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Sonographic Correlation of Gestational Age with Umbilical Cord Diameter in Second and Third Trimester

Zeeshan Khalid¹, Usman Akbar², Raham Bacha³, Zainab Asif⁴, Saima⁵, Mehreen Fatima⁶, Muhammad Yousaf Farooq⁷, Sajid Shaheen Malik⁸, Syed Amir Gilani⁹

¹ Medical imaging Doctor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT) Faculty of Allied Health Sciences (FAHS), The University of Lahore. Contact: Zeeshan9.com99@gmail.com

² Medical imaging Doctor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT) Faculty of Allied Health Sciences (FAHS), The University of Lahore.

³ Assistant Professor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT), Faculty of Allied Health Sciences (FAHS), The University of Lahore. Contact: dr.rahambacha@gmail.com

⁴ Medical imaging Doctor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT) Faculty of Allied Health Sciences (FAHS), The University of Lahore

⁵ Medical imaging Doctor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT) Faculty of Allied Health Sciences (FAHS), The University of Lahore

⁶ Lecturer, Research Coordinator, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT), Faculty of Allied Health Sciences (FAHS), The University of Lahore. Email: mehreen.fatima@uipt.uol.edu.pk

⁷ Assistant Professor, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT), Faculty of Allied Health Sciences (FAHS), The University of Lahore. Email: Yousafgelani@gmail.com

⁸ Head of Department, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT), Faculty of Allied Health Sciences (FAHS), The University of Lahore. Email: Sajid.shaheen@rsmi.uol.edu.pk

⁹ Dean, University Institute of Radiological Sciences and Medical Imaging Technologies (UIRSMIT), Faculty of Allied Health Sciences (FAHS), The University of Lahore. E-mail: Profgilani@gmail.com

Corresponding Author: Zeeshan Khalid. Contact: Zeeshan9.com99@gmail.com

Abstract

Background: Commonly fetal parameter for gestational age (GA) assessment have pitfall mostly in progressive pregnancy and pregnancy complicated by fetal structure abnormality. **Objective:** Correlating of gestational age in the second and third trimesters with umbilical cord diameter. **Methods:** A cross-sectional sonographic study of 370 pregnant women with gestational age from 14 weeks to 40 weeks was done in Government Tehsil Headquarters Hospital Kahn a nau Lahore, Ferozpur Road, Lahore. The gestational age was first estimated using Naegele's GA estimation formula based on the starting date of the last menstrual period of each subject. Fetal parameters like biparietal diameter, femur length, circumference of the head and abdominal circumference have been used to estimate gestational age. The umbilical cord diameter has been measured to find a correlation between gestation age and umbilical cord diameter. **Results:** The fetal parameters and umbilical cord diameter increase in the fetus as the gestational age increases. There seems to be a linear relationship and significant statistical correlation ($p < 0.05$) in between umbilical cord diameter and the gestational age estimation. The umbilical cord diameter appeared to increase by the rate of 1mm/week between 14TH to 40TH weeks of the gestational period. **Conclusions:** The umbilical cord diameter has a strong linear relationship with commonly used parameters for the assessment of fetal gestational age and is able to use as a reliable method to evaluate fetal growth as well as prediction of gestational age.

Keywords: Umbilical Cord, Gestational Age, Sonography, Last Menstrual Period, Biparietal Diameter (BPD)

Introduction

The precise knowledge of gestational age is an important decision of both prenatal care with the successful delivery of babies (Rostamzadeh, Kalantari, et al. 2015). Gestation lasts approximately 40 weeks (280 days), calculate since the first day of the woman's last menstrual period of the woman (LMP) (Olesen, Westergaard, et al. 2004). Unfortunately, the gestational age estimate based on last menstrual period is often unsuitable for as many women, especially women without history (Rostamzadeh, Kalantari, et al. 2014).

Fetal parameters such as biparietal diameter (BPD), femur length (FL), abdominal circumference (AC) and head circumference (HC), commonly used to estimate gestational age. (Leung, Pang, et al. 2008).

The difference in measuring techniques ultrasound measurement tends to reduce accuracy (Lee, Kirk, et al. 2000). Measuring the head circumference (HC) as a gestational age predictor compensates for BPD deficiencies due to head shape, However measuring head circumference is often technically more difficult and has a higher degree bias of observer (Lobo, Favorito et al. 2011).

