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DIAGNOSTIC ACCURACY OF SONOGRAPHICMEASURES TRANSCEREBELLAR DIAMETER/ABDOMINAL CIRCUMFERENCE VERSUS HEAD CIRCUMFERENCE/ABDOMINAL CIRCUMFERENCE FOR PREDICTION OF ASSYMETRIC INTRAUTERINE GROWTH RESTRICTION

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ABSTRACT

Background: Out of many gynecological issues Intrauterine growth restriction (IUGR) is the most common one especially in the females of reproductive age. **Objective(s):** Main objective of the study is to evaluate the accuracy of ultra-sonographic determination of TCD/AC vs HC/AC and to determine more sensitive and specific measure for the determination of IUGR. **Methodology:** For the current study (N=405) females with singleton pregnancy having gestational age between 18-35 weeks and carrying fetuses with no congenital anomaly were substituted. All of the samples were obtained after getting informed consent at Government Haji Abdul Qayyum Teaching Hospital Sahiwal. Ultra-sonographic determination of BPD, FL, TCD, AC, HC and EFW were measured and subjected to analysis for the findings. **Results:** Findings of the study show that among all of the measures determination of ratio TCD/AC most

significant as it shows the area under curve (AUC) to be about 0.911 which is significantly higher as compared to that AUC for of HC/AC (0.652). Moreover, specificity and sensitivity of the ratio remained significantly higher for TCD/AC (88%, 69%) respectively as compared to all other gynecological measures. It shows that the best cut-off value of TCD/AC ratio is 14.3%. **Conclusion(s):** Study concludes on the basis of analysis of the measures obtained from the pregnant females that ratio of TCD/AC was more accurate as compared to the ratio of HC/AC. As signified by the literature the said ratio is far more helpful in the determination of IUGR in early stages in pregnant females.

Keywords: Intrauterine growth restriction (IUGR), Trans-cerebellar Diameter (TCD), Femur Length (FL), Biparietal Diameter (BPD)

INTRODUCTION

The high incidence of IUGR and its low recognition is one vital cause that leads to the ever increasing perinatal morbidity and mortality that makes the identification and management of IUGR significant for gynecologists and obstetricians to overcome the said situation. There are number of studies that have tried to compare the diagnostic efficacy of different sonographic measures in the case of asymmetric intrauterine growth restriction **[1]**. There are different sonographic measures available for the determination of IUGR although, these measures have their own limitations. There is sonographic measurement of biparietal diameter, transverse cerebellar diameter, abdominal circumference, femur length etc. but all of the said measurements are required to be related with the gestational age for significant results. Transverse cerebellar diameter (TCD) is a measure that can rule out inaccuracy without being related with the gestational age and it serves as one of the accurate marker that can be used to determine the gestational age **[2]**. Gestational age is the measurement of the time period for which the fetus is present in the womb of mother. The time period starts from the last menstrual cycle (LMC) and extends to the day of delivery that cumulatively accounts for around 42 weeks **[3]**. The ratio of transverse cerebellar diameter to abdominal circumference and of head circumference to abdominal circumference are also independent of gestational age and can thus, serve as few of the significant markers for the determination and identification of asymmetric intrauterine growth restriction (IUGR). Transverse cerebellar diameter (TCD) is the maximum transverse diameter

