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ORIGINAL ARTICLE

Diagnostic Accuracy of TCD/AC Ratio in Predicting Intrauterine Growth Retardation

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ABSTRACT

Background: Fetal growth assessment is necessary for prediction of fetal health during pregnancy.
Aim: To determine the diagnostic accuracy of transcerebellar diameter / abdominal circumference ratio in predicting intrauterine growth retardation after 20 weeks gestation taking birth weight as gold standard.
Study design: Cross sectional study.
Methodology: Present study was conducted at Department of Obstetrics & Gynecology, Combined Military Hospital Kharian. Patients (n=80) with an age range of 18-40 years with singleton pregnancies at 20 weeks gestation were enrolled. All patients were assessed by ultrasound and TCD/AC ratio was calculated. All patients followed till birth and actual birth weight was obtained. All this information was recorded on Performa. **Statistical analysis:** Data was analyzed using SPSS version 26. Results were presented as frequency and percentage. Age was presented as mean± SD.
Results: The mean age of patients was 28.61±5.72 years. The mean gestational age was 21.96±1.50 weeks. For prediction of IUGR, TCD/AC had sensitivity, specificity, PPV, NPV & diagnostic accuracy of 85.29%, 91.3%, 87.88%, 89.36% & 88.75%, respectively.
Conclusion: It was concluded that TCD/AC ratio is an accurate diagnostic tool accuracy for prediction of IUGR during pregnancy.
Keywords: Transcerebellar Diameter, Abdominal Circumference, Intrauterine Growth Retardation and Birth Weight.

INTRODUCTION

Two factors that contribute to high morbidity and mortality due to intrauterine growth retardation (IUGR) include its high incidence (10%) and low recognition (<40%)[1]. The proper assessment of gestational age and fetal growth is of paramount importance in management of any pregnancy. Ultrasound is a reliable tool for detection of normal fetal growth and IUGR. Fetal head measurements by Biparital diameter, Transcerebellar diameter (TCD), body measurements by Abdominal Circumference (AC) and limb measurements by Femur Length has been used[2,3]. TCD is one of such fetal parameters that remain constantly superior in predicting gestational age both in singleton and multiple pregnancies even in abnormal skull shapes[4].

Poor fetal growth while in the mother's womb during pregnancy is IUGR.[5-7] Many reasons contribute to its incidence like poor maternal nutrition and inadequate oxygen supply to the fetus[8,9]. According to an estimate, almost 60% of the 4 million neonatal deaths/year occur globally by IUGR, preterm delivery and genetic abnormalities.[10] It results in small size baby for gestational age[11]. At the end of pregnancy, it results in a low birth weight babies. There is linear relationship between TCD and gestational age in both normal and IUGR pregnancies.[2] Prevalence of IUGR is 54% according to one estimate[3].

Trans-cerebellar diameter is the maximum transverse diameter of fetal cerebellum[12]. It lies in the posterior cranial fossa and it is protected by the strong bones. This protection contributes to withstand extrinsic pressure better than the parietal bones. Brain sparing phenomenon leads to its relative resistance to hypoxia.[1] Conversely abdominal circumference (AC) reflects the size of liver and volume of subcutaneous fat. In case of impaired fetal growth, earliest affected parameter is AC. One useful parameter in predicting IUGR is the TCD/AC ratio[4]. Due to its increasing prevalence and debilitating effect on the quality of life of the patients, we designed this study.

The objective of the study was to determine the diagnostic accuracy of TCD/AC ratio in predicting intrauterine growth retardation after 20 weeks gestation taking birth weight as gold standard.

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METHODOLOGY

Present study was a cross sectional study. Informed consent was taken prior to enrolling the patients into the study. Present study was conducted at Department of Obstetrics & Gynecology, CMH-Kharian after IRB permission. Patients (n=80) with an age range of 18-40 years with singleton pregnancies and symphysio fundal height less than 20cm at 20 weeks gestation were enrolled. All patients were assessed by ultrasound on 3 serial scans and TCD/AC ratio was calculated. All patients followed till birth and actual birth weight was obtained. Patients having Anomalous pregnancies, irregular menstrual cycle, BMI >40 and Premature birth i.e. <37weeks on LMP were excluded. All this information was recorded on Performa.

Statistical Analysis: SPSS v.26.0 analyzed data. The quantitative variables like age, gestational age BMI, TCD/AC ratio were presented as mean±SD. The qualitative variables like outcome (in term of IUGR on TCD/AC & Birth Weight were presented as frequency and percentages. Effect modifier like BMI was done and post stratification diagnostic accuracy test was applied with P value< 0.05 was considered significant.

