

COMPARATIVE STUDY BETWEEN TRANSCEREBELLAR DIAMETER WITH BIPARIETAL DIAMETER AND FEMUR LENGTH OF ULTRASOUND FOR GESTATIONAL AGE MEASUREMENT IN SECOND TRIMESTER OF PREGNANCY

By

**Ahmed Ali Mohammed Teniteen, Ismaeel Mohammed Abd EL-Azim
Mira and Abd El-Monsef Abd El-Hamed Sedek**

Department of Obstetrics and Gynecology, Faculty of Medicine, Al-Azhar University

Corresponding author: Ahmed Ali Mohammed Teniteen,

Mobile: (+02)01004508804, **E-mail:** ahmedaliteniteen@yahoo.com

ABSTRACT

Background: The exact determination of gestational age is so important in management of outpatient care and for adequate planning of proper intervention or therapy. Transcerebellar diameter has great advantages in prediction of gestational age in cases of uncertain dates or suspected intrauterine growth retardation (IUGR). There are minimal data available about the relationship between transcerebellar diameter and biparietal diameter in second trimester of pregnancy.

Objective: To assess the diagnostic accuracy of transcerebellar diameter (TCD) measurement in estimation of the gestational age during the second trimester compared with the other fetal biometric measurements including femur length (FL) and biparietal diameter (BPD).

Patients and Methods: This study was carried out on 200 pregnant women with normally progressing pregnancies during the second trimester with gestational age between 16 – 28 weeks. The criteria for inclusion in the study were singleton gestation, head presentation, absence of fetal anomalies, and no history of chronic diseases or abnormal babies or stillbirths. All patients provided informed consents and were subjected for assessment of history, general and abdominal examination, and ultrasound (US) to assess: Fetal viability, BPD, FL, AC and TCD. Transabdominal ultrasound (TAUS) was performed for all participants. Fetal TCD was measured by locating the cerebellum in the posterior fossa by means of rotation of the transducer to 30° from the plane that identified the thalamus cavity of the septum pellucidum, third ventricle and cisterna magna (CM), positioning the calipers on the outer margins of the cerebellar hemispheres. at Department of Obstetrics and Gynecology, Al-Hussien and Sayed Galal Hospitals, Al-Azhar University (inpatient and outpatient) from April 2020 to October 2020.

Results: The transcerebellar diameter (TCD) was more accurate than the biparietal diameter (BPD). There were significant statistical differences between transcerebellar diameter (TCD) and biparietal diameter (BPD), and between transcerebellar diameter (TCD) and femur length (FL) for determination of gestational age in the second trimester. All those data were compared to the last menstrual period (LMP).

Conclusion: Transcerebellar diameters (TCD) was more reliable method of gestational age (GA) determination in the second trimester of pregnancy than Bi-parietal diameter (BPD). TCD can be used as a tool to assist in the assessment of GA in the second trimester.

Keywords: Transcerebellar diameter with bi-parietal diameter and femur length of ultrasound for gestational age.

INTRODUCTION

The use of ultrasonography has significantly improved the evaluation of fetal growth and development and has permitted prenatal diagnosis of a variety of congenital malformations. Ultrasonographic fetal biometry is highly reliable in first and second trimester of pregnancy but reliability of any ultrasound method greatly diminishes as gestational age advances, in third trimester, reliability of any single ultrasound parameter alone is poor without correlation with other parameters (*Naseem et al., 2013* and *Satish Prssad & Likhitha, 2014*).

Many patients in our setup due to socio-economic reasons come for their first antenatal visit in third trimester. Most of them are uneducated come from remote areas. Also many being lactating mothers unsure of their LMP or having irregular cycles because of non-availability of any dating scans or earlier ultrasound and uncertainty in LMP, it becomes very difficult to calculate their due dates, so many pregnancies considered to be preterm or posterm are wrongly classified (*Satish Prssad and Likhitha, 2014*).

Many studies states that TCD normogram predicts gestational age with accuracy of 90% in the third trimester (*Goel et al., 2010*). Since the last decades, ultrasound parameter ‘transcerebellar diameter (TCD)’ is considered a more accurate and better predictor of gestational age in both normal and intrauterine growth retardation (IUGR) (*Scott et al., 2012*). Also, the biparietal diameter (BPD) that is commonly used shows margin of error of 3 – 4 weeks from actual gestation because of the large biological variations in fetal skull shape and size (*Naseem et*

al., 2013). In the third trimester, various ultrasound parameters including femur length which is the most commonly used parameter for the assessment of gestational age, yet it shows margin of error 2 - 3 weeks from the actual gestational age (*Naseem et al., 2014*). The fetal cerebellum visualized as early as 10 – 20 post- menstrual weeks. It grows in a linear pattern in the second trimester but the curve flattens in third trimester.

