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ORIGINAL ARTICLE

Role of Trans Cerebellar Diameter for Gestational Age Estimation in Intrauterine Growth Restriction Fetuses

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ABSTRACT

Background: Determining gestational age is crucial for quality maternal and fetal care. Ultrasonographic measurements of femur length (FL), crown-rump length (CRL), head circumference (HC), and biparietal diameter (BPD) are used for gestational dating. However, these don't correlate well in Intrauterine growth restriction (IUGR) cases. Studies report that trans cerebellar diameter could be used for gestational age estimation in IUGR cases.

Objective: To find the correlation between trans cerebellar diameter and gestational age based on the last menstrual period (LMP) in intrauterine growth restriction fetuses.

Methods: It was a cross-sectional study. The data was collected from the Department of Obstetrics and Gynecology, Sir Ganga Ram Hospital Lahore from 20 February 2022 to August 2022. After informed consent 60 women aged 18-40 years and parity <5 with suspected Intrauterine growth restriction (IUGR) were included in the study. Gestational age was determined from the LMP while trans cerebellar diameter was by Ultrasonography. The correlation between gestational age and trans cerebellar diameter was determined and compared across subgroups of the study population based on age, parity, and BMI.

Results: The mean age of the study participants was 25.6±6.3 years. The majority of the women were primiparous. The mean BMI was 27.8±3.4 Kg/m^2. The mean gestational age was 33.35±2.25 weeks. Trans cerebellar diameter range was 36.3 mm to 49.6 mm. A significant correlation was found between gestation age and trans cerebellar diameter (r=0.979, p-value<0.001) in subgroups based on age, parity, and BMI.

Conclusion: A significant positive correlation was observed between Trans cerebellar diameter and gestational age among women with IUGR suggesting its routine use in estimating gestational age among high-risk obstetric care patients.

Key Words: Gestational age, Trans cerebellar diameter, Intrauterine growth restriction fetuses
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INTRODUCTION

In the growth-restricted fetus, many hemodynamic, metabolic, and hormonal changes occur in the uterine environment and these changes may become permanent and irreversible.[1]

Intrauterine growth restriction (IUGR) is when the fetal weight is estimated to be below the 10th

percentile for the gestational age as determined by ultrasonography according to WHO guidelines IUGR. It could be mild, moderate, or severe.[2] The high incidence of IUGR (~10%) and its late recognition (<40%) together lead to increased perinatal morbidity and mortality.[3] Newborns with IUGR may suffer from low blood sugar, low body temperature, and infant respiratory distress syndrome.[4,5]

In routine gestational age is estimated, by the last menstrual period (LMP) and ultrasonography.[6] Many pregnant women are unaware of their LMP or have a history of irregular menstruation and ultrasonography in 2nd and 3rd trimester are not that accurate.[7]

Ultrasonography is a safe, and cost-effective imaging tool in obstetric clinics. With advancing pregnancy, the accuracy of ultrasonographic estimation of gestational age decreases.[8] So, there arises a need for additional parameters while assessing the gestational age in the last trimester of pregnancy.[9]

Routinely, different ultrasonographic parameters including biparietal diameter, femur length, head circumference, and abdominal circumference are used for the estimation of gestational age. However, no single ultra-sonographic parameter is reliable in the third trimester of pregnancy. Fetal trans-cerebellar diameter is an important additional parameter.

We conducted this study to improve our future practices in Pakistan, confirm the gestational age, and plan the delivery timing accordingly.

This study was done to find the correlation between trans cerebellar diameter and gestational age based on the last menstrual period (LMP) in intrauterine growth restriction fetuses.

METHODS

This study received **Ethical approva**l from the Institutional Review Committee (CPSP/REU/ OBG-2018-059-8838, issued on 12.02.2022)

A cross-sectional study was conducted for seven months after ethical clearance. The data was collected at the Department of Obstetrics and Gynecology, Sir Ganga Ram Hospital Lahore. from 20 February 2022 to August 2022.

The study included 60 women, aged 18-40 years, parity <5 with suspicion of intrauterine growth restriction on clinical examination and ultrasonography in the third trimester of pregnancy. Females who were unsure of their LMP, multiple fetuses, and congenital anomalies (on ultrasonography) were excluded from the study.

Intrauterine growth restriction is diagnosed when ultrasound-estimated fetal weight is below the 10th percentile for gestational age. Gestational age was estimated by LMP and Trans-cerebellar diameter by Doppler ultrasonography.

For the determination of Trans-cerebellar diameter, the sinologist identifies key anatomical landmarks, such as the fetal head and the posterior fossa where the cerebellum is located. The trans cerebellar diameter is measured by placing calipers on the outer edges of the cerebellar hemispheres. This measurement is taken in a straight line across the widest parts of the cerebellum.