of the fetal cerebellum that is present in the posterior cranial fossa. The discussed diameter is quite resistant to the growth deviation and external pressure that is why it is considered as one significant tool in the determination of gestational age. Conversely to the fact fetal abdominal circumference (AC) is one of the earliest parameter that is affected in the process of impaired intrauterine growth of the fetus **[4]**. Due to the significance of the TCD and AC in the determination of gestational age and impaired intrauterine growth of the fetus of the said parameters i.e., TCD/AC serves as one useful predictor for the IUGR. Similarly, there another parameter that remains minimally affected with the external pressure is head circumference (HC) and ratio of HC/AC is another parameter that is used in the determination of early IUGR. Although there are number of studies stating the accuracy of the applied techniques especially, to check if the ratio of TCD/AC is more accurate as compared to the ratio of HC/AC. Studies implicated in the recent years reflect the ration of TCD/AC to be more accurate measure that can be employed in the determination of early IUGR. Abdominal circumference is measured in the axial plane that is incorporated with fetal stomach bubble, umbilical vein and portal sinus. While in the determination of ratio of TCD/AC cerebellum is located in the well protected posterior cranial fossa and network of strong bones around it. Due to such stronger network of bones it can withstand the extrinsic pressure better than that of parietal bones **[5]**. Abdominal circumference (AC) reflects the size of the liver thus it explains the situation of fetal malnutrition. Abdominal circumference (AC) is way more good predictor in the growth restriction than other of its relative sonographic measures such as biparietal diameter (BPD) and femur length (FL). Thus estimation of the TCD/AC ratio can be considered as significant measure for the estimation of intrauterine growth restriction (IUGR). Similarly, of head circumference to abdominal circumference (HC/AC) compares organs in the malnourished fetuses it may help in estimating, it can also serve as a measure for the determination of asymmetric IUGR **[6]**.

It has been observed IUGR newborn have varied features of malnutrition. IUGR usually has large head the body this condition scientifically called as brain sparing effect. They have poor formation of membranous bones including large and wide anterior fontanelle. IUGR newborn apparently look like old man because of the absence of buccal fat. IUGR newborns have small or

scaphoid abdomen, thin umbilical cord often stained with meconium, decreased skeletal muscle mass, deceased subcutaneous fat tissue, long finger nails, easy peelable skin, anxious and hyper alert infant, relatively large hands and feet, more than three loose folds of skin (including nape of neck, axilla, inter-scapular area and gluteal region), poor breast bud formation and immature female genitalia **[7]**.

MATERIALS AND METHODS

For the present study four hundred and five (n=405) females with intrauterine growth restriction (IUGR) from Government Haji Abdul Qayyum Teaching Hospital Sahiwal were substituted. Determined by first trimester scan and no congenital anomaly were included. Whereas, females with reported gestational diabetes, history of irregular cycles and preterm birth were excluded from the current study. Ultrasonographic evaluation was carried out and i.e., TCD, HC, AC, FL, EFW, GA, BPD were measured with the help of Xario100 USG machine.

Descriptive statistics, ROC curve, T test and specificity/sensitivity were performed with the help of SPSS v.21. Findings were expressed in the form of Mean±S.D where $p<0.05$ shows the significance. While specificity and sensitivity was explained in the terms of area under curve (AUC). Greater the AUC relates higher the specificity and sensitivity of the performed parameters.

RESULTS

Results of the following study demonstrates the accuracy of the sonographic measures in the diagno asymmetric intrauterine growth restriction (IUGR). Sonographic measures i.e., BPD, FL, HC, AC, TCD, TCD/AC and HC/AC of the samples show TCD/AC as one of the significant in the determination of IUGR. Results of the findings suggests the area under curve (AUC) for the performed variables curve. Findings TCD/AC to be the most specific and sensitive marker for the determination of IUGR. TCD/AC shows the AUC of 0.911 that remains the maximum as compared to all other performed parameters [TCD (0.791), AC (0.667), HC (0.743), HC/AC (0.652), EFW (0.698), FL (0.718), BPD (0.742) and GA (0.745)] as shown in table 01. Area under curve for the transverse cerebellar diameter (TCD) is also quite significant which is almost to 0.791. Results of the findings show the cut-off value of ratio of TCD/AC around 14.3% and HC/AC to be 1.1%. While the specificity and sensitivity of TCD/AC is recorded to be a lot more than that of HC/AC i.e., 80%, 70%,91% and 78%

