

**How to Cite:**

Diwakar, D., Sridhar, M. N., Katur, A., & Kumar M, K. (2022). Role of transcerebellar diameter in fetal growth assessment and its correlation with conventional biometry-An institutional study. *International Journal of Health Sciences*, 6(S7), 6609-6616.  
<https://doi.org/10.53730/ijhs.v6nS7.13767>

# **Role of transcerebellar diameter in fetal growth assessment and its correlation with conventional biometry-An institutional study**

**Dr. Doddamani Diwakar**

Assistant Professor, Department of Radiodiagnosis, JJM Medical College, Davangere, Karnataka, India

**Dr. Sridhar M N**

Senior Resident, Department of Radiodiagnosis, JJM Medical College, Davangere, Karnataka, India

**Dr. Avinash Katur\***

Assistant Professor, Department of Radiodiagnosis, JJM Medical College, Davangere -577004, Karnataka, India

\*Corresponding Author email: [avinashmkatur@yahoo.co.uk](mailto:avinashmkatur@yahoo.co.uk)

**Dr. Kiran Kumar M**

Assistant Professor, Department of Radiodiagnosis, JJM Medical College, Davangere, Karnataka, India

**Abstract**--Background: Accurate assessment of gestational age (GA) for fetal development is of paramount importance in management of pregnancy and for favorable perinatal outcome. The estimation of GA by fetal biometry using Biparietal Diameter (BPD), Head Circumference (HC), Abdominal Circumference (AC) and Femoral Length (FL) in estimation of gestational age (GA) is routinely followed. However, these parameters have limitations. BPD and HC are not reliable in third trimester; FL may be reduced in IUGR and skeletal malformations. Thus we evaluated the Transcerebellar diameter (TCD) as an alternate indicator for fetal growth and GA estimation. Aim: To validate the accuracy of TCD with fetal biometry and calculated ultrasound age (CUA) in assessment of fetal growth and GA in between 18 to 40 weeks of pregnancy. Materials and Methods: The prospective study was carried out with 200 pregnant women between 18 to 40 weeks referred to Radiology department ((JJM Medical College), for antenatal scanning. The subjects were divided into two groups (second and third trimesters). TCD was measured along with other routine parameter for growth assessment. Thus, calculated gestational age (GA) using TCD was compared with GA by Last

menstrual period (LMP) and calculated ultrasound age (CUA). The results were analyzed using SPSS 22 version software. Categorical data was presented in the form of frequencies and proportions and Pearson correlation was done. Results: Mean GA based on LMP was 21.13 weeks in second trimester and 34.37 weeks in third trimester. Mean GA for both groups combined was 27.75 weeks. We compared mean GA based on BPD, HC, AC, FL and TCD were compared with that of LMP, all parameters in the second trimester were showing GA near to that of LMP. TCD had mean GA of 21.12 in the second trimester correlated well to GA by LMP. In the third trimester TCD had mean GA of 34 weeks near to GA by LMP. FL with mean GA of 33.90 was second close to GA by LMP. AC with mean GA was far from mean GA by LMP among all parameters. When we compared overall mean GA, TCD showed mean GA which was closest to that of LMP. In the second trimester, all parameters had near equal r values and TCD had excellent correlation average correlation value of 0.996 and in third trimester average correlation value of 0.971. Conclusion: TCD is relatively accurate parameter in estimation of fetal growth during the second trimester of pregnancy and has close correlation with the GA by LMP and CUA. TCD can be used as an additional parameter in growth assessment.

**Keywords**---transcerebellar, TCD, pregnancy.

## **Introduction**

The accurate Gestational age estimation is essential in dating & management of pregnancy, and used routinely. The accurate estimation of GA using various fetal parameters (BPD, HC, AC and FL) is time tested and used extensively.<sup>1</sup> However conventional methods of GA estimation have limitations. BPD after 26 weeks becomes unreliable in conditions of fetal skull abnormalities, Femoral length is shortened in cases of achondroplasia.<sup>2</sup> The well accepted and commonly followed method for calculating gestational age by LMP (Naegele's rule), however its efficacy is dependent on woman to recall her LMP correctly and is prone for errors. Therefore, the role of additional parameter like TCD, humeral length, tibial length are used as additional and reliable indicators of GA estimation and fetal growth.<sup>3</sup>

TCD is new parameter in estimation of GA. The fetal cerebellum can be seen as early as 10-11 weeks of GA on Ultrasound and is least affected by external factors. The cerebellum located in the posterior cranial fossa is protected by dense skull.<sup>4</sup> from the second trimester onwards the transverse diameter of the cerebellum shows a linear progression on correlation with GA and is used in assessment of growth in the third trimester.<sup>5</sup> Our study validates TCD to fetal biometry and it's usefulness in assessment of growth, and as an additional parameter in routine biometry and in intrauterine growth reduction.