Statistical Analysis

The collected data was entered and analyzed by using SPSS version 21.0. Descriptive statistics and correlation test was applied to find the correlation between Trans-cerebellar diameter and gestational age based on LMP in intrauterine growth restriction fetuses.

RESULTS

The mean age of the study participants was 25.6±6.3 years. The majority of the women were under 30 years of age. Concerning parity, primiparas were 34(56.7%), while 26(43.3%) were multiparas. (Table 1)

The mean BMI of the women was 27.8±3.4 and most women were non-obese. Among the study participants, 58.3% had mild, 25.0% had moderate, and 16.7% had severe IUGR (Table 1).

There was a significant correlation between gestation age on LMP and Trans cerebellar diameter ($r=0.979$, p-value<0.001). (Table 2)

The mean Trans cerebellar diameter was 42.97±3.99 mm (Table 3) and had a positive correlation with gestational age (Table 4).

When compared among different study groups, a similar association of gestation age on LMP and Trans cerebellar diameter was found based on age, parity, and BMI (Tables 5 & 6).

Table 1. Baseline characteristics of the study sample

Characteristics	n (%)
Age	
<30 years	39 (65.0%)
≥30 years	21 (35.0%)
Parity	
Primiparas	34 (56.7%)
Multiparas	26 (43.3%)
BMI (Kg/m^2)	
Non-Obese	41 (68.3%)
Obese	19 (31.7%)
Severity of IUGR	
Mild	35 (58.3%)
Moderate	15 (25.0%)
Severe	10 (16.7%)

Data are expressed as frequencies and percentages. IUGR=Intra uterine growth restriction

Table 2: Correlation of gestational age with Trans cerebellar diameter (TCD) in women with IUGR

Gestational Age	mean±SD	Correlation coefficient (r)	P-value
Gestational age on LMP (weeks)	33.35±2.25	0.979	<0.001
TCD (mm)	42.97±3.99		

Pearson correlation test was applied; P<0.05 was considered statistically significant. IUGR=Intra uterine growth restriction

Table 3: Mean Trans cerebellar diameter (TCD) in women with IUGR about the gestational age on last menstrual period (LMP)

Gestational Age (weeks)	n	Trans cerebellar diameter (mm) (mean±SD)
30	8	36.77±0.36
31	8	38.35±0.24
32	7	40.84±0.56
33	9	43.06±0.61
34	5	44.39±1.20
35	12	46.33±0.81
36	5	46.86±0.38
37	6	48.59±0.79

Data expressed as mean ± SD. IUGR=Intra uterine growth restriction

Table 4: Correlation of gestational age with Trans cerebellar diameter (TCD) in women younger than 30 years and older than 30 years of age

Age	Gestational Age (weeks) mean±SD	TCD (mm) mean±SD	Correlation coefficient (r)	P-value
<30 years (n=39)	33.31±2.32	43.01±4.21	0.980	<0.001
≥30 years (n=21)	34.43±2.16	42.89±3.66	0.979	<0.001

Pearson correlation test was applied; P<0.05 was considered statistically significant

Table 5: Correlation gestational age based on last menstrual period (LMP) and trans-cerebellar diameter in obese and non-obese women with intrauterine growth restriction (IUGR)

BMI	Gestational age (weeks) mean±SD	TCD (mm) mean±SD	Correlation coefficient (r)	P-value
Non-Obese	33.12±2.30	42.53±4.12	0.979	<0.001
Obese	33.84±2.09	43.92±3.66	0.977	<0.001

Pearson correlation test was applied; P<0.05 considered statistically significant

Table 6: Correlation of gestational age and trans-cerebellar (TCD) in patients with different levels of IUGR

Severity	Gestational (weeks) (mean±SD)	TCD (mm) (mean±SD)	Correlation coefficient (r)	p-value
Mild IUGR	33.46±2.15	43.20±3.78	0.978	<0.001
Moderate IUGR	33.20±2.51	42.67±4.58	0.981	<0.001
Severe IUGR	33.20±2.39	42.61±4.22	0.978	<0.001

Pearson correlation test was applied; P<0.05 considered statistically significant. IUGR=Intra uterine growth restriction

DISCUSSION

During pregnancy, gestational age is a significant factor that may be determined in several ways with various degrees of accuracy. Different modes of assessment use various equipment or skills and have varying degrees of accuracy.[11]

An accurate gestational age estimation with a diagnostic approach may help in the timely medical management of a pregnant patient.[12] Before sonography, detailed histories and physical exam findings were used for gestational age calculation especially the last menstrual period date (LMP).[11]

A few recent studies observed that Trans cerebellar diameter (TCD) was the least affected by fetal growth and stayed almost the same across IUGR and non-IUGR pregnancies advocating its potential role in the gestational dating of such cases. Therefore, a study was needed because of the limited evidence available locally.

