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# Role of Transcerebellar Diameter And Abdominal Circumference In Assessment Of Gestational Age In Both Normal And Intrauterine Growth Restricted fetuses

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ORIGINAL ARTICLE

# Role of Transcerebellar Diameter and Abdominal Circumference in Assessment of Gestational Age in Both Normal and Intrauterine Growth Restricted Fetuses

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**Abstract**

*Background*: **The process of providing obstetric and neonatal care, in addition to the monitoring of the outcomes of pregnancy by the public health system, requires an accurate estimate of the gestational age (GA) of the fetus. An incorrect estimation of the mother's GA has been associated with several different unfavorable birth outcomes, for example, low birth weight, spontaneous preterm delivery, and death during the perinatal period.**

*Aim and objectives*: **Identifying a reliable method for second and third Trimester Gestational Age Assessment and intrauterine growth restriction (IUGR) diagnosis.**

*Patients and methods*: **This two-dimensional ultrasound study included 100 pregnant patients at Al Azhar University Hospital's gynecological clinic. The patient was examined while lying on their back (dorsal supine). The ultrasound was only in two-dimensions. Both the fetal size and the amount of amniotic fluid were measured.**

*Results*: **Abortions were more common among those who had IUGR compared with those who did not ($P$ 0.05). Maternal age, BMI, number of pregnancies, mode of delivery, GA at assessment, and GA at birth all showed no significant group variations ($P > 0.05$).**

*Conclusion*: **Preferential preservation of cerebellar development compared with other cranial structures may explain why fetal transcerebellar diameter was less impacted than fetal head circumference (HC) in IUGR babies. The transcerebellar diameter/AC ratio aided in the detection of fetal growth abnormalities. This ratio remained consistent regardless of GA since it was not dependent on maternal age.**

*Keywords:* Gestational age, Intrauterine growth restriction, Transcerebellar diameter

## 1. Introduction

An accurate determination of the gestational age (GA) of the fetus is essential for public health systems to be able to provide obstetric and neonatal care, and to track the results of pregnancies. Indeterminate GA has been associated to several unfavorable outcomes in pregnancy, involving low birth weight, early delivery and mortality during the perinatal period.[1]

The examination of fetal growth and development has been greatly enhanced by ultrasonography, and a wide range of congenital abnormalities may now be diagnosed before birth. Transcerebellar diameter (TCD) is an ultrasound characteristic that has been used as a reliable indicator of gestational age for decades, in cases of both normal development and intrauterine growth restriction (IGUR).[2,3]

The cerebellum of the fetus is seen as early as 12 weeks after the last menstrual period (LMP). In the second trimester, it expands linearly, but by the third trimester, the curve has flattened. Up to 24 weeks of gestation, TCD measured in millimeters has been demonstrated to correlate with week of gestation.[4]

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Femur Length, the most often used ultrasonography metric for estimating gestational age, has a margin of error of 2.5–3.1 weeks when compared with the true gestational age when measured in the third trimester.[5]

In addition, because of the large amount of natural variation that exists in the shape and size of the fetal skull, the Biparietal Diameter (BPD) that is often used has a margin of error that ranges from 3 to 4 weeks in relation to the actual gestational age. TCD, on the other hand, is not subject to change in shape or size due to the thick petrous ridges and occipital bone that surround it, making it an independent biometric measure. Therefore, in situations when measuring BPD is problematic, such as when there are significant differences in head size or shape, TCD may be employed instead. Throughout pregnancy, TCD nomograms have been constructed based on gestational age.[6]

Extreme cases of growth anomalies and changes in embryonic head shape, such as Dolichocephaly and Brachycephaly, are cited as examples where TCD is said to be more equivalent. It seems sense, therefore, to look into whether or whether TCD and abdominal circumference (AC) are connected in any way that might be used to anticipate embryonic growth issues.[3]

The purpose of this research was to assess Role of TCD and Abdominal Circumference in Assessment of Gestational Age in Both Normal and IUGR fetuses.

## 2. Patients and methods

This prospective research used two-dimensional ultrasound (GE VERSANA BALANCE US SYSTEM AND GE LOGIQ P US) on a total of 100 pregnant females seen by the obstetrics and gynecology staff at Al Azhar University Hospitals. The patient was examined while laying on their back (dorsal supine). The amniotic fluid content and fetal body size were measured. Research performed between February 2021 and February 2023.