## Materials and Methods

A prospective study was conducted on 200 pregnant women of 18 to 40 weeks of gestational age referred to Radiology Department for antenatal scan during period June 2021 to May 2022.

The inclusion criteria were the women with normal pregnancy between 18 to 40 weeks of GA having known LMP. Clinically diagnosed IUGR and multiple pregnancy and congenital malformations were excluded from the study. To determine accuracy of TCD in estimating GA and by using GA by LMP as gold standard, we excluded many cases of irregular cycles and those with not known LMP, so the sample size considered for this study was less.

Main purpose of this study was to demonstrate how accurately GA by TCD is correlating with that of GA by LMP so that TCD can be included in routine fetal biometry.

With low frequency transducer (3.5 MHz), Transcerebellar plane is identified by obtaining an oblique view through posterior fossa that included visualization of midline thalamus, cerebellar hemispheres and cisterna magna. Single measurement is used for each pregnancy. Other parameters such as BPD, HC, AC and FL were also measured according to previously described standard planes.

GA based on individual parameters was compared with GA by LMP.

The subjects were further divided into sub groups based on gestational age at the time of ultrasound scan into second trimester (15 to 28 weeks) which includes 100 members and third trimester (29 to 40 weeks) which includes 100 members. Subjects were further divided based on age and parity. The above ultrasound parameters were compared within the individual sub-groups to look for any confounding effects that these variables had on the study.

**Statistical analysis:** Statistical analysis was performed using SPSS software version 22 and using Karl Pearson's coefficient of correlation ( $r$ ) and regression analysis.

## Results

Mean GA based on LMP was 21.13 weeks in second trimester and 34.37 weeks in third trimester. mean GA for both groups combined was 27.75 weeks. When, mean GA based on BPD, HC, AC, FL and TCD were compared with that of LMP, all parameters in second trimester had GA value near to GA by LMP. TCD had mean GA of 21.12 in second trimesters correlated well to corresponding GA by LMP. In third trimester TCD had mean GA of 34 weeks correlating well to GA by LMP. FL was having mean GA of 33.90 which was second close to GA by LMP. AC had mean GA which was far from mean GA by LMP among all parameters. When we compared overall mean GA, TCD showed mean GA that was nearest to that of LMP.

We obtained a Pearson's coefficient of correlation ( $r$ ) of all parameters by comparing gestational age by LMP and gestational age by TCD. In the second trimester, all parameters had nearly equal  $r$ -values. TCD had the highest correlation of all. There was a significant difference in  $r$ -value in the third trimester, with TCD being a parameter with a high correlation. The average correlation value of 0.996 in second trimester and in third trimester average correlation value of 0.971 was found.

By using regression, we can derive an equation to calculate the actual gestational age from TCD. There was no influence of age and parity on the parameters for calculation of gestational age as the equation does not contain variables such as age and parity; hence these did not have statistically significant effect on estimation of GA by TCD.

