



## PREDICTION OF TRANSVERSE CEREBELLAR DIAMETER AS A BETTER INDICATOR FOR ESTIMATION OF GESTATIONAL AGE IN SECOND TRIMESTER

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**ABSTRACT** **INTRODUCTION:** Gestational age determination is of utmost importance in the care and management of the pregnant women. Transverse cerebellar diameter (TCD) is a useful biometric parameter in estimating gestational age (GA) in the second trimester. TCD may be a more reliable predictor than biparietal diameter, since the posterior fossa is not affected by external pressure including fetal malposition, breech presentation or oligohydramnios, which may induce distortion of the fetal head. TCD can reliably be used in cases of femur achondroplasia where femur length is unreliable.

**AIMS AND OBJECTIVE:** To predict gestational age using TCD and BPD measurement in second trimester and correlate the predictions of gestational age from second trimester by comparing TCD and BPD.

**MATERIALS AND METHODS:** Present study was done on 100 pregnant women in the Department of Radio diagnosis, SIMS, Hapur from the month of October 2016 to March 2017. Study group included antenatal women between 14 to 28 weeks of gestation by applying simple random technique. Ultrasonography (USG) were done between 14 to 28 weeks of POG, after filling PNDT form.

**RESULT:** The Pearson's correlation coefficient was found to be 0.958 for TCD and 0.877 for BPD. Although correlation was found to be statistically significant in both TCD and BPD groups but GA had better correlation with TCD than the BPD ( $p < 0.001$ ).

**CONCLUSION:** The present study has revealed that both TCD and BPD have good correlation with the LMP for the prediction of gestational age in second trimester, however TCD has a better correlation with LMP than BPD for the gestational age estimation.

**KEYWORDS :** Transverse Cerebellar Diameter (TCD), Gestational Age (GA), Ultrasonography (USG), Period of Gestation (POG)

### INTRODUCTION

Gestational age determination is of utmost importance in the care and management of the pregnant women. There are three primary methods of gestational age estimation: estimation based on last menstrual period (LMP), ultrasound-based gestational age estimation and neonatal estimating gestational age. The commonly employed method and the standard of care in monitoring gestation is antenatal ultrasound examination. Based on certain fetal parameters the gestational age is calculated and compared with period of gestation to look for fetal growth. The commonly employed fetal parameters for estimating gestational age include biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL). The accurate measurement of these parameters depends a lot on fetal lie, shape of skull, location of placenta, flexion of fetal head and engagement, maternal obesity and multiplicity of gestation. More recently another fetal parameter, transverse cerebellar diameter (TCD) has evolved as a promising indicator for assessing fetal growth and gestational age. Fetal transverse cerebellar diameter (TCD) is independent of fetal head shape and is an easily measurable dimension in most cases. It has been well established that cerebellar growth is least affected by intra uterine growth retardation (IUGR) and transverse cerebellar diameter shows linear growth through gestation thus, the measurement of TCD appears to be the most reliable biometric parameters for gestational age production.

### AIMS AND OBJECTIVES

To predict gestational age using TCD and BPD measurement in second trimester and correlate the predictions of gestational age from second trimester by comparing TCD and BPD.

### MATERIAL AND METHODS

Present study was done on 100 pregnant women coming to the Department of Radio diagnosis, SIMS, Hapur from the month of October 2016 to March 2017. Study group included antenatal women between 14 to 28 weeks of gestation by applying simple random technique. Informed consent were obtained. Ultrasonography (USG) was done between 14 to 28 weeks of POG, after filling PNDT form.

### INCLUSION CRITERIA

1. Singleton pregnancy.
2. Gestational age between 14 to 28 weeks.
3. Patient sure of her last menstrual period (LMP)
4. Previous regular menstrual cycles.