First group: 50 cases were considered, all of which had singleton pregnancies in which the mother was certain that she was in her second or third trimester of pregnancy as determined by the 1st day of her LMP or an ultrasound in the 1st trimester that revealed intrauterine growth limitation. Second group: The other 50 cases included healthy, pregnant women who were either carrying a single child or were in their second or third trimester of pregnancy as determined by the 1st day of their LMP or an ultrasound taken during their first trimester. Patients were not included if they had misdiagnosed dates, intrauterine fetal death (IUFD), or multiple pregnancies.

### 2.1. Inclusion criteria

A mother's age between 21 and 40 (during her reproductive years), a proven GA as of the first day of the patient's LMP cycle or an early ultrasound, and a healthy, uncomplicated, singleton pregnancy.

### 2.2. Exclusion criteria

Those who have preeclampsia or gestational diabetes as a result of pregnancy, in addition to those who have diabetes mellitus or hypertension as a result of a chronic medical condition, such as diabetes mellitus.

### 2.3. Sample size

This research base on study performed by Khan and colleagues was used to calculate the sample size by considering the following assumptions: 95% two-sided confidence level, with a power of 80% and α error of 5%. The final maximum sample size taken from output was 94. Therefore, the sample size was increased to 100 patients to assume any drop out cases during follow-up.[7]

**Sample Size For Comparing Two Means**

**Input Data**

| | |
|---|---|
| Confidence Interval (2-sided) | 95% |
| Power | 80% |
| Ratio of sample size (Group 2/Group 1) | 1 |

| | Group 1 | Group 2 | Difference* |
|---|---|---|---|
| Mean | 17.14 | 17.27 | -0.13 |
| Standard deviation | 0.27 | 0.16 | |
| Variance | 0.0729 | 0.0256 | |

| | |
|---|---|
| Sample size of Group 1 | 46 |
| Sample size of Group 2 | 46 |
| Total sample size | 92 |

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

### 2.4. Methods

After outlining the aim of the study and the planned technique, consent was requested from all

cases who would be participating in the research, complete history taking, Physical examinations (General examination and Abdominal obstetric examination) and Investigational Studies (Routine laboratory investigations and Radiological investigation).

Abdominal ultrasound examination: For assessment of estimated fetal weight, fetal movement, fetal heart sounds and GA.

The TCD is one of the parameters used in ultrasound examination for GA estimation and assessment of fetal growth. It is particularly useful in cases where the BPD or femur length measurements may not be reliable or when there is suspected IUGR.

### 2.5. Ethical consideration

Participants' personal information and data were kept strictly secret. No report or publication detailing the study included any information that may be used to identify the participants. The participants in this research were given a full explanation of the study's goals and techniques, in addition to a rundown of the potential benefits and drawbacks, before they were enrolled. Consent after full disclosure was obtained.

### 2.6. Statistical analysis

The data were statistically reported using words such as mean, SD and range, or, where applicable, frequencies (number of instances), and percentages. The paired *t*-test was used in order to facilitate a comparison of the various techniques for determining the gestational age. When contrasted with the LMP parameter, the accuracy of the various estimate parameters was determined to be within a week's margin of error. If the *P* value was below 0.05, then the results were considered significant.

## 3. Results

Table 1.

This Table showed statistically significant higher previous abortion in the group with IUGR than the group without IUGR ($P < 0.05$). no statistically significant variance was found among groups concerning maternal age, BMI, gravidity, type of labor, GA at assessment and GA at birth ($P > 0.05$) (Fig. 1, Table 2).

This table showed statistically significant lower BPD, FL, head circumference (HC), AC in the group with IUGR than the group without IUGR ($P < 0.05$).

