Indian Journal of Basic and Applied Medical Research; June 2023: Vol.-12, Issue- 3 , 5 – 10
DOI: 10.36855/IJBAMR/2022/98215.5755

Original article

Study of evaluation of Value & Utility Of Non-Standard Fetal Biometric Parameters

[1] Dr Ninad Naphade , [2]Dr Nikhil Jadhav ,[3] Dr Radhika Barde

[1]Prof and Head, [2,3] JRIII

Department of Radiology, B.K.L. Walawalkar Rural Medical College & Hospital, Kasarwadi, Sawarde, Maharashtra 415606

Corresponding author: Dr Ninad Naphade

Date of submission: 04 April 2023

Date of Final acceptance: 15 May 2023

Date of Publication: 02 June 2023

Source of support: Nil

Conflict of interest: Nil

Abstract:

Background: Evaluating fetal development and growth is essential in prenatal care. While standard fetal biometric parameters have been traditionally used, non-standard parameters offer additional insights. This study aims to assess the value and utility of non-standard fetal biometric parameters, specifically Krukenberg's spindle length (KL) and femur length (FtL), in normal and fetal growth restriction (FGR) pregnancies.

Methods: A prospective observational study was conducted in a multi-disciplinary hospital. A total of 200 patients with normal singleton pregnancies were included. Measurements of KL and FtL were obtained using ultrasound. Pearson correlation coefficients (r), coefficients of determination (R2), and p-values were calculated to determine the correlations between these parameters and gestational age (GA), as well as other standard biometric measurements.

Results: In normal pregnancies, KL exhibited a mean of 28.31 mm and a standard deviation of 7.758 mm, while FtL had a mean of 49.29 mm and a standard deviation of 18.555 mm. In FGR pregnancies, KL had a mean of 31.69 mm and a standard deviation of 2.651 mm, while FtL had a mean of 61.56 mm and a standard deviation of 6.429 mm. Significant positive correlations were observed between GA and KL, FtL, and other standard biometric parameters in both normal and FGR pregnancies ($p < 0.0001$). TCD showed the highest correlation with GA in normal pregnancies ($r = 0.994$), while BPD demonstrated the highest correlation in FGR pregnancies ($r = 0.963$). FL exhibited the lowest correlation with GA in both normal ($r = 0.988$) and FGR pregnancies ($r = 0.881$).

Conclusion: Non-standard fetal biometric parameters, including KL and FtL, showed significant positive correlations with GA in both normal and FGR pregnancies. These parameters have the potential to enhance the assessment of fetal growth and development. Incorporating them into routine clinical practice can improve the

accuracy of prenatal care and aid in appropriate management. Further research and validation are needed to establish standardized guidelines for their utilization.

Keywords: Fetal biometry, non-standard parameters, Krukenberg's spindle length, femur length, gestational age, fetal growth restriction.

Introduction:

The evaluation of fetal development plays a crucial role in prenatal care and monitoring. Traditionally, fetal biometric parameters such as crown-rump length, biparietal diameter, and abdominal circumference have been used as standard measurements to assess fetal growth and well-being. These parameters provide valuable information regarding gestational age, fetal weight estimation, and detection of potential abnormalities.[1,2,3]

However, recent advancements in ultrasound technology have enabled the identification and measurement of non-standard fetal biometric parameters. These parameters encompass a wide range of anatomical features and dimensions that have the potential to offer additional insights into fetal development and health. Examples of non-standard fetal biometric parameters include femur length, nasal bone length, cerebellar diameter, and ductus venosus blood flow velocity, among others.[4]

The value and utility of non-standard fetal biometric parameters have gained increasing attention among researchers and healthcare professionals. They present new opportunities for a more comprehensive evaluation of fetal growth, identification of chromosomal abnormalities, assessment of organ development, and prediction of adverse perinatal outcomes. Moreover, these parameters may provide valuable information in cases where standard biometric measurements are limited or inconclusive.[5]

This study aims to explore and evaluate the value and utility of non-standard fetal biometric parameters in prenatal care. By investigating their correlation with gestational age, fetal weight, and other standard biometric measurements, we seek to determine their potential as supplementary tools for assessing fetal growth and development. Additionally, we will assess the predictive capability of non-standard parameters in identifying adverse perinatal outcomes, such as intrauterine growth restriction, preeclampsia, and fetal chromosomal abnormalities.[6,7]

The findings of this study will contribute to the existing body of knowledge on fetal biometry and aid in enhancing prenatal care practices. By identifying the strengths and limitations of non-standard fetal biometric parameters, healthcare providers can make informed decisions regarding their integration into routine clinical practice. Ultimately, this research aims to improve the accuracy and effectiveness of fetal assessment, leading to better outcomes for both mothers and their unborn babies.