respectively. Negative predictive variable and Positive predictive variable (NPV and PPV) of the TCD/AC and HC/AC expresses the higher accuracy of the ratio of TCD/AC in determining intrauterine growth restriction (IUGR). Such PPV for both variables were recorded as 63% and 59% while NPV remained 57% and 41% respectively. Ratio of TCD/AC has served as prime significant marker in the determination of IUGR in early trimesters of pregnant females and therefore, the accuracy of the said ratio the other markers that have been served to determine the condition with the help of ultrasonography (USG). Whereas, rest of parameters were not that significant in the early determination of asymmetric intrauterine growth restriction (IUGR). Descriptive statistics performed within the results of findings show that the ratio of TCD/AC as the hallmark for the determination of IUGR. Values increasing the benchmark may relate to the higher the risk of developing IUGR in the subjects. Findings of the study also suggest significant increase in the TCD/AC ratio in the patients suffering from IUGR as compared to the control. Current findings demonstrate significant differences in the ratio of TCD/AC as ratio remained (12.46±0.4) in non-IUGR fetuses while in the IUGR-fetuses (14.3±1.06).

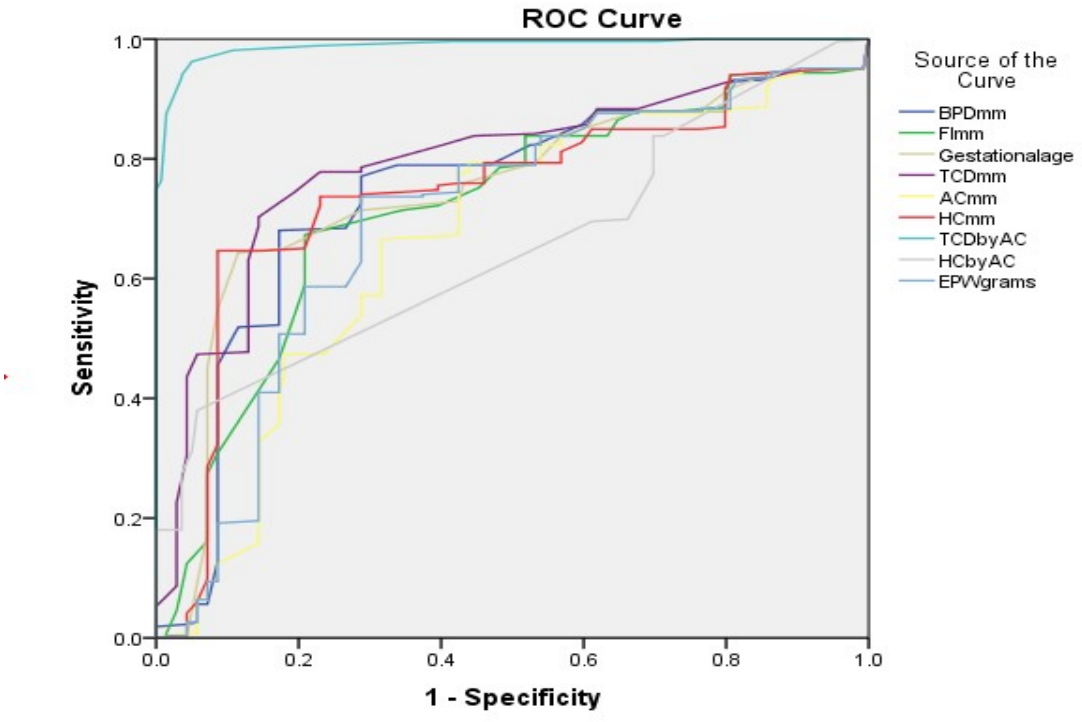

Figure 1: ROC analysis of fetal measures in the females with IUGR

Table 1: Area Under the Curve obtained by the ROC Curve Analysis of the parameters