Parameters		N	Mean	SD	95% Confidence Interval	
					Lower bound	Upper Bound
<b>LMP</b>	<b>Second trimester</b>	100	20.12	21.87	19.56	21.17
	<b>Third Trimester</b>	100	33.17	3.19	33.06	35.19
	<b>Total</b>	200	26.54	7.04	26.16	28.17
<b>HC</b>	<b>Second trimester</b>	100	21.03	4.42	19.65	22.12
	<b>Third Trimester</b>	100	33.17	2.65	32.19	34.12
	<b>Total</b>	200	27.16	7.20	25.17	28.10
<b>AC</b>	<b>Second trimester</b>	100	20.17	4.01	19.12	22.15
	<b>Third Trimester</b>	100	33.12	2.65	30.13	34.10
	<b>Total</b>	200	27.10	7.10	25.10	28.60
<b>FL</b>	<b>Second trimester</b>	100	20.13	4.10	19.82	22.47
	<b>Third Trimester</b>	100	32.18	3.10	32.19	34.65
	<b>Total</b>	200	27.12	7.12	26.10	29.10
<b>BPD</b>	<b>Second trimester</b>	100	21.10	4.18	19.14	22.16
	<b>Third Trimester</b>	100	33.10	2.60	32.19	34.15
	<b>Total</b>	200	26.13	7.10	25.10	28.79
<b>TCD</b>	<b>Second trimester</b>	100	21.10	4.10	19.12	22.10
	<b>Third Trimester</b>	100	34.10	2.75	31.65	33.67
	<b>Total</b>	200	27.13	7.12	25.17	28.16
<b>Average</b>	<b>Second trimester</b>	100	20.16	4.16	19.45	22.10
	<b>Third Trimester</b>	100	32.17	2.65	32.10	33.17
	<b>Total</b>	200	27.16	7.20	25.10	28.18

**Table 1: Mean and standard deviations of all parameters with confidence intervals**

Parameters		Intra-Class Correlation	95% confidence interval		P value
			Lower Bound	Upper Bound	
<b>Second trimester</b>	HC	0.991	0.995	0.996	0.001
	AC	0.997	0.994	0.994	0.001
	FL	0.996	0.991	0.996	0.001
	BPD	0.993	0.990	0.997	0.001
	TCD	0.992	0.996	0.998	0.001
	Average	0.996	0.994	0.999	0.001
<b>Third trimester</b>	HC	0.956	0.698	0.982	0.007
	AC	0.959	0.443	0.989	0.006
	FL	0.980	0.959	0.992	0.005
	BPD	0.954	0.690	0.984	0.005
	TCD	0.982	0.865	0.990	0.003
	Average	0.977	0.850	0.991	0.001
<b>Total</b>	HC	0.994	0.987	0.992	0.004
	AC	0.995	0.981	0.993	0.003
	FL	0.996	0.996	0.996	0.005
	BPD	0.995	0.990	0.994	0.001
	TCD	0.996	0.995	0.990	0.003
	Average	0.995	0.996	0.991	0.002

**Table 2: Intraclass correlation with confidence intervals and t-test p-values**

Parameters		Trimester	Karl pearson correlation	P value
<b>LMP</b>	<b>With AC</b>	Second trimester	0.990	0.005
		Third trimester	0.972	0.006
	<b>With TCD</b>	Second trimester	0.991	0.001
		Third trimester	0.982	0.004
	<b>With BPD</b>	Second trimester	0.992	0.005
		Third trimester	0.951	0.008
	<b>With FL</b>	Second trimester	0.994	0.003
		Third trimester	0.980	0.004
	<b>With HC</b>	Second trimester	0.992	0.001
		Third trimester	0.951	0.008
	<b>With average</b>	Second trimester	0.996	0.001
		Third trimester	0.971	0.007

**Table 3: Karl Pearson correlation coefficients of individual parameters compared with LMP**



**Image 1: the second trimester TCD measurement corresponding to GA**



**Image 2: TCD corresponding to early the third trimester**



**Image 3: TCD corresponding to late the third trimester**

## **Discussion**

Accurate assessment of fetal age either by pregnant women LMP or using fetal biometry by ultrasound is vital for obstetrician in effective management of pregnancy. Although GA calculated by fetal biometry is helpful in normal pregnancy, pregnancy with intrauterine growth restriction and congenital fetal anomalies make it difficult to assess accurately.<sup>6</sup>

The focus shifts towards sonological assessment of growth using various other parameters which are least affected by impaired fetal growth. In the recent past

Transcerebellar diameter is used as independent and useful growth indicator irrespective of fetal growth abnormalities. In our study we used this parameter to assess growth and correlated with other growth indicators.<sup>7</sup>

Our study was conducted on 200 pregnant women with age group 20 to 38 yrs with mean age of 28 years belonging to various socioeconomic backgrounds referred to Radiology department in a Medical College Teaching Hospital.

Gupta AD et al., studied role of TCD in singleton pregnancy and observed that the gestational age of pregnant women with unknown LMP can be reliably estimated by TCD measurement with good correlation ( $r=+0.946$ ,  $r^2=89.6\%$  and  $p<0.001$ ).