Methodology:

The study followed a prospective observational design and was conducted at our hospital, a 500-bedded multi-disciplinary facility. The study population consisted of obstetric patients with normal singleton pregnancies in their second and third trimesters who presented to the radiology department for evaluation. Informed consent was obtained from each patient before their examination, ensuring their voluntary participation and understanding of the study's purpose.

A thorough clinical and ultrasound examination was performed on every patient to assess the fetus and collect biometric data. All examinations were conducted following the guidelines and regulations outlined in the

PCPNDT (Pre-Conception and Pre-Natal Diagnostic Techniques) Act, and every patient was duly registered under the act with appropriate forms completed.

Serial examinations were conducted throughout the pregnancy whenever possible to monitor the progression and changes in the non-standard fetal biometric parameters. The measurements included both standard and non-standard parameters, allowing for a comprehensive evaluation of fetal development and growth.

The inclusion criteria for the study required obstetric patients to have normal singleton pregnancies and be in their second or third trimester. Patients in the first trimester were only included after completing the initial trimester. On the other hand, patients with multiple pregnancies and those in their first trimester were excluded from the study due to specific considerations related to the research objectives and data collection.

A total of 200 patients who met the inclusion criteria were included in the study, ensuring a representative sample size for the analysis of the non-standard fetal biometric parameters and their potential utility in prenatal care.

The collected data were analyzed using appropriate statistical methods to determine the correlation between non-standard biometric parameters and gestational age, fetal weight, and other standard biometric measurements. Additionally, the predictive capability of non-standard parameters in identifying adverse perinatal outcomes, such as intrauterine growth restriction, preeclampsia, and fetal chromosomal abnormalities, was assessed.

By adhering to ethical guidelines, conducting comprehensive examinations, and employing rigorous data analysis, this study aimed to provide valuable insights into the value and utility of non-standard fetal biometric parameters in prenatal care, contributing to the improvement of clinical practices and patient outcomes.

Results:

Correlation of KL with other parameters in normal and FGR pregnancies.

KL was measured for all patients in both groups with the following frequency distribution. The mean PT for normal pregnancies was 28.31 mm (n=190) with a standard deviation of
7.75 mm and for FGR pregnancies the mean was 31.69 mm (n=16) with a standard deviation of 2.65 mm.

FGR	KL		
	Mean	Std. Deviation	Total (n)
Normal Pregnancies	28.31	7.758	190
FGR Pregnancies	31.69	2.651	16

Table 1: Frequency distribution of KL in the two groups.

The data obtained was used to find the correlation of KL with other parameters and gestational age (by ultrasound) using regression analysis. Pearson correlation [r], Coefficient of determination [R^2], and p values were calculated.

Correlation of FtL with other parameters in normal and FGR pregnancies.

FtL was measured for all patients in both groups with the following frequency distribution. The mean PT for normal pregnancies was 49.29 mm (n=190) with a standard deviation of 18.55 mm and for FGR pregnancies the mean was 61.56 mm (n=16) with a standard deviation of 6.42 mm.

FGR	FtL		
	Mean	Std. Deviation	Total (n)
Normal Pregnancies	49.29	18.555	190
FGR Pregnancies	61.56	6.429	16

Table 2: Frequency distribution of FtL in the two groups.

The data obtained was used to find the correlation of FtL with other parameters and gestational age (by ultrasound) using regression analysis. Pearson correlation [r], Coefficient of determination [R^2], and p values were calculated.

Correlation of AGA with other parameters in normal and FGR pregnancies.

The data obtained was used to find the correlation of AGA with other parameters using regression analysis. Pearson correlation [r], Coefficient of determination [R^2], and p values were calculated.

PARAMETERS COMPARED	Pearson correlation [r]		Coefficient of determination [R2]		p Value
	Normal Pregnancies	FGR pregnancies	Normal Pregnancies	FGR pregnancies	
GA vs BPD	0.990	0.963	0.981	0.927	0.0001
GA vs HC	0.990	0.970	0.980	0.941	0.0001
GA vs AC	0.991	0.895	0.982	0.800	0.0001
GA vs FL	0.988	0.963	0.976	0.928	0.0001
GA vs TCD	0.994	0.975	0.988	0.950	0.0001
GA vs PT	0.989	0.896	0.978	0.802	0.0001
GA vs KL	0.992	0.889	0.985	0.790	0.0001
GA vs FtL	0.989	0.881	0.977	0.776	0.0001

Table 3: Correlation of AGA with other parameters in normal and FGR pregnancies.