In addition, the measurement of FL for dating at later stages in pregnancy is considered unreliable, since the femur, in some cases, foreshortened appear and can therefore not provide accurate (Abd AL-fadel 2017). GA in cases of dwarfism abdominal circumference in the later stage of pregnancy measurement was considered to be the most important fetal dimension, However, the fetal size/weight is more reflective than the gestational age (Cromi, Ghezzi, et al. 2007).

The accuracy of fetal parameters as gestational age scheduler can increase or decline as pregnancy progresses (Tanner 1998). For example, biparietal diameter (BPD) is accurate to gestational age in the second quarter by + 10 days and + 21 days in the third quarter. Similarly, in the second trimester, Femur length is accurate to GA by + 6 days, while in the third trimester, GA by + 14 days. 4, 5 Since 20 weeks of gestation (Cromi, Ghezzi, et al. 2007, Abd AL-fadel 2017).

An important fetal-maternal unit is an umbilical cord with a vein and two arteries. It module blood from the placenta to the fetus (Heifetz 1996). This study estimated a strong co-relationship in between umbilical cord diameter and gestation age in second and third trimesters (Raio, Ghezzi, et al. 1999).

Methodology

This comparative and cross-sectional study was carried out at Government Tehsil Headquarters Hospital Kahn a nau Lahore, Ferozpur Road, Lahore, while 370 individual were recruited. This research was started after the Approval of the Institution Review Board (IRB). The duration of the study was three months (October 10, 2018, to January 10, 2019). The patient was briefly explained the research procedure and the objective of the study to correlate gestational age with umbilical cord diameter in the second and third trimester. 370 pregnant women are subjected to routine obstetric scanning in the second and third trimesters.

Every pregnancy is a singleton. Complicated pregnancies such as IUGR, multiple pregnancies, Oligohydramnios, Anhydramnios, diabetic and hypertensive are excluded. The diameter of the umbilical cord measured in mm and tabulated BPD, AC, HC, FL. The age of gestation determined by the formula of Nagele (i.e., EDD determined by adding 7 days and 9 months to LMP). Only transabdominal sonographic examinations were performed in the supine position. Commonly considered parameters of fetal for gestational age estimates such as HC, FL, AC, and BPD were all measured in accordance with departmental protocols, These measurements sonography estimate the gestational age as shown in (fig:1) by using the scanner based on Hadlock et al. 1985 proposed formula. Umbilical cord measurement only is taken when the outer edges of the cord were outlined in a longitudinal plane as shown in (fig:2). The ultrasound machines of Mindray Z5, Toshiba xario 100 and Samsung HS 40 with convex transducer probe of 3- 5 MHz and linear array with a 7-12 MHz frequency was used. The gestational age estimation was based on a reliable collection of date of onset the last menstrual period (LMP) and validated by ultrasound scan done within 2nd and 3rd trimester of pregnancy. All patient data were analyzed on Statistical Package for the Social Sciences (SPSS) is a software package used in statistical analysis of data. It

was developed by SPSS Inc. and acquired by IBM in 2009. In 2014, the software was officially renamed IBM SPSS Statistics.