### EXCLUSION CRITERIA

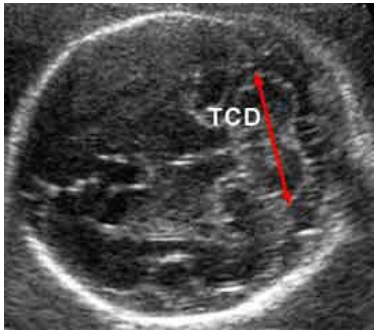
1. Patient not sure of her last menstrual periods.
2. Multiple pregnancies.
3. Previous irregular cycles
4. Fetuses having any gross congenital anomaly
5. Patients having any chronic medical illness.
6. Gestational age of < 14 weeks at the time of recruitment.

### THE METHOD OF STUDY

USG machine used was of model PHILIP HDI 4000. All the routine fetal parameters i.e. biparietal diameter (BPD), abdominal circumference (AC) femur length (FL) and head circumference (HC) were taken. Transverse cerebellar diameter (TCD) was measured by identifying the transverse cerebellar plane by obtaining an oblique view through the posterior fossa that included visualization of the midline thalamus, cerebellar hemisphere and cisterna magna. Measurement were obtained by placing the on- screen calipers of the ultrasound machine at the outer margins of the cerebellum. Gestational age (GA) was then calculated using BPD, and by using TCD and the results were subjected to statistical analysis. In addition the amount of liquor, placental localization, estimated fetal weight, and any gross congenital abnormality (GCA) in the fetus were noted. GA was predicted in second trimester using BPD. Similarly GA was estimated for TCD measurement by using the nomograms given by Chavez. M.R et. al in 2004 in both second and third trimester. The results were compared with the actual GA calculated from the LMP and statistical analysis was carried out. Correlation and regression equations were then applied to assess the concordance and the accuracy of these parameters.

**TECHNIQUES OF MEASUREMENT**

**Transverse cerebellar diameter** is mainly measured in transcerebellar plane. The measurement of TCD was obtained by placing electronic calipers at outer to outer margins of cerebellum. The landmarks of thalami, cavum, septum pellucidum and third ventricle were identified thereby slightly rotating the transducer below the thalamic plane. The posterior fossa was revealed with the characteristic butterfly like appearance of cerebellum. In all cases cerebellum was seen as two lobules on either side of midline in the posterior cranial fossa. The measurement is obtained by positioning the calipers on the outer margins of the two hemispheres (TCD or transverse cerebellum diameter).



**Figure -1** Showing measurement of Transverse Cerebellar Diameter

**Biparietal diameter** is imaged in the transaxial plane of the fetal head at a level depicting thalami in the midline, equidistant from the temporoparietal bones and usually the cavum septum pellucidum anteriorly<sup>17</sup>. BPD is measured from outer to inner edge of the skull.



**Figure -2** Showing measurement of biparietal diameter

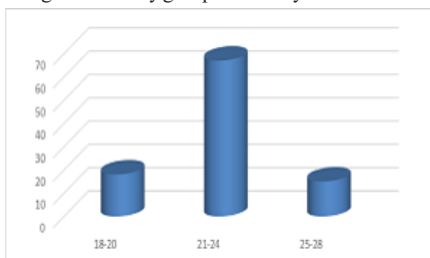
**OBSERVATION & RESULT**

In this prospective study, 100 antenatal women coming Department of Radiodiagnosis, SIMS, Hapur, U.P., without high risk factor were selected. USG was performed between 14-28 weeks. The biometric parameters TCD and BPD measured ultrasonographically.

**Table 1: Age distribution of the study group women**

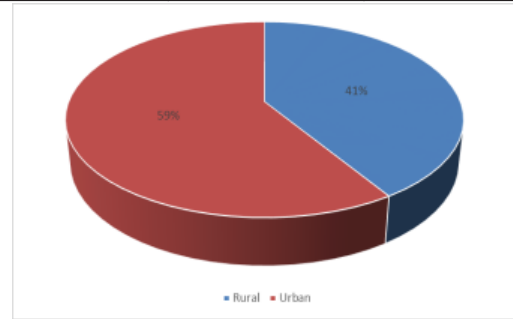
Age groups (years)	No. of patients	Percent
18-20	18	18.0
21-24	67	67.0
25-28	15	15.0
Total	100	100.0

67% of the study group women belonged to the age group of 21-24 years. Mean age in the study group was 22.5 years.