Since the introduction of diagnostic ultrasound (US), more reliable methods to date the pregnancy have been developed in early pregnancy. These are gestational sac diameter and volume and crown – Rump length (CRL) measurements in second trimester most commonly used biometric parameters for estimating gestational age are biparietal diameter (BPD) and femur length (FL) (*Whitworth et al., 2010*) and another used parameter are transverse cerebellar diameter (TCD) (*Ahmed, 2014*).

The present work aimed to assess the accuracy of transcerebellar diameter (TCD) measurement in estimation of the gestational age during the second Trimester compared to current fetal biometric measurements Femur length (FL) and biparietal diameter (BPD) according to last menstrual period (L.M.P).

PATIENTS AND METHODS

The observational study was conducted on 200 pregnant women at department of obstetrics and Gynecology, Al-Hussien and Sayed Galal Hospitals, Al-Azhar University (inpatient and outpatient) from April 2020 to October 2020.

The entire patients were during the second trimester of pregnancy. The transcerebellar diameter, the biparietal diameter, femur and AC length were measured for determination of the gestational age.

Inclusion criteria: Women in child bearing period singleton pregnancy at 16 – 28 weeks of pregnancy calculated by the 1st day of last menstrual periods.

Exclusion criteria: Patients who were unsure of date, or those with fetal anomalies intrauterine fetal death (IUFD) or with multiple gestation or patient with medical disorder like hypertension (HIN) or diabetes mellitus (D.M) were excluded.

Verbal and consents were obtained from the pregnant women who were included in the study.

Full history taking included obstetric history, 1st day of last menstrual period (LMP), gestational age documentation, medical or surgical history any operations and drug allergy if obstetric or operative complication were verified.

Ultrasound was done by Voluson E6 BT16 ultrasound apparatus (GE Healthcare Austria GmbH & Co OG) to measure the fetal TCD, BPD, FL, AC and HC as parameters of gestational age estimation. The technique of ultrasound conducted was included to perform a transabdominal ultrasound on all pregnant women while were in tiletposition with the head of the bed raised 30 degree and small pillow under the right loin. Measurement of the BPD was taken in the lateral ventricles view, rugby – foot ball – shaped skull rounded at the back (occiput) and more pointed at the front (synciput) along midline equidistant from the

proximal and direct scale echaes. The cavum septum pellucidam listed the midline one – third (1/3) of the distance from synciput to occiput the two anterior horns of the lateral ventricles symmetrically placed about the midline the BPD included the thickness of the upper partial bone (outer to outer) measurement. Both calipers were placed according to specific methodology because more than one technique has been described (e.g outer edge to inner edge or leading-edge technique VS outer edge to outer edge at the widest part of the skull using an angle that was perpendicular to the midline flax (*Damasio and Damasio, 1983*).

Regarding the measurement of the TCD obtaining the transthalamic view of BPD then rotation of the probe slightly downwards the fetal neck the position horn of the lateral ventricle was designed from the view to be replaced by the cerebellum the TCD measured at 90 degrees to the long axis of the cerebellum across its widest point by the use of the outer-to-outer methods. Regarding the measurement of the femur length, the FDL was in imaged optimally with both ends of the ossified metaphysicclearly visible. The largest axis of ossified diaphysis was measured by the same technique as that used to establish the reference chest as regards the angle of insemination between 45-90 is typical regarding the caliper placement. Each caliper was placed at the end of the ossified diaphysis without including the distal femur to be excluded trigular supra-art facts that can falsely extend the diaphysis length 11 ultrasound device: values 730 ultrasound apparatus, austria software.

Statistical methods:

Data were statistically described in terms of mean \pm standard deviation (\pm SD) and, range, or frequencies (number cases) and percentages when appropriate. Comparison between the different methods of estimating gestational age was done using paired t Test. Accuracy of different estimation parameters in relation

to the LMP parameter was done within 1 week error. P values less than 0.05 was considered statistically significant. All statistical calculation were done using computer program (SPSS) (statistical package for the social science, SPSS/ inc, Chicago IL USA) release 15 for Microsoft windows (2006).