Fig 1: Grayscale ultrasound measuring the (BPD) and FL

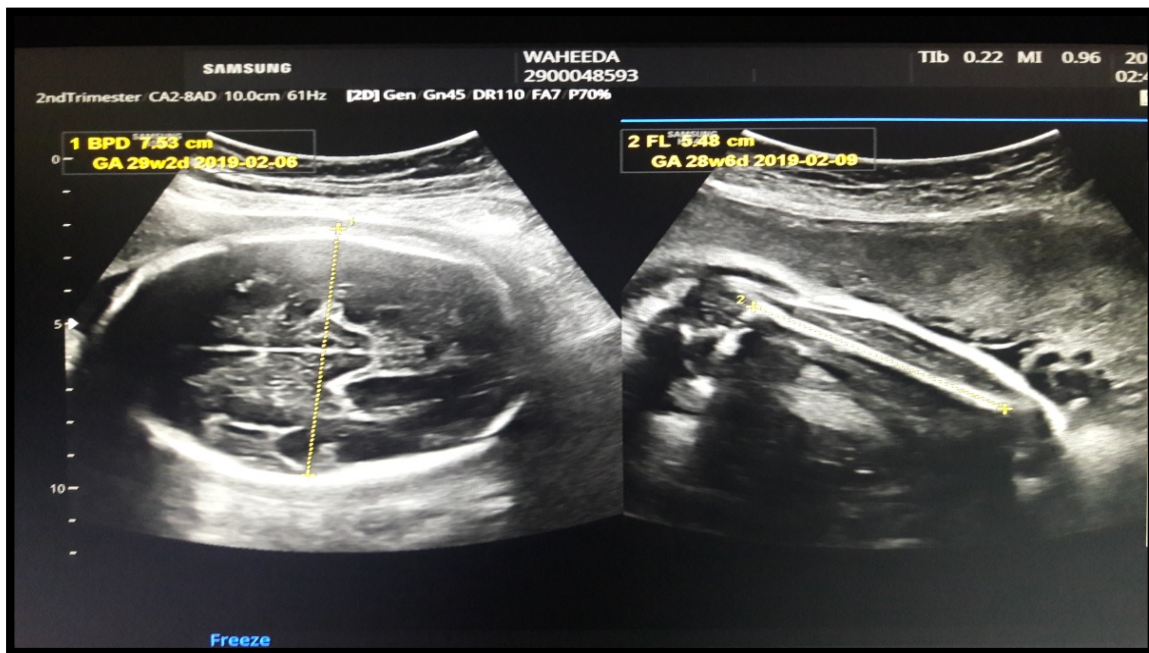
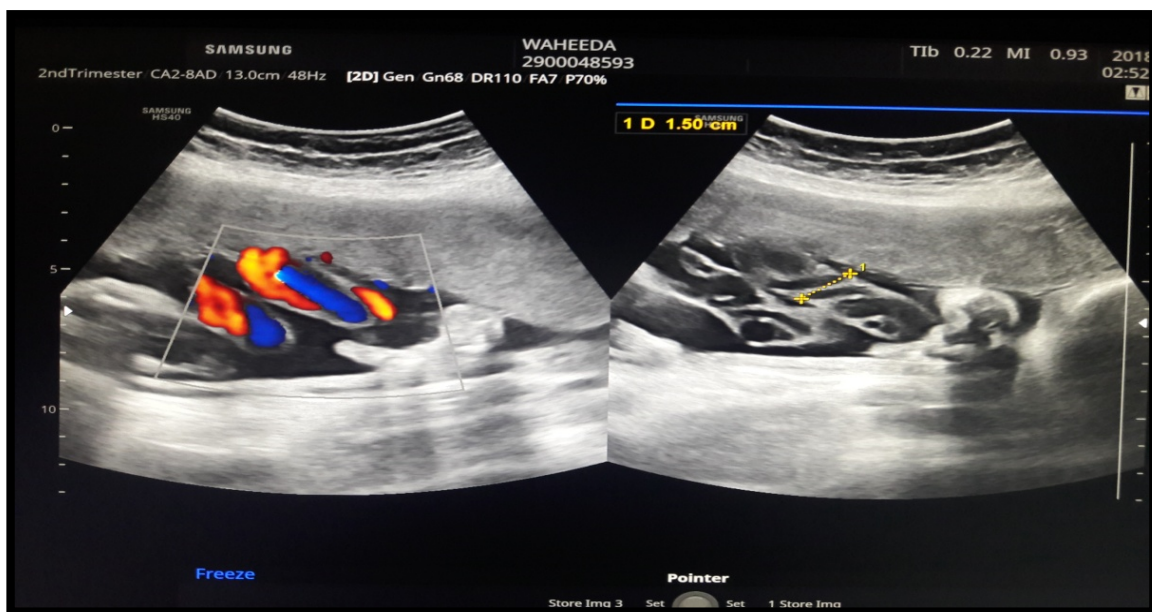