The progressive increase in the Transcerebellar diameter with development of cerebellum was corresponding to the GA.<sup>4</sup>

Naseem F et al., in a study in 327 patients, TCD showed correct assessment of gestational age by LMP in 262 (82.1%) patients and FL measurement gave correct GA in 232 (70.9%) patients. They compared GA by TCD and BPD with LMP.<sup>8</sup>

In a study by Joshi BR et al., of 594 singleton pregnancies, gestational age and TCD (50<sup>th</sup> percentile in mm) coincided well till 20<sup>th</sup> week of GA. Between 21<sup>st</sup> to 28<sup>th</sup> weeks, there was no significant difference with the monograms created by them in Nepalese population to that of other published studies. They observed significant difference in the third trimester monograms.<sup>9</sup>

Ramireddy HR et al., studied in 100 subjects showed TCD revealed highest correlation (value 0.997) in second trimester and in third trimester they found difference in r values. When GA by TCD and LMP was compared r value (0.982) was more than other parameters.<sup>10</sup>

In our study, when mean GA based all parameters were compared with that of LMP; all parameters in second trimester were showing GA correlating with GA by LMP. TCD had mean GA of 21.12 in second trimester close to that GA by LMP. In third trimester, TCD showed mean GA of 34 wks, which correlated better with GA by LMP. When we compared overall mean GA also, TCD showed better correlation with that of LMP.

We obtained a Pearson's coefficient of correlation (r) of all parameters by comparing gestational age by LMP and gestational age by TCD. In the second trimester, all parameters had nearly equal r-values. TCD had the highest correlation of all. There was a significant difference in r-value in the third trimester, with TCD being a parameter with a high correlation. The intra-class correlation between the TCD and the actual gestational age showed excellent agreement.

## **Conclusion**

Our study showed that TCD is a reliable and fairly accurate predictor of the gestational age in second and third trimester of pregnancy. The correlation between the gestational age calculated by LMP and TCD are comparable in

gestational age below 18 weeks and above 38 weeks of pregnancy. TCD is a better predictor of gestational age in third trimester when compared to BPD, AC, HC and FL. TCD is not affected by the age of mother or the parity in our study, hence TCD can be used a single parameter or additional parameter along with conventional biometry for estimation of gestational age.

## References

1. Kalish PB, Chervenak FA. Sonographic determination of gestational age. The Ultrasound review of Obstetrics & Gynecology. 2005;5(4):254-58.
2. Dewhurst CJ, Beazley JM, Campell S. Assessment of fetal maturity and dysmaturity. Am J Obstet Gynecol. 1972;113:141-49.
3. Hashimoto K, Shimizu T, Shimoya K, Kanzaki T, Clapp JF, Murata Y. Fetal cerebellum: US appearance with advancing gestational age. Radiology.2001;221(1):70-74
4. Gupta AD, Banerjee A, Rammurthy N, Revati P, Jose J. Gestational age estimation using transcerebellar diameter with grading of fetal cerebellar growth. National Journal of Clinical Anatomy. 2012; 1(3); 115-20.
5. Davies MW, Swaminathan M, Betheras FR. Measurement of transverse cerebellar diameter in preterm Neonates and its use in assessment of gestational age. Australian Radiology. 2001;45(3):309-12.
6. Donald I. Ultrasonics and other electronic techniques. J Obstet Gynaecol Br Emp. 1962;69:1036-38.
7. Chavez MR, Ananth CV, Smulian JC, Yeo L, Oyelese Y, Vintzileos AM. Foetal transcerebellar diameter measurement with particular emphasis in the third trimester: a reliable predictor of gestational age. Am J Obstet Gynecol. 2004; 191:979-84.
8. Naseem F, Ali S, Basit U, Fatima N. Assessment of gestational age; comparison between transcerebellar diameter versus femur length on ultrasound in third trimester of pregnancy. Professional Med J.2014;21(2):412-17
9. Joshi BR. Fetal transcerebellar diameter nomogram in Nepalese population. Journal of Institute of Medicine. 2010;32(1):19-23
10. Ramireddy HR, Kumar P, Mahale A. Significance of fetal transcerebellar diameter in fetal biometry- A pilot study. J Clin Diagn Res. 2017;11(6);01-04