**Table 2: Distribution of the study group women into according to their background**

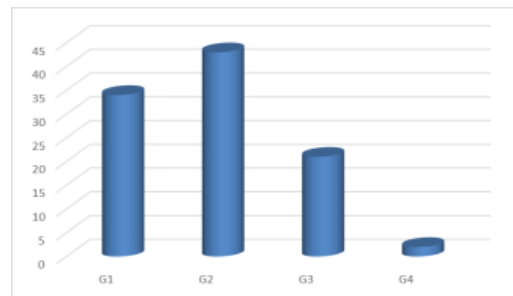
Residence	No. of patients	Percent
Rural	41	41.0
Urban	59	59.0
Total	100	100.0



**Table 3: Distribution of the study group women according to their parity**

Parity	No. of women	Percent
G1	34	34.0
G2	43	43.0
G3	21	21.0
G4	2	2.0
Total	100	100.0

Majority of the patients (43%) in our study group were second gravida.



**Table 4: Gestational age prediction by BPD in first USG POG1 (14-20 weeks)**

	Gastational age according to LMP	POG1 BY BPD in weeks	P value 1.
POG1 USG	17.26 ±1.30	16.14±1.32	P<0.001

Mean period of gestation was 17 weeks 2 days by LMP. Mean period of gestation predicted by BPD was 16 weeks 1 day.

**Table 5: Gestational age prediction by TCD in USG POG (14-28 weeks)**

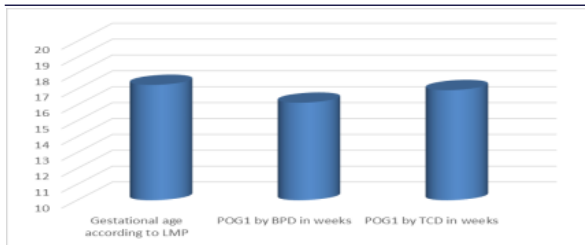
	Gastational age according to LMP	TCD in weeks	P value
POG1 USG	17.26 ±1.30	16.93±1.34	P>0.05

Mean period of gestation was 17 weeks 2 days by LMP. Mean period of gestation predicted by TCD was 16 weeks 6 days.

**Table 6: Gestational age prediction by BPD in USG POG (14-28 weeks)**

	Gestational age according to LMP	POG by BPD in weeks	POG by TCD in weeks	P value
USG POG1	17.26±1.30	16.14±1.32	16.93±1.34	LMP vs BPD p<0.001 LMP vs TCD p<0.001 BPD vs TCD p>0.005

USG was performed between 14-28 weeks of gestation and gestational age was predicted by measuring BPD and TCD. A comparison of estimated gestational age by using these biometric parameters and by LMP is depicted in Table 6.



**Table 7: Statistical correlation of POG1 by BPD and TCD with POG1 by LMP**

		Gestational age according to LMP	POG1 by TCD in weeks	POG1 by BPD in weeks
Pearson Correlation	POG1 by LMP in wks	1.000	0.958	0.877
	POG1 by TCD in wks	0.958	1.000	0.877
	POG1 by BPD in wks	0.877	0.877	1.000
Sig. (1-tailed)	POG1 by LMP in wks	.	.000	.000
	POG1 by TCD in wks	.000	.000	.
	POG1 by BPD in wks	.000	.000	.
N	POG1 by LMP in wks	100	100	100
	POG1 by TCD in wks	100	100	100
	POG1 by BPD in wks	100	100	100

The Pearson's correlation coefficient was found to be 0.958 for TCD and 0.877 for BPD. Although correlation was found to be statistically significant in both TCD and BPD groups but GA had better correlation with TCD than the BPD.

( $p < 0.001$ ).