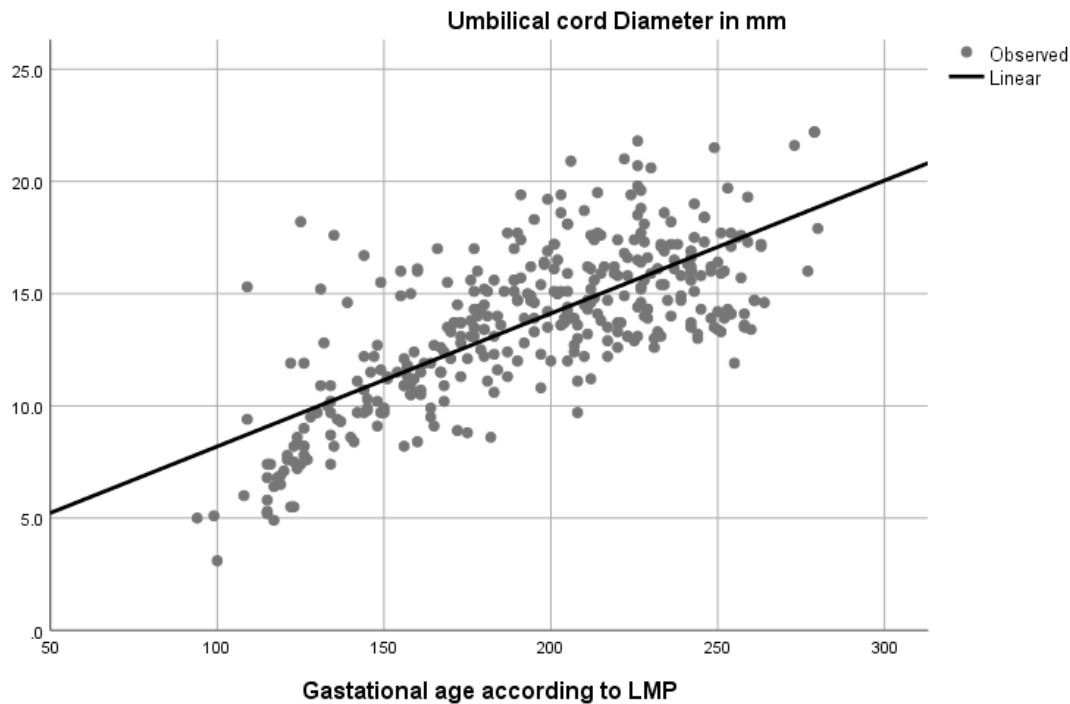
Fig 2: Measures the umbilical cord Diameter on grayscale with color Doppler



Results

The mean cord diameter is around $3.10 \pm S.D$ mm at the beginning of 2nd trimester (14th wk) while it is around $22.2 \pm S.D$ mm at last trimester (40th wk) and the significant value ($p < 0.01$) as shown in (table1 and table 2). The findings showed that the cord diameter increases gradually as pregnancy advances (at the rate of approx 1mm/wk). There were linear relationship and statistically significant correlation between umbilical cord diameter and gestational age. Data on Umbilical cord diameter, gestational age (USG), gestational age (LMP), were collected 370 cases and entered into Statistical Package for the Social Sciences (SPSS) 24.0 software for

analysis. Descriptive analysis, mean, SD, correlation and regression analysis were undertaken (Graph 1 :). Scatter plot shows that cord diameter appears to increase as (GA) increased.



Graph 1: Scatter plot of umbilical cord Diameter Vs (GA) estimated by LMP

Discussion

The main observation of this study is that the umbilical cord diameter and either gestational age are strongly related (Ghezzi, Raio, et al. 2001). The accurate knowledge of the gestational age (GA) depends largely on the achievement of the best possible prenatal care and successful pregnancy outcome (Ghezzi, Raio, et al. 2002). Ultrasound has remained an important imaging method in the estimation of GA (Hill, DiNofrio, et al. 1994). Many authors using multiple fetal parameters on ultrasound for measuring gestational age (Mital, Gupta, et al. 2014). A cross-sectional study of the umbilical cord to estimate gestational age has been reported in a previous study; In our study mean umbilical cord diameter is $13.70 \pm$ S.D mm. This result is slightly different from the previous study in which the mean umbilical cord diameter was $15 \pm$ SD mm (Eze, Ugwuja, et al. 2014). However, our study is extensively smaller than the mean umbilical cord diameter found in the 20mm report in a Turkish population (Deen, Hill, DiNofrio, et al. 1994). The umbilical cord Diameter mean in our study, appears significantly larger than 191mm² as reported in Indian subjects (Tahmasebi and Alighanbari 2011). These variations were not investigated in the study. It is likely; the variation in the mean of umbilical cord sizes may suggest environmental differences in the development of umbilical cord.