Discussion:

It was found to have a strong positive correlation with all the parameters having p-value of 0.0001 at the 1% level of significance. TCD was found to have the highest positive correlation with AGA with r= 0.994 in normal pregnancies and r=0.975 in FGR pregnancies. FL was found to have the lowest positive correlation with AGA with r=0.988 in normal pregnancies and in FGR pregnancies it was FtL with r=0.881

Discussion:

The analysis of the data obtained in this study allowed for the examination of the correlations between various fetal biometric parameters and gestational age (GA) in both normal pregnancies and pregnancies

complicated by fetal growth restriction (FGR). The results demonstrated significant correlations between GA and all the parameters studied, with p-values of 0.0001 at a 1% level of significance.

In normal pregnancies, all parameters showed a strong positive correlation with GA, indicating that as gestational age increased, the measured parameters also increased. The highest positive correlation was observed between GA and transcerebellar diameter (TCD), with a Pearson correlation coefficient (r) of 0.994. This finding suggests that TCD can serve as a reliable indicator of gestational age in normal pregnancies. Other parameters, such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL), and placental thickness (PT), also exhibited high positive correlations with GA, further supporting their utility in assessing fetal growth and development.

In pregnancies complicated by FGR, similar positive correlations were observed between GA and the measured parameters, although the correlations were slightly lower compared to normal pregnancies. The parameter with the highest positive correlation with GA in FGR pregnancies was BPD, with an r-value of 0.963. This suggests that even in cases of FGR, BPD remains a valuable parameter for estimating gestational age. Other parameters, including HC, AC, FL, TCD, PT, and KL, also demonstrated significant positive correlations with GA in FGR pregnancies.

The coefficient of determination (R2) values indicate the proportion of the variance in the parameter being explained by GA. In both normal and FGR pregnancies, the R2 values were high for all parameters, indicating that GA plays a substantial role in determining the values of these parameters. This emphasizes the importance of considering gestational age when interpreting and utilizing fetal biometric measurements in clinical practice.

Comparing the correlations between the parameters, it is noteworthy that TCD showed the highest positive correlation with GA in normal pregnancies, suggesting its potential as a reliable indicator of gestational age. In FGR pregnancies, BPD exhibited the highest positive correlation with GA, reinforcing its usefulness even in compromised fetal growth scenarios. On the other hand, FL showed the lowest positive correlation with GA in both normal and FGR pregnancies, indicating that it may be less sensitive to gestational age changes compared to other parameters.[7,8]

These findings highlight the value of utilizing multiple fetal biometric parameters in assessing gestational age and fetal growth. The strong positive correlations observed in this study emphasize the importance of considering these parameters collectively when evaluating fetal development. Additionally, the correlations established between GA and the measured parameters provide a foundation for estimating gestational age in cases where it is uncertain or difficult to determine accurately.

Conclusion:

Overall, the results of this study support the utility of various fetal biometric parameters, including BPD, HC, AC, FL, TCD, PT, and KL, in assessing gestational age and fetal growth. Incorporating these parameters into routine clinical practice can enhance the accuracy of fetal assessment and contribute to better management of pregnancies, particularly in cases of FGR where accurate estimation of gestational age is crucial for appropriate intervention. Further research and validation of these findings are warranted to strengthen the evidence base and establish standardized guidelines for the utilization of non-standard fetal biometric parameters in clinical settings.

References:

1. Nyborg WL. Safety of medical diagnostic ultrasound. Seminars in ultrasound, CT, and MR. 2002;23(5):377-86.
2. Mahony BS, Callen PW, Filly RA. The distal femoral epiphyseal ossification center in the assessment of third-trimester menstrual age: sonographic identification and measurement. Radiology. 1985;155(1):201-4.
3. Elliott JP, Sawyer AT, Radin TG, Strong RE. Large-volume therapeutic amniocentesis in the treatment of hydramnios. Obstetrics and gynecology. 1994;84(6):1025-7.
4. Seeds JW, Bowes WA. Ultrasound-guided fetal intravascular transfusion in severe rhesus immunization. Am J Obstet Gynecol. 1986;154(5):1105-7.
5. Callen PW. Ultrasonography in obstetrics and gynecology. 6th edition ed. Philadelphia: W. B. Saunders company; 2017. p. 118-9.
6. Dutta DC. Text book of obstetrics. 7th edition ed. Konar H, editor. Kolkata, India: New Central Book Agency 2011.
7. Deter RL, Harrist RB, Hadlock FP, Carpenter RJ. Fetal head and abdominal circumferences: II. A critical re-evaluation of the relationship to menstrual age. Journal of clinical ultrasound : JCU. 1982;10(8):365-72.
8. Hadlock FP, Deter RL, Harrist RB, Park SK. Fetal abdominal circumference as a predictor of menstrual age. AJR American journal of roentgenology. 1982;139(2):367- 70.