RESULTS

The exclusion criteria were women who were unsure of dates or those with anomalous fetus or intra uterine fetal death (IUFD) or with multiple gestation

and with medical disorders like hypertension or diabetes were excluded.

The mean gravida of the pregnant women that were 2.1 with a standard deviation of 0.9 (**Figure 1**).

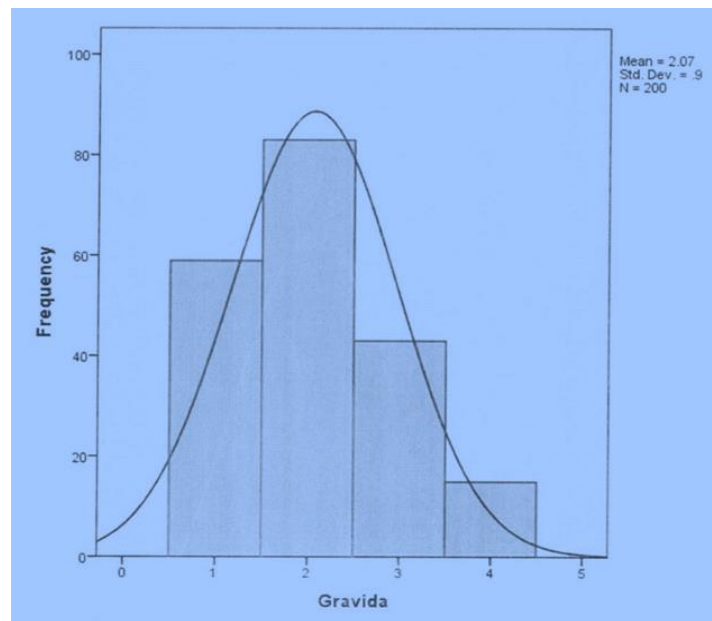


Figure (1): Histogram for gravida.

The mean length was 160.93 with minimum 158.9 and maximum 165 CM patients included in this study was subjected to verbal consent obtained from the pregnant women who were included in the study. Full history taking which included the name, age, occupation and address. Obstetric history and 1st day of last menstrual period (LMP), gestational

age documentation, medical or operative history, and any allergy or obstetric or operative complication were verified the inclusion criteria were women in child bearing period only singleton, uncomplicated pregnancy between 16 – 28 weeks of pregnancy calculated by the first day of last menstrual periods (**Table 1**).

Table (1): Gravida distribution

Length of the pregnant women	Frequency	Percent
1	59	29.5%
2	83	41.5%
3	43	21.5%
4	15	7.5%
Total	200	100

The summarization of the length of the pregnant women during the second trimester with the mean length 160.9cm

and standard deviation 2.9 women Age (Figure 2).

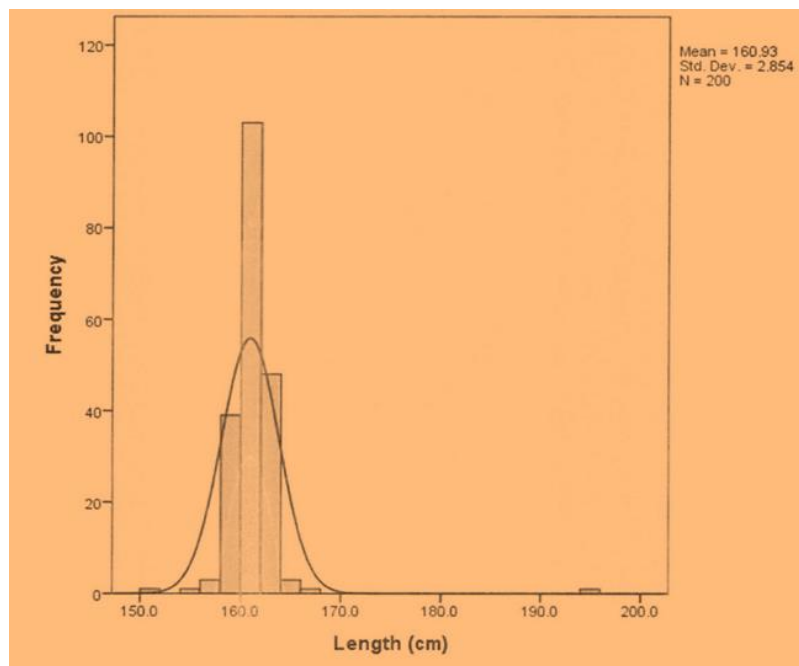


Figure (2): Histogram for length (cm)

The histogram showed the mean weight of the pregnant women that were

63.7 kg with a standard deviation of 4.8 (Figure 3).