The fluctuation in our and previous study due to different umbilical cord protocol applied by a different observer. Table (1) presented the Mean and Std Deviation of gestational age according to sonography, gestational age according to LMP and Umbilical cord Diameter in mm. In (figure 3): Graph of umbilical cord Diameter Vs (GA) estimated by LMP shows the strong correlation between the umbilical cord diameter and the gestational age by last menstrual Period (LMP) in weeks. The umbilical cord diameter increased at the rate of 1mm/week from the 14th-40th week of gestation in our study. Mean umbilical cord diameter was also found to increase steadily as pregnancy advances. In the present study umbilical cord diameter increased as reported in a previous study (Ghezzi, Raio et al. 2001) as pregnancy advanced umbilical diameter positively correlated ($r=0.973$ and $r=0.974$ respectively) with GA. Results of the present study also near to Weismann and Drugan. Who reported a strong positive correlation between umbilical cord (diameter) and gestational age. Furthermore, Gehzziet al16 had equally reported that sonographic cross-sectional diameter and area of umbilical cord

increased as cyesis advanced while Togni et al²¹ 336 had earlier reported a significant correlation between cord diameter and gestational age. Thus results of the present study supported previous study and opinions or suggestions. That sonographic measurement of umbilical cord important tools for the assessment of fetal growth. Which is proven by the result of the table. (Table2 and Table 3). The correlation between the gestational age according to LMP and the sonography of the gestational age was compared separately with the umbilical cord diameter (UCD) and the significant value ($p < 0.01$) relationship between the umbilical cord and gestational age.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gestational age according to sonography	370	98	279	189.93	41.164
Gastational age according to LMP	370	94	280	193.11	42.702
Umbilical cord Diameter in mm	370	3.1	22.2	13.707	3.4832
Valid N (listwise)	370				

Table 2: Correlation GA according to sonography with Umbilical cord diameter in mm in different trimester indicated a very high level of correlation ($p < 0.01$) within themselves in the second trimester, third trimester and overall.

		Gestational age according to sonography	Umbilical cord Diameter in mm
Gestational age according to sonography	Pearson Correlation	1	.750**
	Sig. (2-tailed)		.000
	N	370	370
Umbilical cord Diameter in mm	Pearson Correlation	.750**	1
	Sig. (2-tailed)	.000	
	N	370	370

** . Correlation is significant at the 0.01 level (2-tailed).

Table 3: The correlation of GA according to (LMP) with Umbilical cord diameter in mm in different trimester indicated a very high level of correlation ($p < 0.01$) within themselves in the second trimester, third trimester and overall.

		Umbilical cord Diameter in mm	Gestational age according to LMP
Umbilical cord Diameter in mm	Pearson Correlation	1	.726**
	Sig. (2-tailed)		.000
	N	370	370
Gestational age according to LMP	Pearson Correlation	.726**	1
	Sig. (2-tailed)	.000	
	N	370	370

** . Correlation is significant at the 0.01 level (2-tailed).

Since the umbilical cord diameter has an accurate estimation of gestational age; it is recommended to be part of a routine ultrasound evaluation and as a routine part of prenatal care as it can greatly impact obstetric management

and improve ante partum care. UCD measurement should prompt the physician to carefully evaluate the case whenever there is an incongruity between the observed and the normal values using ultrasound, as it is the modality of choice for the assessment of gestational age in the first and second and third trimester of pregnancy as it is the modality of choice for the assessment.

Conclusions

Umbilical cord diameter has a strong linear relationship with commonly used parameters for the estimation of fetal gestational age and can be used as a reliable method to evaluate fetal growth and prediction of gestational age.

Coefficients

Unstandardized Coefficients		Standardized Coefficients
B	Std. Error	Beta
71.059	6.212	
8.905	.439	.726

a. Dependent Variable: Gestational age according to LMP

(table: 3). Show significant value.

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