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A study to determine the correlation between transverse cerebellar diameter and gestational age among the pregnant women in second and third trimester

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Abstract: *Background:* With advent of ultrasound, fetal changes are efficiently illustrated by ultrasonography with the evolving parameters as indicators of intrauterine growth. *Methods:* A prospective study was conducted on pregnant women in second and third trimester presented to the Department of Radio Diagnosis, Navodaya Medical College Hospital and Research Centre, Raichur. *Result:* Study results showed that TCD and GA was highly correlated with BPD, FL, AC and HC with p-value < 0.0001. *Conclusion:* It was concluded that TCD and GA was well correlated with various ultrasonic parameters including BPD, FL, AC, HC and TCD. The correlation between GA and TCD in IUGR pregnancies was highly significant with (R^2 =0.85).
Keywords: Transverse cerebellar diameter, Gestational Age, Pregnant women, Trimester.

Abbreviations: IUGR-Intrauterine growth restriction, TCD- Transverse cerebellar diameter, GA-Gestational Age, BD-Biparietal diameter, FL-Femur length, HC- Head circumference, AC- Abdominal circumference.

Introduction

A pregnancy ultrasound is an imaging test that uses sound waves to create a picture of how baby is developing in the womb [1]. Accurate assessment of gestational age (GA) and fetal development is critical for optimal obstetric care during delivery [2]. Transverse Cerebellar Diameter (TCD) is a more accurate & better predictor of gestational age in normal as well as in IUGR fetuses. In intra uterine growth restricted (IUGR) Fetuses, the transverse cerebellar diameter does not get affected due to insufficiency of fetal circulation and so can be used as an unbiased measurement of gestational age [3].

Planning pregnancy care, especially for low birth-weight infants, depends heavily on fetal age and its growth. The mortality rate is reduced by 60% when low birth weight pregnancies are ultrasound examined and handled [4]. TCD is significant useful biometric parameter in estimating gestational age (GA) in the second trimester [5]. Measurement of TCD is particularly informative when IUGR is suspected or Gestational age is unknown [6]. The most commonly used biometric parameters to determine the fetal growth include biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL) [7]. Diseases that alter the shape of the skull, such as clench cephaly and brachycephaly, affect BPD, awell-known indicator of GA, thus leaving few limitations on these parameters [8-9].

Measurement of cerebellar transverse diameter has emerged as a new biometric parameter to assess fetal growth [10-13] because TCD is located deep in the brain and protected by the bony pyramidal crest, it is rarely affected by diseases that change the shape of the skull [14]. Usually, the

cerebellum transverse diameter (mm) corresponds roughly to gestational age, especially between 14and 20 weeks of gestation. Determining fetal growth restriction is paramount [15].

Aims and objectives of the study: The study was conducted;

1) To determine the correlation of TCD & GA with ultrasonic parameters in normal pregnancy
2) To determine the correlation of GA with BPD, FL, AC, HC in IUGR pregnancy
3) To evaluate correlation between GA and TCD

Material and Methods

This study of ultrasonography estimation of gestational age by transcerebellar diameter in normal and intrauterine growth retarded pregnancies was conducted on 100 pregnant women (80 normal pregnancies and 20 IUGR pregnancies). These 100 women recruited into the study from routine antenatal clinic (OPD) and in patients admitted (IP) into Navodaya Medical College Hospital & Research Center, Raichur.

Sampling procedure: Data regarding TCD and GA with ultrasonic parameters were collected from Navodaya Medical College Hospital & Research Center, Raichur. A total number of 100 scans were performed between 15 and 40 weeks out of which 80 were in the group unassociated with any medical disorder and 20 were in the group of intra uterine growth retarded pregnancies

Statistical techniques used: The collected data were analyzed using correlation and regression analysis. The ultrasonic parameters TCD, BPD, FL, AC and HC were compared with GA by regression analysis. TCD was compared with BPD, FL, AC and HC using correlation statistics in both normal and IUGR pregnancy groups.

Results

Table no 1 revealed that the patients with normal pregnancies were aged between 18 to 32 years with a mean of 21.9 years with SD of 3.18. The patients with IUGR pregnancies were aged between 17 to 30 years with a mean of 22.8 and SD of 3.38 years. There was no statistically significant difference (P=0.26) between the two groups with respect to age.

Table-1: Comparison of mean age of Normal and IUGR pregnancy patients

Pregnancy	Mean	SD	p-value	Result
Normal	21.9	3.8	0.26	NS
IUGR	22.8	3.38		

Table no 2 revealed that, Among the 80 patients with normal pregnancies 45 were primigravida, 18 were gravida-2, 15 were gravida-3 and 2 were gravida-4. Among 20 patients with IUGR pregnancies 11 were primigravida, 5 were gravida-2, 3 were gravida-3 and 1 was gravida-4.

