

A Comparative Study of Foetal Trans Cerebellar Diameter and Other Established Sonographic Parameters for Estimation of Gestational Age in Second and Third Trimester at Tertiary Care Hospital

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Abstract

Introduction: The gestational age is of importance in management of pregnancy and planning of appropriate therapy and intervention. TCD appears to be the most reliable age independent biometric parameter in the evaluation of true gestational age. We have tried to compare relationship between TCD and other foetal parameters (BPD, HC, AC, FL) between 15 to 40 weeks of gestation for estimation of gestational age.

Aim: To study accuracy of trans cerebellar diameter as a reliable foetal parameter on USG to assess gestational age at second and third trimester.

Method: Comparative cross sectional study conducted in Department of obstetrics and Gynecology, Sardar Patel Medical College & AGH, Bikaner (Rajasthan) on 200 antenatal pregnant women between 15 weeks to 40 weeks of gestation from May 2021 to 2022 who subjected to USG for estimation of GA by FL, BPD, AC and TCD.

Result: The foetal TCD showed a significant linear correlation with GA, BPD, HC, AC and FL ($P < 0.001$). The correlation was the highest with GA followed by FL, HC, BPD and was the least with AC (0.8937).

Conclusion: Foetal trans cerebellar diameter shows a good correlation with gestational age.

Keywords: Sonographic Parameters, Trans Cerebellar Diameter, Gestational Age.

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Introduction

In the management of pregnancy and the planning of appropriate treatment and intervention, the gestational age is of particular importance. Three major methods of estimating gestation age are: menopausal history, diagnostic examination and ultrasound. These two classes are subject to significant errors, and should only be applied where sonographic equipment is not available.

Naegele's rule is fairly accurate in women with regular cycles, but miscalculations are reported in many cases such as women with irregular periods and women whose LMP is not known [1]. Due to intrauterine stress and potential early neurological maturation, symphytometric height is of greatest accuracy at approximately 20 weeks gestation when a fundus has been elevated from the symphysis which may

not function as well in starving populations.[2,3] In assessing the age of pregnancy during the first and second trimesters, ultrasound scans have been shown to be a reliable, cost effective and useful method. In first trimester best parameter is Crown lump length(CRL) for gestational age while BPD in second trimester, other biometric parameters were head circumference (HC), abdominal circumference (AC), femur length (FL). But these are situations where measurement of these parameters have some limitations or, cannot be used. HC and BPD cannot be used in condition affecting foetal skull like hydrocephalus, brachycephaly or dolicocephaly. AC cannot be used in hydrops foetalis, macrosomia and severe growth restriction. FL is not appropriate for the treatment of short limb dysplasia, fetilla achondroplasia or deeply engaged breech. Other parameters should be used to estimate the fetus' age under these circumstances. Recently evaluation of posterior fossa of the fetal cranium has been accepted as part of routine obstetrics ultrasonographic examination and therefore, can predict fetal gestational age.

The trans cerebellar diameter (TCD) is the maximum transverse diameter of the fetal cerebellum. Fetal cerebellar hemispheres are located in the occipital fossa and are surrounded by dense pyramidal apexes, which allows them to withstand intense pressure and growth inhibition.[4] It is well documented and proven that despite pathological changes in the fetal growth tract due to macrosomia or IUGR, there is no change in cerebellar blood flow, thereby preserving TCD well. Even with changes in arcing due to external pressure, TCD did not change. Therefore, TCD is

considered the most reliable age-independent biological parameter for assessing actual gestational age.[5] The TCD nomogram predicts a gestational age of 94°C in the third trimester, as 37 weeks is her days 0–9 of her actual pregnancy.[6] Given these advantages of his TCD over other parameters, in this study, the relationship between fetal his TCD and gestational age (calculated by LMP) between his 15th and his 40th weeks investigated the relationship.

Aim: To assess accuracy of trans cerebellar diameter as a reliable fetal parameter on USG for gestational age assessment.

