DOI: https://doi.org/10.53350/pjmhs22168280

ORIGINAL ARTICLE

Diagnostic Accuracy of Fetal Transverse Cerebellar Diameter (TCD) Measurement as an Individual Parameter for Prediction of Gestational Age in Pregnant Ladies

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ABSTRACT

Objective: To determine a relation between fetal transverse cerebellar diameter (TCD) and gestational age from 14 to 36 weeks in pregnant ladies including local population of Karachi from different areas.

Methodology: One hundred and seventeen pregnant women were included. The sample size was determined via Online WHO EPI sample size calculator considering the previous study [(21)] via correlation (r=0.94) with confidence interval 95% and power of test 90%. Booked cases of pregnant women age ranging between 18-40 years with singleton pregnancies of any parity seeking ultrasound for antenatal care were included. Pregnant women with known case of hypertension, diabetes mellitus or diagnosed case of pregnancy induced hypertension or gestational diabetes &fetal structural anomalies were excluded. Demographics and obstetrical data including name, age, parity and relevant records of gestational age from early dating sonographic scan were recorded. Under supervision of expert radiologist in addition to regular biometry parameters T.C.D was also recorded for determination of gestational age. Recorded data was analyzed electronically via SPSS version 22.

Results: A quantitative analysis of 117 patients For determination of a correlation between transverse cerebellar diameter (TCD) and gestational age of fetus revealed that out of total 117 pregnant women 29 were primiparous, six were grand multiparous (>5 parity) and the rest were multiparous. Mean ± SD of maternal age was 26.4±4.7 years with minimum 18 and maximum 40 years. Pearson's correlation coefficient showed that a strong and linear correlation was found among fetal transverse cerebellar diameter & the gestational age i.e. (r=0.99) P<0.005.

Conclusion: Between Transverse cerebellar diameter and the gestational age of the fetus between 15 to 36 weeks, a linear correlation was noted. Hence, it can be utilized as a reliable predictor of gestational age.

Keywords: Fetal Transverse Cerebellar Diameter, Ultrasound, Gestational Age.

INTRODUCTION

The Gestational Age of fetus is vitally important for antepartum management and timely appropriate therapy or intervention.[1] Methods for determination of gestational age from sonographic fetal biometric parameters have been reported since more than four decades. The early ultrasound reports are useful for assessment of gestational age.[1,2,3] Early dating scan is an ultrasound spanning first ten weeks of pregnancy. In this scan transvaginal or Transabdominal ultrasound is performed and gestational age is assigned through either the mean sac diameter or the crown rump length. Crown Rump Length (CRL) provides an accurate gestational age within 95% confidence range.[4,5,6,7] Most of the pregnant women in Pakistan go for an antenatal consultation in the third trimester of pregnancy and are unassertive about their last menstrual period required for clinical estimation of fetal gestational age. Most of these women never get an opportunity to get an early dating dating scan done either.[8,9]

Sonographically, Variable combination of parameters are used for assessment of gestational age. Some of these are biparietal diameter (B.P.D), head circumference (H.C) abdominal circumference (A.C), and femur length (F.L) but as gestational age progresses, dependability of any solitary parameter diminishes.[2-3] Also in conditions like skeletal dysplasia, intrauterine growth restriction, altered skull shape etc results in compromised measurement of gestational age. The cerebellum is well confined within petrous bony ridge and occiput thereby not affected by extrinsic pressure. The acceleration or restriction of intrauterine growth does not significantly affect the growth of cerebellum.[10] So it can be utilized as a dependable predictor for gestational age in those who are unaware of their last menstrual period and suffering from intrauterine growth retardation (IUGR).[11] In the preceding decade, transcerebellar diameter (T.C.D) has been used as a valid predictor for assessment of gestational age in the third trimester only.[5-9]

The aim of conducting this research is to assess the correlation of transcerebellar diameter and gestational age of fetus ranging between 14 to 36 weeks of pregnancy keeping the early dating scan for gestational age determination via crown rump length as gold standard. The advantage of conducting this study will be validating the use of fetal T.C.D as a reliable predictor for the prediction of gestational age independently as opposed to combination of multiple parameters.