In the present study, the mean age of the women with IUGR was 25.6±6.3 years which is similar to that study that observed a similar mean age of 24.8 ± 4.1 years among women presenting with IUGR at Lady Reading Hospital, Peshawar.[12] in another study similar 26.8±2.7 years mean was observed.[13]

Among such women at Combined Military Hospital Lahore also observed a similar 25±2.8 years mean age in Nepali women.[14] other studies reported it to be 24.2±5.6 years in Bangladeshi women with IUGR.[15,16]

We observed that there was a significant strong positive correlation between gestation age on LMP and Trans cerebellar diameter (r=0.979, p-value<0.001). The Indian study involving pregnant women in their second trimester reported the value of the correlation coefficient to be 0.991 (p-value <0.0001), 0.989 (p-value<0.0001), and 0.920 (p-value=0.0006).[17]

A Nigerian study reported comparable results with TCD estimation of gestational age and actual gestational age in the 2nd and 3rd trimesters (r=0.93; p-value<0.05).[18] The study conducted in australia, reported TCD to be superior to other ultrasonographic parameters in 3rd trimester with a correlation coefficient of 0.80 (p<0.001).[19] Similar results (p<0.0001) have been published in Nigerian women with 18th-23rd week of gestation.[10] A more recent study observed a comparable correlation between TCD and gestational age on LMP in normal (r=0.979; p value<0.001) and IUGR pregnancies (r=0.972; p value<0.001) in line with the present study.[19] A similar significant and positive correlation

between TCD and gestational age (r=0.975, p value<0.001) has also been reported in Nepalese women with IUGR.[20]

A study has reported among all parameters, TCD revealed highest correlation. TCD is an accurate parameter in estimation of gestational age in second and third trimesters as its values are in close relation with that of GA by LMP.[21]

The present study is an addition to limited already published local and international research. In the present study,

In another two studies in India Statistically significant relationship found between TCD and gestational age (p=0.0006) and they suggested regression formulae based on TCD with other parameters can be used to predict the gestational age of the fetus.[22,23]

CONCLUSION

Trans cerebellar diameter showed a significant correlation with gestational age among women with IUGR. Hence Trans cerebellar diameter can be used to estimate the gestational age for the patients with IUGR.

Study Limitation & Future Direction

The limitation of the study is that we did not determine the cutoff values for the trans cerebellar diameter against the various gestational ages.

The cutoff values can be determined for the trans cerebellar diameter against the various gestational ages in future studies with large sample size involving multiple centers.

REFERENCES

1. Priante E, Verlato G, Giordano G, Stocchero M, Visentin S, Mardegan V, et al. Intrauterine growth restriction: new insight from the metabolomic approach. Metabolites. 2019; 9(11): 267.doi:10.3390/ metabo9110267.
2. Menendz-Castro C, Rascher W, Hartner A. Intrauterin growth restriction- impact on cardiovasclar diseases later in life. Mol Cell Pediatr. 2018; 5(1): 4. doi: 10.1186/s40348-018-0082-5.
3. Nagaraju RM, Bhat V, Gowda PV. Efficacy of transcerebellar diameter/abdominal circumference versus head circumference/abdominal circumference in predicting asymmetric intrauterine growth retardation. J Clin Diagn Res. 2015; 9(10): TC01-TC05.doi:10.7860/JCDR/2015/ 14079.6554.
4. Legrand M, Elie C, Stefani J, N Florès, Culeux C, Delissen O, et al. Cell proliferation and cell death are disturbed during prenatal and postnatal brain development after uranium exposure. Neurotoxicology. 2016; 52: 34-45.doi:10.1016/j.neu ro.2015.10.007.
5. Mierzyński R, Dłuski D, Darmochwał-Kolarz D, Poniedziałek-Czajkowska E, Leszczyńska-Gorzelak B, Kimber-Trojnar Z, et al. Intrauterine growth retardation as a risk factor of postnatal metabolic disorders. Curr Pharm Biotechnol. 2016; 17(7): 587-596.doi:10.2174/1389201017666160301104323.
6. Fleiss B, Wong F, Brownfoot F, Shearer IK, Baud O, Walker DW, et al. Knowledge gaps and emerging research areas in intrauterine growth restriction-associated brain injury. Front Endocrinol (Lausanne). 2019; 10: 188. doi:10.3389/fendo.2019.00188.
7. Dashottar S, Senger KP, Shukla Y, Singh A, Sharma S. Transcerebellar diameter: an effective tool in predicting gestational age in normal and IUGR pregnancy. Int J Reprod Contracept Obstet Gynecol. 2018; 7(10): 4190-4196.doi:10.18203/2320-1770. ijrcog20184150
8. Sersam LW, Findakly SB, Fleeh NH. Fetal Tran's cerebellar diameter in estimating gestational age in the third trimester of pregnancy. J Res Med Dent Sci. 2019; 7(5): 60-66.
9. Alalfy M, Idris O, Gaafar H, Saad H, Nagy O, Lasheen Y, et al. The value of fetal Tran's cerebellar diameter in detecting GA in different fetal growth patterns in Egyptian fetuses. Imaging Med. 2017; 9(5): 131-138.
10. Whitworth M, Bricker L, Mullan C. Ultrasound for fetal assessment in early pregnancy. Cochrane Database System Rev. 2015; 2015(7): CD007058. doi: 10.1002/14651858.CD007058.pub3.
11. Committee Opinion No 700: Methods for Estimating the Due Date. Obstet Gynecol. 2017; 129(5): e150-e154. doi:10.1097/AOG.0000000000002046.
12. Muhammad T, Khattak AA, Shafiq-ur-Rehman, Khan MA, Khan A, Khan MA. Maternal factors