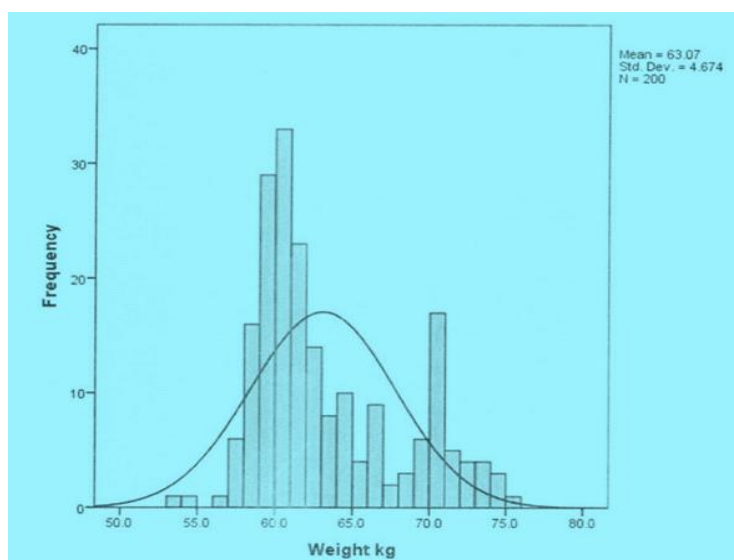


Figure (3): Histogram for weight (kg).

With minimum 19 and maximum 44 years, while the mean gestational age by the reference dates (LMP) was 18.56, with minimum 13 and maximum 25 weeks

13 and maximum 24 weeks, the mean gestational age by the BPD was 18.42 with minimum 13 and with maximum 24 weeks. The mean gestational age by A.C was 18.20 with minimum 13 and maximum 23 weeks, while the mean gravida 2.07 with minimum 1 & maximum 4 while the mean weight was 63.07 with minimum 58 and maximum 75.0 kg (**Table 2**). Measures of summarization of

TCD was 18.61 with minimum 13 and maximum 24 and the mean gestational age by the average of FL was 18.43 with minimum.

the biometric measurements the mean age 30.2 years standard deviation 7.1 the mean of TCD is 18.4 mm were:

- Mean of LMB 18.56.
- The mean of TCD is 18.61mm.
- The mean of FL 18.43.
- The mean of BPD 18.42.
- The mean of ADC 18.20. eight was 63.07 with minimum 58 and maximum 75.0 kg.

Table (2): The mean of four parameters and women age

	N	Minimum	Maximum	Mean	Std. Deviation
Age	200	19	44	30.23	7.05
GA-LMP	200	16	28	18.56	3.412
GA-TCD	200	16	28	18.61	3.432
GA-FL	200	16	28	18.43	3.321
GA-BPD	200	16	28	18.42	3.330
GA-ADC	200	16	28	18.20	3.130

The gestational age according LMP the frequency and percentage of the gestational age according LMP. As regard the study population was 200, the

gestational age according to the BPD the pregnancy of gestational age and percentage in (16-28) weeks. The gestational age according to BPD the

frequency of gestational age and 3). percentage were in 16-28 weeks (Table

Table (3): GA-LMP/ wks, GA-TCD/ wks GA-FL/ wks and GA-BPD/ wks. distributions among population under study

Variables	Count	Number of weeks	Frequency	Percent
GA- LMP/ wks		16	10	5.0
		17	18	9.0
		18	19	9.5
		19	12	6.0
		20	21	10.5
		21	17	8.5
		22	13	6.5
		23	16	8.0
		24	14	7.0
		25	22	11.5
		26	15	7.5
		27	11	5.5
		28	12	6.0
		Total	200	100.0
GA- TCD/ wks		16	10	5.0
		17	20	10.0
		18	22	11.0
		19	12	6.0
		20	21	10.5
		21	16	8.0
		22	14	7.0
		23	8	4.0
		24	15	7.5
		25	16	8.0
		26	14	7.0
		27	13	6.5
		28	19	9.5
		Total	200	100.0
GA- FL/ wks.		16	14	7.0
		17	15	7.5
		18	20	10.0
		19	12	6.0
		20	21	10.5
		21	19	9.5
		22	9	4.5
		23	21	10.5
		24	12	6.0
		25	22	11.0
		26	10	5.0
		27	14	7.0
		28	11	5.5
		Total	200	100.0