METHODOLOGY

This is an observational descriptive cross-sectional study, conducted at ultrasound unit of Diagnostic Radiology Department, from February 2019 to July 2019. After the approval of synopsis and granting of permission from Ethical and Scientific Review Committee, KMDC, the study was conducted on local population. Sample size was determined by using Online Who Calculator. For Sample Size Determination keeping previous study[21] correlation coefficient r=0.94 and p value below 0.001 as significant. The sample size turned out to be 117 patients.

Criteria for selection of patients were booked case of Pregnancy (Gynecology and Obstetrics department of Hospital) with any parity having single intrauterine fetus looking for ultrasound for antenatal well-being between 14 to 36 weeks of pregnancy. Pregnant women with known case of hypertension, diabetes mellitus or diagnosed case of pregnancy induced hypertension or gestational diabetes & fetal structural anomalies that are diagnosed during the ultrasound exams were excluded. Co-morbidities and structural anomaly information were sought from booking and follow up records.

A high-resolution general electric (GE) ultrasound unit set with a convex probe having a frequency of 3.75 MHz's was used to carry out ultrasound examination on patients. It is generally used as the standard for obstetric examinations.

Ultrasonography was performed under an expert radiologist's guidance with the patient lying supine on table, coupling gel was applied to the abdomen of pregnant lady; on visualization of fetus, focus was made on revelation of posterior fossa. For this, the anatomical landmark of thalami, 3rd ventricle and cavum septum pellucidum were used, slight posterior angulation of transducer below thalamic plane revealed characteristic butterfly shaped cerebellum. Electronic calipers were set at the outer margin of the cerebellum to record maximum

widest diameter. Along with this demographical data including patients name, age, parity, the relevant routine measurements especially with corresponding gestational age from early dating scan were taken.

All data were put on SPSS version 22 and analyzed. Means and standard deviations along with minimum and maximum values were determined for the quantitative variables like gestational age and maternal age, parity and TCD.

Pearson's Correlation was applied between the fetal transverse cerebellar diameter and the gestational age and displayed on the scatter plot.

RESULTS

In this study 117 patients were included to evaluate the correlation among transverse cerebellar diameter (TCD) and gestational age. Out of total 117 pregnant women 29 were primiparous, six were grand multiparous (>5 parity) and rest were multiparous.

Mean ± SD of maternal age was 26.36 ±4.7 years with minimum 18 and maximum 40 years as we see in TABLE 1.

Table 1: Descriptive statistics of maternal age (n=117)

Descriptive statistics of mothers (n=117)			
Characteristic	Minimum value	Maximum value	Mean (Standard deviation)
Maternal Age (in years)	18	40	26.36 (4.73)

Mean ± SD of transcerebellar diameter (T.C.D) was 3.43+3.97 with minimum 1.4 and maximum 30 as shown in table 2

Mean ± SD of gestational age (G.A) was 28.02+5.78 with minimum 14 and maximum 36 as shown in TABLE 2

Table 2: Descriptive statistics of transverse cerebellar diameter and gestational age (n=117)

Characteristic	Minimum value (cm)	Maximum value	Mean (Standard deviation)
Transverse cerebellar diameter	1.40	30	3.43 (3.97)
Gestational Age (in weeks)	14.00	36	28.02 (5.78)

Pearson's correlation coefficient showed there is linear correlation found between transverse cerebellar diameter the & gestational age i.e. (r=0.137) p<0.142.