associated with intrauterine growth restriction. J Ayub Med Coll Abbottabad. 2010; 22(4): 64-69.
13. Fatima K, Shahid R, Virk A. Determination of mean fetal Tran's cerebellar diameter as a predictive biometric parameter in the third trimester of pregnancy in correlation with fetal gestational age. Pak Armed Forces Med J. 2017; 67(1): 155-160
14. Jha A, Joshi B, Pradhan S. Fetal transcerebellar diameter/ abdominal circumference ratio as a gestational age independent parameter for fetal growth. Nepal J Obstet Gynaecol. 2014; 9(2): 79-82.
15. Mishra S, Ghatak S, Singh P, Agrawal D, Garg P. Transverse cerebellar diameter: a reliable predictor of gestational age. Afr Health Sci. 2020; 20(4): 1927-1932. doi:10.4314/ahs.v20i4.51.
16. 16.Ravindernath ML, Mahender R, Nihar R. Accuracy of transverse cerebellar diameter measurement by ultrasonography in the evaluation of fetal age. Int J Adv. Med. 2017; 4(3): 836-841. doi:10.18203/2349-3933.ijam20172281
17. R Nagesh, Seetha Pramila VV, Anil Kumar Shukla. Transverse cerebellar diameter – an ultrasonographic parameter for estimation of fetal gestational age. IJCMR. 2016; 3(4): 1029-1031.
18. Eze CU, Onwuzu QE, Nwadike IU. Sonographic reference values for fetal transverse cerebellar diameter in the second and third trimesters in a Nigerian population. J Diagn Med Solography. 2017; 33(3): 174-181. doi:10.1177/8756479316687997
19. Singh J, Thukral CL, Singh P, Pahwa S, Choudhary G. Utility of sonographic transcerebellar diameter in the assessment of gestational age in normal and intrauterine growth-retarded fetuses. Niger J Clin Pract. 2022; 25(2): 167-172. doi:10.4103/njcp.njcp_ 594_20.
20. Neha Patial, Jhobta A, Kapila S. Assessment of correlation between Tran's cerebellar diameter and gestational age in IUGR pregnancies. IAR J Med Sci. 2022; 3(1): 70-74. doi:10.47310/ijme.2022.v03i01.
21. Reddy RH, Prashanth K, Ajit M. Significance of foetal transcerebellar diameter in foetal biometry: a pilot study. J Clin Diagn Res. 2017;11(6): TC01-TC04. doi:10.7860/JCDR/2017/23583.9968.
22. Mishra S, Ghatak S, Singh P, Agrawal D, Garg P. Transverse cerebellar diameter: a reliable predictor of gestational age. Afr Health Sci. 2020; 20(4): 1927-32. doi: 10.4314/ahs.V 20i4.51
23. Ravindernath ML, Mahender R, Nihar R. Accuracy of transverse cerebellar diameter measurement by ultrasonography in the evaluation of fetal age. Int J Adv Med. 2017; 4(3): 836-841.

AUTHORS' CONTRIBUTION:

RB: Designed study, reviewed it critically for important intellectual content

SN: Drafted the work, critical reviewed

SS: Data acquisition, conception, designed the study

SR: Literature search, data entry

DJ: Critically reviewed manuscript, data analysis

RM: Data analysis, acquisition data interpretation

All Authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST:

All authors declared no conflict of interest.

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