GA- BPD/ wks.	16	10	5.0
	17	22	11.0
	18	21	10.5
	19	15	7.5
	20	20	10.0
	21	17	8.5
	22	16	8.0
	23	9	4.5
	24	11	5.5
	25	29	14.5
	26	7	3.5
	27	14	7.0
	28	9	4.5
	Total	200	100.0

As regard the study population was 200, the gestational age according to AC the pregnancy of gestational age and percentage in (16 – 28) weeks. The gestational age according to A.C the

frequency of gestational age and percentage were in 16-28 weeks. The G.A according TCD the frequency of gestational age and percentage were in 16-28 weeks (**Table 4**).

Table (4): Comparison between different methods of measuring at gestational age.

Gestational Age “wks.”		Range	Mean±SD
Parameters	GA-LMP	16-28	18.56±3.412B
	GA-TCD	16-28	18.61±3.432A
	GA-FL	16-28	18.43±3.321C
	GA-BPD	16-28	18.42±3.330C
	GA-ADC	16-28	18.20±3.130D
	Repeated Measurement ANOVA	F-ratio	68.281
p-value		<0.001 highly significant	

Using: Repeated measures ANOVA was performed & multiple comparison between related means through Bonferroni correction.

Values in the column which have different letters are significantly different at (P<0.05).

There was a statistically significant difference between different methods of measuring at gestational age with p-value ($p < 0.001$). The highest value was found in GA-TCD ($18.61 \pm 3.432A$), followed by

GA-LMP (18.56 ± 3.412), while the lowest value was found in GA-FL and GA-BPD (18.43 ± 3.321 and 18.42 ± 3.330) respectively, finally there was mean of GA-ADC (18.20 ± 3.130) (**Figure 4**).