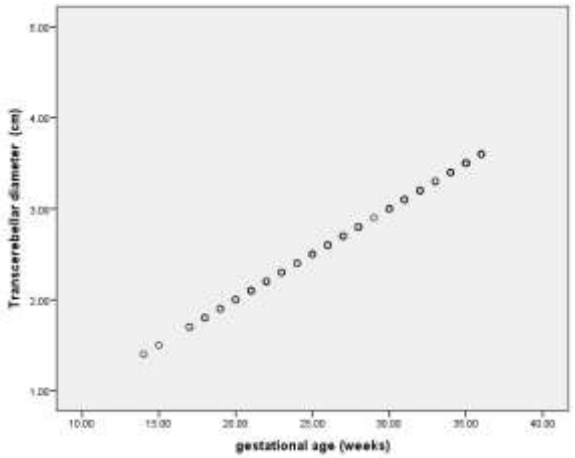

Figure 1: Graph showing the correlation among gestational age and transverse cerebellar diameter.

DISCUSSION

Fetal biometry is essential for obstetric management. It is assessed with ultrasonography. Variable parameters are used like biparietal diameter (BPD), Crown-Rump length (CRL), Femoral Length (FL) and Abdominal Circumference (AC). Such biometric measurements are useful in determining the gestational age, fetal growth and wellbeing (including fetal weight, growth restriction or macrosomic fetus) as well as the fetal weight with high degree of precision. Furthermore, it is essential to estimate these parameters for optimal obstetric managements and outcomes.[12] Accurate evaluation of gestational age is always very crucial for correct and apposite obstetric management.[13] As the gestation advances reliability of single parameter diminishes.[5-9]

Malik G et al, in their observational study found out that the transverse cerebellar diameter had a variation in linear manner in last trimester, whereas the transverse cerebellar diameter to abdominal circumference (TCD/AC) ratio had a consistency in second half of pregnancy.[14] Holanda-Filho JA et al, in their research conducted among pregnant women between thirteenth and fortieth week of gestation as part of low-risk prenatal care showed correlation between gestational age and fetal transverse cerebellar diameter (TCD) using single ultrasonographic TCD assessment. The correlation was found to be very strong (r=0.97: p-value 0.001). The researchers also determined that using regression analyses, accurate gestational age can be predicted during the last two trimesters of pregnancy[15]. A study published by Vinkesteijn AS et al, examined the relationship between TCD growth relative to gestational age among restricted growth and normal fetuses. They also assessed the significance of transverse cerebellar diameter as well as abdominal circumference in predicting perinatal mortality among normal fetuses of gestational ages between 17th and 34th weeks and among growth-restricted fetuses between 24th and 34th week of gestation. They found a positive association and ability of TCD and AC to predict, with significant accuracy, the perinatal mortality among these fetuses.[16]

Orji MO and Adeyekun AA,[17] in their study found that the range of TCD of the fetuses studied was from 11.9 mm (at 13 weeks) to 59.3mm (at 41 weeks). The mean value was found to be 34.2 ± 14.1mm and there was noteworthy correlation linking TCD and the menstrual gestational age (r =0.984; p=0.000). So, they concluded that fetal TCD throughout gestation is well correlated with gestational age.

The prospective cross-sectional study of Ramireddy HR et al[25] revealed that all pregnant women having single intrauterine fetus getting ultrasound for antenatal care between 14 to 36 weeks of their pregnancy underwent for fetal biometry. Transverse cerebellar diameter (T.C.D) of fetus was measured and gestational age determined by Early Dating Scan via Transvaginal ultrasound using CRL with accuracy for gestational age within 95%, confidence range, were correlated using Pearson correlation on SPSS version 22. Correlation(r=0.137) p=0.142 found between (T.C.D) and gestational age indicating the reliability of use of T.C.D for prediction of gestational age from 14 to 36 weeks of pregnancy.

CONCLUSION

The conclusion of this study is that a highly significant and strong positive linear correlation was noted between TCD measured by ultrasonography and gestational age in this study. Yet, this subject is still left unexplored and there is an urgent and essential requirement to carry out more such studies utilizing larger sample sizes and including multiple study sited in Pakistan to substantiate these results.

Conflict of interest: None

Ethical Approval: The ethics review board of the University approved this study

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