RESULTS

Parameters like age, gestational age and BMI among all enrolled patients (n=80) throughout the current study was summarized as mean ± SD in table-1.

Table-1: Descriptive parameters among enrolled patients (n=80) as mean±SD

Variables	Mean ± SD	Minimum	Maximum
Age (years)	28.61± 5.72	19	39
Gestational age (weeks)	21.96±1.50	20	24
BMI (kg/m^2)	25.63±4.50	18.5	34.9

Table 2: TCD/AC, birth weight & IUGR among patients (n=80)

Variables	Mean ± SD	Minimum	Maximum
TCD / AC	13.17±2.21.	10.20	16.97
IUGR	Positive	33	41.25%
	Negative	47	58.75%
Birth weight (kg)	2.55±0.59	1.52	3.48
IUGR	Positive	34	42.5%
	Negative	46	57.5%

The mean TCD/AC on ultrasound was 13.17±2.21. There were 33 (41.25%) positive for IUGR while 47(58.75%) were negative for IUGR as shown by table-2. The mean birth weight was 2.55±0.59kg. There were 34(42.5%) positive for IUGR while 46(57.5%) were negative for IUGR.

For prediction of IUGR, TCD/AC had sensitivity, specificity, PPV, NPV and diagnostic accuracy of 85.29%, 91.3%, 87.88%, 89.36% and 88.75%, respectively as shown in table-3.

Table 3: Accuracy of TCD / AC taking birth weight as gold standard

IUGR on TCD/AC	IUGR		Total
	Positive	Negative	
Positive	29	4	33
Negative	5	42	47
Total	34	46	80

Data was stratified for BMI of patients. In normal weight patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 33.33%, 100%, 100%, 94.59% and 94.74%, respectively. In overweight patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 85%, 71.43%, 89.47%, 62.5% and 81.48%, respectively. In obese patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 100%, 50%, 84.62%, 100%, 86.67%, respectively as shown in table-4.

Table-4: Accuracy of TCD / AC stratified for BMI

BMI	TCD/AC	IUGR		Total
		Positive	Negative	
Normal	Positive	1	0	1
	Negative	2	35	37
	Total	3	35	38
Overweight	Positive	17	2	19
	Negative	3	5	8
	Total	20	7	27
Obese	Positive	11	2	13
	Negative	0	2	2
	Total	11	4	15

DISCUSSION

In case of impaired fetal growth, earliest affected parameter is AC. One useful parameter in predicting IUGR is the TCD/AC ratio. Head circumference is another parameter which resists changes exerted by external pressure thus causing deformation of fetal head and growth alterations. Many past studies have compared the efficacy of several gestational age independent parameters but concluded that TCD/AC is a better predictor of asymmetric IUGR[1,11].

In our study, the mean birth weight was 2.48±0.57kg. There were 34(42.5%) positive for IUGR while 46(57.5%) were negative for IUGR. The mean TCD/AC on ultrasound was 14.31±2.52. There were 33++(41.25%) positive for IUGR while 47 (58.75%) were negative for IUGR. For prediction of IUGR, TCD/AC had sensitivity, specificity, PPV, NPV and diagnostic accuracy of 85.29%, 91.3%, 87.88%, 89.36% and 88.75%, respectively.

One previous study held in India showed linear relation of trans-cerebellar diameter in IUGR fetuses with gestation. Their results showed parameters like sensitivity, specificity and DA were 88%, 93.5% and 92.4% respectively for TCD/AC ratio in predicting IUGR. Thus morphometric ratio TCD/AC is gestational age independent parameter thus can be used in detecting IUGR with good diagnostic accuracy[1]. Another study concluded that TCD/AC ratio showed better diagnostic validity and accuracy in comparison to HC/AC ratio[13].

In our study, the mean BMI of patients was 25.63±4.50kg/m^2. Data was stratified for BMI of patients. In normal weight patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 33.33%, 100%, 100%, 94.59% and 94.74%, respectively. In overweight patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 85%, 71.43%, 89.47%, 62.5% and 81.48%, respectively. In obese patients, sensitivity, specificity, PPV, NPV and diagnostic accuracy of TCD/AC were 100%, 50%, 84.62%, 100%, 86.67%, respectively. Our results were in line with many studies that measured the accuracy of TCD/AC in predicting IUGR.

Limitations: Limited funds with resources and short duration of study were the limitations.

CONCLUSION

It was concluded that TCD/AC ratio is an accurate diagnostic tool accuracy for prediction of IUGR during pregnancy.

Authors' Contribution: NA&UA: Conceptualized the study, analyzed the data, and formulated the initial draft, **RZ:** Contributed to the proof reading, **RK:** Collected data

Conflict of Interest: None to declare

Financial Disclosure: None

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