## DISCUSSION

Accurate determination of gestational age is fundamental to obstetric care and is important in a variety of situations. Proper decisions regarding the presumed labour or postdated pregnancies are only possible when gestational age is accurately estimated. All methods of gestational age assessment have merits and demerits that deserve careful consideration. 3 primary methods of gestational age estimation: estimation based on last menstrual period (LMP), ultrasound-based gestational age estimation and neonatal estimating gestational age. Estimation of EDD based on LMP is a simple, low-cost method of estimating gestational age. Limitations associated with the use of menstrual based gestational age estimation include reporting problems such as uncertainty regarding the LMP date, possible due to bleeding not associated with menses, as well as concerns about the incidence of delayed ovulation, which can result in invalid estimation, even for women with certain LMP. Most women have at least one ultrasound during pregnancy and it is becoming increasingly common for clinicians to verify menstrual dates using early ultrasound. To calculate gestational age with the use of ultrasound fetal measurement are compared with a gestational age- specific reference. The primary limitation of this method is the fact that the gestational age estimates of symmetrically large or small fetuses will be biased. A certain percentage of women comes to the obstetrician for the first time for their antenatal check up in the last trimester only without any previous visits or ultrasound. We faces problems regarding their gestational age estimation because the ultrasound done in third trimester for these group of women will give a gestational age estimation with an error of 3 weeks by using of current parameters (BPD, HE, FL, AC). This is associated with the problems regarding the termination of pregnancy if required and issues related to prematurity, postmaturity and the perinatal problems associated with them. Obstetric management most appreciate this potential for error. If the gestational age from the average of all the parameters are similar, assignment of gestational age from the average of all of the parameters improves the accuracy. If gestational age estimates of the various parameters are quite different, averaging multiple parameters decrease the accuracy of the best predictor(s), a patient presenting in spontaneous labor at  $33 \pm 3$  weeks gestation should be managed as if the pregnancy may be as little as 30 weeks gestation, rather than as advanced at 36 weeks gestation. The patient presenting for prenatal care at  $39 \pm 3$  weeks gestation, should be managed for the potential of postdated pregnancy<sup>48</sup>.

The present study is an endeavor to determine the accuracy of TCD, BPD, and HC for gestational age estimation in second and third trimester antenatal women, and the neonatal outcome associated with

it. A study by Doublet PM<sup>29</sup> et al. on improved prediction of GA using fetal head measurement revealed that BPD when used in second trimester was able to predict the GA with an error of 6 days. Benson BC at al. Doublet<sup>41</sup> studied the reliability of second and third trimester fetal measurements for gestational age estimation and concluded that BPD was able to predict the GA with an error of 1.4 wks in 14 to 20 wks of POG. The observation of present study conquer with the results of both the investigator.

Pearson's correlation coefficient ( $r$ ) was calculated by applying statistical analysis and correlation was calculated for POG by TCD and POG by BPD. Correlation of POG1 by TCD with POG1 by LMP was found to be 95.8% ( $r = .958$ ,  $p < 0.001$ ) which was statistically significant. Our results are in strong agreement with the results of Chavez MR. et al. study on fetal TCD measurement for gestational age estimation. The concordance between the actual GA and the predicted GA by TCD was high ( $r = 0.92$ ,  $p < 0.0001$ ) in the second trimester.

Correlation of POG1 by BPD with POG1 by LMP was found to be 87% ( $r = .877$ ,  $p < 0.001$ ) which was statistically significant. In the present study our results are well in accordance with the reports of Varol. F. et al<sup>45</sup>. who studied the evaluation of gestational age based on ultrasound fetal growth measurement and found that correlation coefficient ( $r$ ) for BPD in 2<sup>nd</sup> trimester was 0.872 ( $p < 0.001$ ). MALIK.R. et al. who studied the gestational age estimation using transcerebellar diameter with grading of fetal cerebellum and their results have shown the predictive accuracy of TCD to be 92% for gestational age estimation. Varol F. et al.<sup>45</sup> studied the evaluation of gestational age based on ultrasound fetal growth measurement and found that predictive accuracy of BPD in second trimester was 87%.

## CONCLUSION

The present study has revealed that both TCD and BPD have good correlation with the LMP for the prediction of gestational age in second trimester, however TCD has a better correlation with LMP than BPD for the gestational age estimation.

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