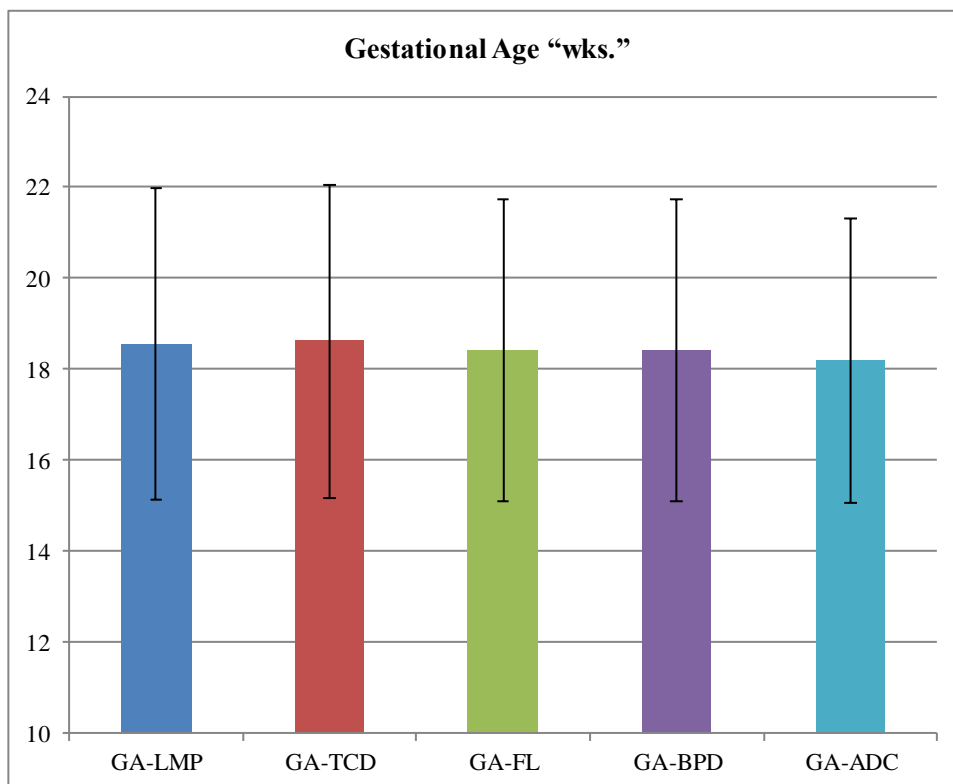


Figure (4): Comparison between different methods of measuring at gestational age

The statistical t test for the regard the study population was done which showing that the mean of the TCD, FL, BPD and AC to the reference date (LMP) and SD error mean 95% confidence interval of difference and P value. The statistical t test for the study population was done which showing that the mean of the TCD, FL, BPD and A.C to the reference date (LMP) and SD error mean, 95% confidence interval of difference and P value. The paired differences between the gestational age by the TCD and the gestational age by the FL was 0.537 and SD error was 0.038, 95% confidence interval from 0.060 to 0.210 and P value was > 0.01 . Form the numerical data from above table, these were in significant difference between the tree assessment tools we had compared (LMP and TCD), (LMP and FL) and (TCD and FL) while these were statistical different between the (LMP and BPD) and (TCD and PBD). The paired differences between the gestational age by TCD and the gestational by the FL was 0.537 and SD error was 0.038 95% confidence interval from 0.060 to 0.210 and P value was > 0.01 . The statistical paired t-test for comparison of means of the gestational age by LMP and gestational age estimation by the biometric measurements. The P-Values were significant for all comparisons. The smallest difference in means was found in the comparison between GA-LMP and GA-TCD. The accuracy rate of the biometric measurements in one week. TCD was more accurate (98%) than the other

biometric measurements accurate (98%) than the other biometric measurements. P-Values were significant for all comparisons. The smallest difference in means was found in the comparison between GA-TCD and GA-FL. The largest difference in means was found in the comparison between GA-TCD and GA-AC (Table 5).

Table (5): The accuracy rate in one week of the biometric measurements in comparison with the TCD during the second trimester

Parameters	Accuracy in 1 week		
	Accurate	Inaccurate	% Accurate
TCD	196	4	98.0%
BPD	190	10	95.0%
FL	187	13	93.5%
AC	190	10	95.0%

As regards the parity of the study population, 146 pregnant women (73%) were multipara and 54 (27%) were primigravida. The bias for TCD to the reference dates (LMP) was 0.344 with SD 0.24 and 95% limits of agreement from -0.098 to -0.002 while the bias for the BPD/FL to the reference dates (LMP and/or CRL) was 0.453 with SD 0.32 and 95% limits of agreement from 0.82 to 0.208 these numerical data have insignificant difference between the late assessment

tools we compare (TCD and LMP). The correlation between the biometric measurements and their gestational age estimation. We notice that there were significant correlations between all biometric measurement and their gestational age estimation (P-value < 0.001). On the other hand, we found that the TCD had the highest correlation in comparison to the other biometric measurements (Table 6).

Table (6): Correlation between the biometric measurements and the gestational age estimation during the second trimester

Biometric Measurements and GA estimation	r	P-value
Trans Cerebellar Diameter (TCD) & GA TCD	0.995	0.000
Biprietal Diameter (BPD) mm & GA - BPD	0.986	0.000
Femur Length (FT) mm & GA-FT	0.944	0.000

DISCUSSION

A study assessed the second –trimester ultrasound examination of women during this period of pregnancy. The data from the studies had shown that ultrasound estimation of GA during this period might be better than specific in older publications. Transcerebellar (TCD) diameter had been considered a unique parameter, well ascertained in ultrasound

literature as liable parameter for estimating the duration of gestation.

The aim of the present study was to assess the accuracy of TCD measurement in estimation of the GA during the second and the third trimester compared with the current fetal biometric measurements (FL and BPD) e.g. (Goel *et al.*, 2010).

We found that TCD was reliable in the prediction of GA, with concordance between the actual and the predicted GA

by TCD throughout gestation with an acceptable degree of accuracy.

Other studies have reported the reliable use of TCD with other multiple biometric parameters in an attempt to find a method to determine the GA and identify the GA of fetus.

In a study carried out by Reece, multiple biometric parameters were obtained, including the TCD using the electronic calipers of the machine. The findings indicate that growth of the TCD is not affected by intrauterine growth retardation; thus, this sonographic measurement may serve as a reliable correlate of GA against which potential deviations of growth may be compared (*Bhimarao et al., 2015*).

In the study by *Kocaoglu et al. (2010)* GA prediction intervals were derived from 270 normal fetuses between 14- and 40-weeks' gestation for BPD, head circumference, FL, and TCD. TCD satisfactorily predicted GA for six fetuses with asymmetric intrauterine growth retardation and was associated with the least amount of underestimation bias compared with other ultrasonographic parameters. In the present study, they found minimal differences between the TCD measurement-GA relationship and nomograms in other studies. The predicted GA in the third trimester was different in comparison with other studies by 0-3 weeks up to 30 weeks and by 0.5-6 weeks from 32 weeks of gestation.