Method

Hospital based descriptive type of observational comparative study comprises of 200 pregnant women in second and third trimester attending opd in department of Obstetrics and Gynaecology, SPMC, Bikaner. Detailed clinical history and examination will be done. Routine blood investigations will be done. By detailed history and examination, foetal gestational age will be estimated separately from LMP. All patients will be subjected to USG for estimation of GA by FL, BPD, AC and TCD (TCD measure on USG in suboccipitobregmatic plane). Estimation of gestational age from LMP will be considered for comparison to gestational age calculated from TCD and other sonographic parameter.

Statistical Analysis: data thus collected was entered in excel sheet and was analyzed by Epi info software by t test, Anova test as applicable and taken P value <0.05.

Results

Table 1: Transcerebellar Diameter

GA (weeks)		TCD (mm)	N (cases)
15	Mean	14.20	2
	SD	0.14	
16	Mean	14.95	4
	SD	0.52	

17	Mean	15.92	10
	SD	0.23	
18	Mean	17.26	7
	SD	0.16	
19	Mean	17.90	12
	SD	0.30	
20	Mean	18.85	33
	SD	0.41	
21	Mean	20.04	10
	SD	0.30	
22	Mean	20.99	9
	SD	0.40	
23	Mean	22.06	7
	SD	0.26	
24	Mean	23.30	7
	SD	0.10	
25	Mean	24.00	7
	SD	0.23	
26	Mean	25.08	5
	SD	0.27	
27	Mean	26.15	8
	SD	0.23	
28	Mean	26.85	6
	SD	0.27	
29	Mean	27.80	4
	SD	0.23	
30	Mean	28.90	9
	SD	0.34	
31	Mean	30.03	7
	SD	0.28	
32	Mean	33.26	5
	SD	4.89	
33	Mean	31.83	3
	SD	0.29	
34	Mean	33.06	18
	SD	0.19	
35	Mean	35.38	11
	SD	4.85	
36	Mean	34.93	12
	SD	0.21	
37	Mean	35.70	3
	SD	0.35	
38	Mean	36.98	9
	SD	0.37	
39	Mean	37.64	7
	SD	0.24	
40	Mean	38.80	5
	SD	0.27	

Total	Mean	26.71	200
	SD	7.54	

A linear relationship between foetal TCD and gestational age was seen. Mean TCD at 15 weeks is 14 ± 0.20 mm and 38.80 ± 0.27 at 40 week.

Table 2: Correlation b/w TCD and Gestational Age

	Mean	Std. Deviation
TCD (mm)	26.71	7.54
GA (weeks. days)	27.58	7.30

TCD and gestational age exhibits strong linear association ($r= 0.9603$ and $p<0.001$).

Table 3: Gestational age calculated by TCD / FL / AC/ HC/TCD and gestational age by LMP

		GA bpd (mm)	GA femur length(mm)	GA AC (mm)	GA HC (mm)	GA TCD (mm)
GA (weeks. days)	Pearson Correlation	0.9554**	0.9614**	0.9131**	0.9681**	0.9835**
	Sig.(2-tailed)	<0.0001 HS	<0.0001 HS	<0.0001 HS	<0.0001 HS	<0.0001 HS
	N	200	200	200	200	200

Table 4: Summary

X axis	Y axis	Correlation Coefficient	p value
TCD	GA	0.9603	<0.001
	BPD	0.9205	<0.001
	HC	0.9381	<0.001
	AC	0.8937	<0.001
	FL	0.9487	<0.001

A significant linear correlation was seen between foetal TCD and GA, BPD, HC, AC and FL ($P<0.001$) which was highest with GA (0.9603), followed by FL (0.94.87), HC (0.9318), BPD (0.92.05) and minimum with AC (0.8937).