AREA UNDER THE CURVE	
TEST RESULT VARIABLE(S)	AREA
TCDmm	0.791
ACmm	0.667
HCmm	0.743
TCD/AC	0.911
HC/AC	0.652
EFWgrams	0.698
FLmm	0.718
BPDmm	0.742
Gestational Age	0.745

Table 2: Specificity of TCD/AC and HC/AC

	TCD/AC	HC/AC
Specificity	88%	41%

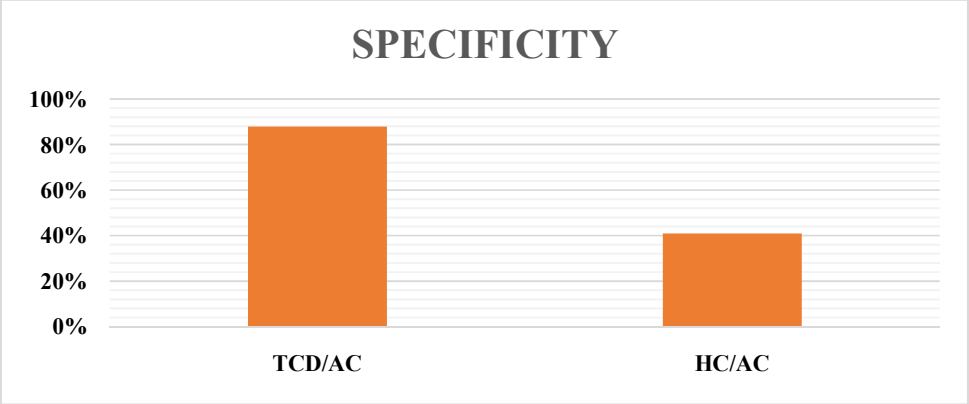

Figure 2: Specificity of TCD/AC and HC/AC

Table 3: Sensitivity of TCD/AC and HC/AC

	TCD/AC	HC/AC
Sensitivity	69%	49%

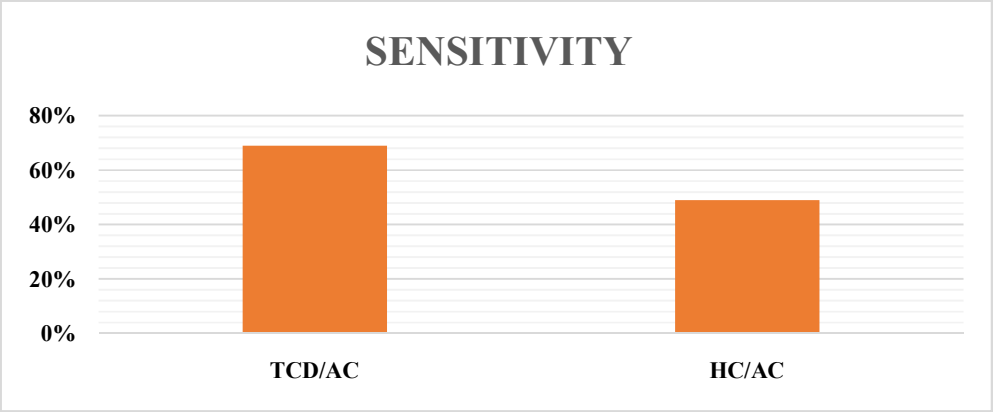

Figure 3: Sensitivity of TCD/AC and HC/AC

DISCUSSION

Intrauterine growth restriction is a major neonatal health issue. The term IUGR generally should be assigned only to those infants with birth weight or birth length below the 10th percentile for GA with a pathologic restriction of fetal growth. Infants with intrauterine Growth Restriction (IUGR) or Small for gestational age (SGA) are at increased risk of perinatal morbidity and mortality. IUGR is a type of fetal growth which is less than the growth potential of a specific infants as per the race and gender of the fetus. IUGR is a deprived fetal growth pattern and it is the outcome of innate reduced growth potential or due to multiple adverse effects on the fetus. In medical literature, IUGR and small for gestational age (SGA) usually use but slight difference exists between them. IUGR is a common cause of perinatal morbidity and impaired growth during childhood. SGA are neonates whose birth weight is less than the 10th percentile for gestational age as per the population growth charts. SGA can be moderate or severe if it is moderate than birth weight would be from 3rd or 10th percentile and if it is severe then birth weight would be less than the 3rd percentile. IUGR or SGA are at increased risk of perinatal morbidity and mortality. The term IUGR usually implies to neonates born with clinical features of malnutrition and in-utero growth retardation, irrespective of their birth weight percentile **[8]**.

IUGR is found to be the communal outcome of maternal, placental, fetal or genetic factors. Besides an assessment of maternal factors for IUGR. IUGR can also be caused by the combination of any of these factors. Symmetric IUGR fetuses may present at an earlier stage in gestation and incidence of total Symmetric IUGR are 20 to 30%. The antenatal scan head circumference, Abdominal circumference, Biparietal diameter and Femur length are observed to be proportionally reduced on the other hand cell number are reduced and cell size is normal. Difference between the head and chest circumference would be less than 3cm. In Symmetrical IUGR features of malnutrition are less pronounced and prognosis will be poor. On the other hand, Asymmetrical IUGR present at the later gestational stages and incidence of Asymmetric IUGR are 70 to 80%. Abdominal circumference decreased Biperietal diameter while Head circumference and femur length will be normal. The difference between the head and chest circumference will be more than 3cm. The features of malnutrition will be more