The study carried out by *Rizzo et al. (2020)* showed that between 14- and 27-weeks' gestation, there were no clinically significant differences between their nomogram and the previously published studies in terms of the predicted GA.

However, predicted GA in the third trimester was considerably different on using their nomogram by 1-2 weeks from 28 to 30 weeks and by 4-6 weeks after 32 weeks.

In the present study, regression analysis indicated a strong linear relationship between TCD and GA, which makes the present study highly significant, and proved that TCD may serve as a reliable indicator of GA and fetal growth.

Similar to our findings, fetal imaging studies have shown that TCD correlates closely with GA and that the increase in TCD is linear during the second 20-22 and third trimester. Also, it has been shown that this correlation is not affected significantly by sex, fetal growth restriction, multiple pregnancy, or fetal macrosomy.

The study by *Davies et al.* aimed to confirm the relationship between GA and TCD to define the prediction of GA by TCD and assess the reliability of TCD measurements. TCD was measured in a total of 221 infants with known GA. TCD correlates closely with GA and predicts GA to ± 2.33 weeks. Measurements of TCD have excellent reproducibility.

The study by *Goel et al.* was carried out on 50 antenatal patients (20-40 years of age) between 14 and 40 weeks of pregnancy attending the clinic for routine ultrasound examination. Ultrasonographic measurement of TCD was performed to assess GA. The regression analysis indicated a significant relationship between TCD and GA, indicating that TCD is a good marker for the estimation of GA.

The TCD measurement appears to be an accurate predictor of GA, even in the third trimester of pregnancy. It correlates closely with GA and predicts GA up to ± 2 week in 83.3% of gestations. The suggested nomogram for TCD in the current study may be particularly useful for accurate dating of pregnancies in the third trimester. It is recommended to use TCD as an important ultrasound biometric parameter in normal singleton for the prediction of GA.

We compared transverse cerebellar diameter and gestation age in our study and found that sonographic evaluation of cerebellar growth reveals a linear relationship.

Similar to the findings of *Goel et al. (2010)* in their study found that TCD from 15th to 24th week gestation in millimeters is equivalent to the gestation age in weeks. However, after 24 weeks the TCD in millimeters exceeds gestational age in weeks. In our study, measurement of TCD in mm up to 24 weeks is equal to gestational age. The results of our prospective study provide normative data of fetal cerebellar growth throughout gestation.

In a recent study conducted on 228 Pakistani women at 36 weeks of gestation, the accuracy of TCD in corresponding to gestational age by LMP was higher than that of BPD (91.7% vs. 77.2%).

In conclusion TCD measured at the third trimester seems to be as accurate as BPD/FL in estimating the gestational age.

In other study, early sonographic visualization of the cerebellum occurred as early as 12 to 13 weeks gestation. During 14th to 20th week of gestation,

TCD in millimeters is equivalent to the gestation age in weeks. After 20 weeks, however the TCD in millimeters exceeds gestational age in weeks. According to another study, the normal fetal TCD exhibited a more than two-fold increase in size during the second half of pregnancy (*Wickum et al., 2014*).

It is said that USG fetal biometry is reliable in first two trimesters and its reliability diminishes as the gestation advances/ No single parameter is reliable in third trimester as shown by many studies. Usually average gestational age is calculated using one or more parameters is the currently practiced method in routine obstetric USG. In patients with incorrect and unknown LMP dates, USG helps in the assessment of correct fetal gestational age and fetal disorders. Hence USG plays a major role in modern obstetric practice in addition to the currently used biometric parameters, TCD can be used as an established and reliable USG parameter. TCD measurement is very simple and accurate. It is superior to other biometric parameters as it is not affected in many disorders like abnormal skull shapes, fetal growth retardation, and multiple pregnancies and large for date fetuses (*Anirban et al., 2012*). Hence it can be used as a reliable parameter in all routine antenatal USG.

In this study USG visualization of cerebellum was around 13 to 14 weeks of gestation. We observed the progressive USG changes of cerebellum from grade I to grade III as described in earlier literatures. Cerebellum can be easily imaged in the transverse sections of posterior cranial fossa without any difficulty and TCD measurement can be

taken. We noticed in our study the TCD in millimeters is almost equal to gestational age in weeks up to 20 weeks, thereafter TCD in millimeters exceeds gestational age in weeks and reached up to 56 mm. in our study we observed a linear relationship between TCD and gestational age indicating the reliability in the estimation of gestational age and monitoring fetal growth. Our findings are consistent with observations made in previous studies. The progressive USG changes of the cerebellar development is attributed to purkinje cell differentiation and decrease in cerebellar water content with advancing gestational age (*Gabay et al., 2017*).