Table-2: Frequency & percentage Distribution of normal and IUGR pregnancy patients according to parity

Parity	Normal pregnancies	%	IUGR Pregnancies	%
Primigravida	45	56.3	11	55.0
Gravida-2	18	22.5	5	25.0
Gravida-3	15	18.7	3	15.0
Gravida-4	2	2.5	1	5.0
Total	80	100.0	20	100.0

The regression analysis from the table no 3 & table no 4 revealed that TCD and GA was well correlated with various ultrasonic parameters including BPD, FL, AC, HC and TCD with (R^2>0.9) and the relationship was curvilinear, best described by a polynomial equation of the second order.

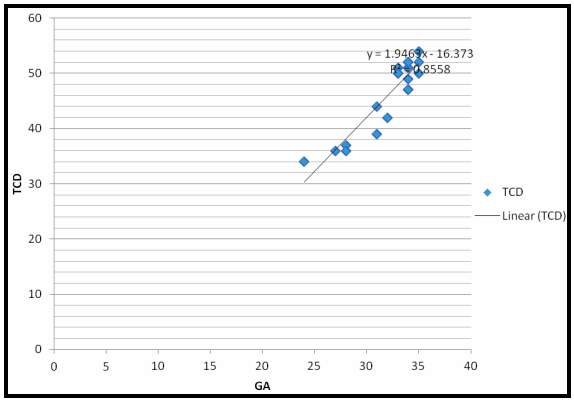
Table-3: Correlation of TCD with BPD, FL, AC and HC in normal pregnancies		
Parameters Compared	**R^2**	**p-value**
TCD versus BPD	0.89	0.0001
TCD versus FL	0.94	0.0001
TCD versus AC	0.90	0.0001
TCD versus HC	0.90	0.0001

Table-4: Correlation of GA with BPD, FL, AC and HC in normal pregnancies		
Parameters compared	**R^2**	**p-value**
GA vs BPD	0.98	0.0001
GA versus FL	0.97	0.0001
GA versus AC	0.99	0.0001
GA versus HC	0.98	0.0001
GA versus TCD	0.95	0.0001

Table no 5 showed that in IUGR pregnancies the gestational age was correlated tovarious ultrasonic parameters including BPD, FL, AC and HC. The high correlation was seen between gestational age and other parameters including BPD (R^2 = 0.92), FL (R^2 = 0.83), AC (R^2 = 0.90) and HC (R^2 = 0.95).

Table-5: Correlation that is R^2 and P value GA with BPD, FL, AC, HC in IUGR pregnancies		
Parameters compared	**R^2**	**p-value**
GA vs BPD	0.92	0.0001
GA versus FL	0.83	0.001
GA versus AC	0.90	0.001
GA versus HC	0.95	0.001
GA versus TCD	0.85	0.001

Fig-1: Linear regression showing relationship between GA and TCD in IUGR pregnancy



From figure 1 showed that in IUGR pregnancies the gestational age was correlated to TCD.The correlation between GA and TCD was highly significant with (R^2 =0.85).

Discussion

The transverse cerebellar diameter, biparietal diameter, femur length, abdominal circumference and head circumference were measured in all the cases to assess the gestational age of the fetus and an attempt was made to detect the correlation between all these parameters and gestational age. An attempt was also made to know correlation between TCD and other parameters.In our study we have found a good correlation between BPD and gestational age.

The estimated gestational age by measuring BPD in the second trimester and early third trimester was more consistent where as it varied in the late third trimester. In the late third trimester alteration in the shape was found due to moulding in most of the cases.

We above discussion concludes about the uncertainty in the estimation of gestational age, which is further amplified in cases of fetal growth retardation, which are further hampered by lack of precise estimation of gestational age, leading to difficulty in determining whether a fetus is truly growth retarded, constitutionally small for age or appropriately grown, but with incorrect gestational age. To solve this dilemma estimation of gestational by transcerbellar diameter has been found to be of much advantage.

In our study, it was seen that correlation between TCD and GA was 0.85 with p-value =0.0001 which is statistically significant, these findings are similar to the study conducted by Meyer WJ et al (1993) [16], Goel P. et al (2010) [17].

Conclusion

In our study, it was concluded that Fetalbiparietal diameter, femar length, abdominal circumference and head circumference measurements of the fetus in normal pregnancies were comparable with

transcerebellar diameter measurement between 15 and 40 weeks of gestation.

Transcerebellar diameter is an added advantage in causes of IUGR pregnancies as it correlates well with the gestational age as compared to other growth parameters .TCD can also be used as a single growth parameter to predict the gestational age using the various formulas obtained both in normal and IUGR pregnancies.

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