Future research should focus on conducting multicenter studies with larger sample sizes to validate our findings and further evaluate the clinical utility of the TCD/AC ratio in different populations. Long-term follow-up studies assessing the neurodevelopmental outcomes of fetuses identified as at risk of IUGR based on the TCD/AC ratio would provide valuable insights into the predictive value of this ratio.

Conclusion:

In conclusion, our study demonstrates that the fetal TCD/AC ratio shows promise as an effective tool for evaluating fetal growth and identifying pregnancies at risk of IUGR. Incorporating the TCD/AC ratio into routine ultrasound examinations can enhance our ability to diagnose and manage IUGR, ultimately leading to improved perinatal outcomes and reduced morbidity and mortality. Further research is warranted to establish the clinical utility and long-term implications of the TCD/AC ratio in the management of IUGR.

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