pronounced and prognosis will be good. Maternal malnutrition and uteroplacental inadequacy causes asymmetric IUGR while congenital infections encounter early in pregnancy cause symmetric IUGR **[9]**.

Many studies suggest fetal deformity may also lead to IUGR. Fetal deformities cause inborn error of metabolism (including agenesis of pancreas, congenital absence of islets of Langerhans, congenital lipodystrophy, galactosemia, hypophos-phatasia, transient neonatal diabetes mellitus, Leprechaunism), chromosomal abnormalities (including trisomies 13, 18, 21, autosomal deletions, ring chromosomes, uniparental disomy), 50-70% of SGA fetuses with fetal growth appropriate for maternal size, multiple gestation, congenital infections (TORCH, Malaria, congenital HIV infection, syphilis), major congenital anomalies (trachea-esophageal fistula, congenital heart disease, congenital diaphragmatic hernia, anorectal malformation), genetic syndrome (bloom syndrome, Russell-Silver syndrome, Brachmann-de Lange syndrome). With the recent advancement in the field of molecular biology and genetics, role of various maternal, fetal and placental genes polymorphism has become important and has now been implicated as a cause of IUGR **[10]**.

CONCLUSION

Current study concludes that one of the most important complications come across during pregnancy is intrauterine fetal growth restriction. The growth-restricted fetus is at menace for adverse perinatal morbidity and mortality. Sonographic fetal parameters are regularly examined for gestational age prediction. Now-a-days, Fetal ultrasonic biometry is used for evaluating growth of fetus. Numerous diameters and circumferences included biparietal diameter (BPD), femur length (FL), head circumference (HC) and abdominal circumference (AC) have been deliberated regarding their association with the gestational age but these all are gestational age dependent. Two morphometric ratios, TCD/AC and HC/AC, are considered to be independent gestational age parameters and can be used in predicting intrauterine growth retardation (IUGR) with better diagnostic precision. The current study has revealed a strong significant correlation between TCD and AC throughout the pregnancy time with constant TCD/AC with a cut off value of 14.38 could be used as a growth factor for IUGR detection. And also evident that TCD/AC ratio had a better diagnostic legitimacy and accuracy compared to HC/AC ratio in detecting asymmetric IUGR.

CONFLICT OF INTERESTS

Author declare no conflict of interests

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