Discussion

In our study 87.50% were between 19 to 29 years, with mean age of 25.17 ± 4.02 years (19 to 35 years). Age distribution in our study was consistent with that observed in the study of Faiza Naseem et al 2014[9]. They observed that 33.9% respondents were in between 21-25 years, 27.8% in 26-30 years, 23.9% of respondent belong to maternal age <20 years and 14.4% of respondent belong to maternal age >30 years. Mean age in our study (25.17 ± 4.02 years) was higher than

that observed by Sumanta Kumar Mandal et al 2019[10] in his study (22.16 ± 2.93). In our study, 85 (42.50%) were gravid 1 followed by gravida 2 55(27.50%) and gravid 3 41 (20.56%). Only 9.5% women were gravida 4. Mean gravidity of the women was 1.94 ± 0.89 . Our results were contrast to that observed by Sumanta Kumar Mandal et al 2019[10] that 49.49% were gravida 1 followed by 36.36% were gravid 2 followed by 14.14% gravid 3. Only 1.1% women were gravid 4. Majority of women (46%) were nulliparous followed by para1 (27%), para 2 (19%) & para 3 (8%) Mean Parity of the women was 0.93 ± 1.07 Our results were in contrast to that observed by Mandal et al 2019[10] observed that 88.88% women were nulliparous followed by para 1 (11.11%) & para 3 (1.1%). In our study

USG cerebellar grading 8%, 42% and 50% of grade I, II and III respectively, similarly R Nagesh et al (2016)[7] studied USG cerebellar grading 18%, 49% and 33% respectively. TCD at 15 week is 14 ± 0.20 mm and 38.80 ± 0.27 at 40 week. The foetal TCD showed a strongly positive linear correlation with gestational age ($r=0.9603$ and $P<0.001$). A formula was derived [Gestational age (weeks) = $1.6386 \times \text{TCD (mm)} - 12.1779$] to calculate gestational age from TCD by the graph. The mean biparietal diameters at 15 and 40 weeks were 32.95 ± 0.07 mm and 93.98 ± 1.27 mm, respectively. Mean HC at weeks 15 and 40 were 110.10 ± 0.00 mm and 340.60 ± 1.95 mm, respectively. Mean FL at weeks 15 and 40 were 18.00 ± 0.00 mm and 77.42 ± 1.35 mm, respectively. Mean AC at 15 and 40 weeks were 98.05 ± 0.07 mm and 220.04 ± 83.16 mm, respectively. A significant linear relationship was seen between foetal TCD and BPD ($r=0.9205$, $p<0.001$). A linear relationship between TCD and femur length was seen. The regression equation is: Femur length (mm) = $1.2507x$ foetal TCD (mm) + 9.071 ($r=0.9487$, $P<0.001$). The foetal HC had a strong positive linear relationship with foetal TCD ($r=0.9381$, $p<0.001$). The foetal AC shows a positive linear relationship with foetal TCD ($r=0.8937$, $p<0.001$). A significant linear correlation was found between foetal TCD and GA, BPD, HC, AC and FL ($P<0.001$), highest with GA (0.9603), followed by FL (0.9487), HC (0.9381), BPD (0.9205) and was minimum with AC (0.8937). Significant linear correlation was found between Gestational age by LMP and GA by BPD, HC, AC, FL and TCD ($p<0.001$), highest with GA by TCD (0.9835), followed by GA by and HC (0.9681), FL (0.9614), BPD(0.9554) and was least with AC (0.9131).

Conclusion

This study shows that fetal TCD correlates well with gestational age. Moreover, linear growth functions between TCD and other

common fetal biometric parameters such as BPD, HC, FL and AC are observed. Current data demonstrate a normal range of fetal TCD measurements throughout gestation (15-40 weeks) in our population. Therefore, fetal TCD can be used as a surrogate fetal parameter to assess gestational age and should be used in cases of erroneous data, when other routine parameters are inconclusive, or when gestational age is unknown. Couldn't predict exactly, but it works, e.g. Hydrocephalus, brachycephaly, cleidocephaly, intrauterine hypoplasia, achondroplasia, or short-limbed dwarfism.

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