CONCLUSION

Transcerebellar diameter was more reliable method of gestational age determination in second trimester of pregnancy than biparietal diameter transcerebellar diameter, and femur length used as a tool to assist in assessment of gestational age in second trimester.

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دراسة مقارنة بين القطر المخيخ مع قطر بين الجدارين
وطول عظم الفخذ بالموجات فوق الصوتية لقياس عمر
الجنين في الثلاثة أشهر الثانية من الحمل
أحمد علي محمد تنيتين، إسماعيل محمد عبد العظيم ميرة،

عبد المنصف عبد الحميد صديق

قسم أمراض النساء والتوليد، كلية الطب، جامعة الأزهر

الكاتب المراسل: أحمد علي محمد تنيتين، جوال: 01004508804

الايمل: ahmedaliteniteen@yahoo.com

خلفية البحث: التحديد الدقيق لسن الحمل مهم في إدارة رعاية العيادات الخارجية والتخطيط المناسب للتدخل أو العلاج المناسب للقطر عبر المخيخ مزايا كبيرة في التنبؤ بعمر الحمل في حالات المواعيد غير المؤكدة أو تأخر النمو داخل الرحم المشتبه به (تأخر النمو داخل الرحم). هناك قدر ضئيل من البيانات المتاحة حول العلاقة بين القطر عبر المخيخ والقطر الثنائي في الثلث الثاني من الحمل.

الهدف من البحث: تقييم الدقة التشخيصية لقياس القطر عبر المخيخ (TCD) في تقدير عمر الحمل خلال الفصل الثاني مقارنة مع القياسات الحيوية للجنين الأخرى بما في ذلك طول عظم الفخذ (FL) والقطر الثنائي (BPD).

المريضات وطرق البحث: أجريت هذه الدراسة على 200 امرأة حامل مع تقدم الحمل بشكل طبيعي خلال الثلث الثاني من الحمل مع عمر الحمل بين (16 - 28 أسبوعاً) في الفترة ما بين ابريل 2020 حتى اكتوبر 2020 بمستشفيات جامعة الأزهر (الحسين، السيد جلال). وكانت معايير التضمين في الدراسة هي عرض رأس الحمل المفرد وغياب التشوهات الجنينية وعدم وجود تاريخ للأمراض المزمنة: مرض السكري أو ارتفاع ضغط الدم وعدم وجود تاريخ لأطفال غير طبيعيين أو ولادة جنين ميت، وقدم جميع المريضات موافقة مستنيرة وخضعوا لما يلي: من خلال التقييم من التاريخ، الفحص العام والبطن والموجات فوق الصوتية (الولايات المتحدة) لتقييم: تم إجراء الموجات فوق الصوتية للجنين، FL، BPD،

AC و TCD عبر البطن لجميع المشاركين تم قياس TCD عن طريق تحديد موقع المخيخ في الحفرة الخلفية عن طريق دوران محول الطاقة إلى 30 درجة من الطائرة التي حددت تجويف المهاد للحاجز الشفوي، والبطين الثالث وصهرج ماجنا، (CM) وضع الفرجار على الهوامش الخارجية لنصفي الكرة المخية.

النتائج: أظهرت نتيجة الدراسة المحسوبة أن القطر عبر المخيخ (TCD) أكثر دقة من القطر الثنائي (BPD)، وكان هناك فروق ذات دلالة إحصائية بين القطر عبر المخيخ (TCD) و قطر القطرين (BPD)، كما كان هناك فرق معنوي. الفرق الإحصائي بين قطر عبر المخيخ (TCD) وطول عظم الفخذ (FL) لتحديد عمر الحمل في الثلث الثاني، تمت مقارنة جميع هذه البيانات مع آخر فترة حيض (LMP).

الإستنتاج: أقطار المخيخ (TCD) هي طريقة أكثر توثيقاً لتحديد عمر الحمل (GA) في الثلث الثاني من الحمل من القطر الثنائي الجداري (BPD)، ويمكن استخدام TCD كأداة للمساعدة في تقييم GA.

الكلمات الدالة: القطر عبر المخيخ بقطر ثنائي الجداري وطول عظم الفخذ بالموجات فوق الصوتية لعمر الحمل.