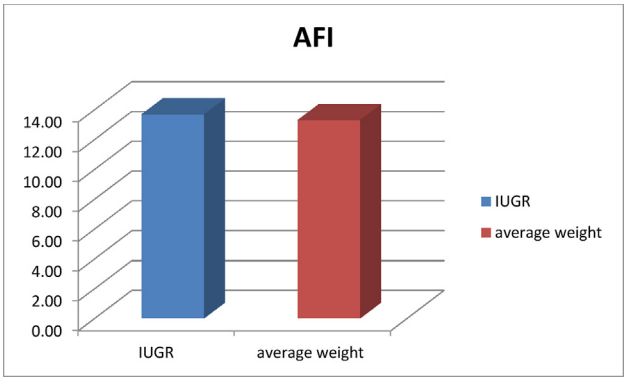


*Fig. 1. AFI of the studied groups. AFI, amniotic fluid index.*

*Table 1. Comparison of clinical data regarding neonatal outcome.*

| | Intrauterine growth restriction ($N = 50$) | | No intrauterine growth restriction ($N = 50$) | | Test of significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t | *P* value |
| Age (y) | 27.44 | 3.74 | 27.10 | 4.07 | 0.435 | 0.665 |
| BMI | 24.72 | 2.08 | 25.32 | 2.03 | −1.458 | 0.148 |
| GA at assessment (weeks) | 32.50 | 0.51 | 32.46 | 0.50 | 0.397 | 0.693 |
| GA at birth (weeks) | 37.08 | 1.48 | 37.48 | 1.42 | −1.379 | 0.171 |
| Birth weight (kg) | 1.63 | 0.27 | 3.18 | 0.22 | −31.896 | 0.0001 |
| | *N* (%) | | *N* (%) | | X2 | *P* value |
| Gravidity | | | | | | |
| PG | 2 (4) | | 3 (5) | | 1.060 | 0.787 |
| G1 | 18 (36) | | 14 (32) | | | |
| G2 | 19 (38) | | 19 (38) | | | |
| G3 | 11 (22) | | 14 (25) | | | |
| Previous abortion | | | | | | |
| Yes | 15 (30) | | 3 (6) | | 9.756 | 0.002 |
| No | 35 (70) | | 47 (94) | | | |
| Labor | | | | | | |
| NVD | 25 (50) | | 18 (36) | | 1.999 | 0.157 |
| CS | 25 (50) | | 32 (64) | | | |

**SD**, standard deviation; **t**, independent student *t*-test; $\chi^2$, chi square test.
*P* value greater than 0.05: Nonsignificant; *P* value less than 0.05: Significant; *P* value less than 0.001: Highly significant.

*Table 2. Comparison of fetal US parameters amongst the examined groups.*

| | Intrauterine growth restriction ($N = 50$) | | No intrauterine growth restriction ($N = 50$) | | Test of significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t | *P* value |
| BPD | 30.93 | 2.68 | 42.76 | 6.01 | −6.058 | <0.0001 |
| FL (mm) | 38.66 | 5.29 | 42.76 | 6.01 | −3.624 | <0.0001 |
| HC (mm) | 298.60 | 10.30 | 318.00 | 10.30 | −9.415 | <0.0001 |
| AC (mm) | 269.40 | 10.95 | 288.80 | 11.89 | −8.484 | <0.0001 |
| BPP | 8.68 | 0.71 | 8.54 | 0.65 | 1.03 | 0.3061 |

AC, abdominal circumference; HC, head circumference.

*Table 3. Comparison of fetal transcerebellar diameter parameters between the examined groups.*

| | Intrauterine growth restriction ($N = 50$) | | No intrauterine growth restriction ($N = 50$) | | Test of significance | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t | *P* value |
| TCD | 33.74 | 2.36 | 37.28 | 2.98 | −6.557 | <0.0001 |
| TCD/AC | 12.37 | 0.28 | 13.04 | 0.82 | −5.533 | <0.0001 |

*Table 4. Comparison of APGAR score among the studied groups.*

| | Intrauterine growth restriction ($N = 50$) | | No intrauterine growth restriction ($N = 50$) | | Test of sig. | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t | *P* value |
| APGAR at 1st min | 7.16 | 0.37 | 7.08 | 0.34 | 1.125 | 0.264 |
| APGAR at 5th min | 8.20 | 0.40 | 8.16 | 0.42 | 0.484 | 0.629 |
| | *N* (%) | | *N* (%) | | $\chi^2$ | *P* value |
| NICU admission | | | | | | |
| No | 33 (66) | | 49 (98) | | 17.344 | <0.0001 |
| Yes | 17 (34) | | 1 (2) | | | |

*Table 5. Correlation among transcerebellar diameter/AC ratio with clinical and sonographic parameters of the studied groups (N = 100).*

| | Transcerebellar diameter/AC ratio | |
|---|---|---|
| | r | *P* value |
| Maternal age | −0.148 | 0.141 |
| BMI | 0.134 | 0.184 |
| Gravidity | 0.007 | 0.943 |
| GA at assessment (weeks) | 0.022 | 0.827 |
| GA at birth | −0.025 | 0.805 |
| AF volume | 0.027 | 0.790 |
| AFI | −0.033 | 0.743 |
| HC | 0.433 | 0.743 |
| AC | 0.399 | 0.00001 |
| BPD | 0.199 | 0.047 |
| FL | 0.195 | 0.052 |
| BPP | 0.093 | 0.359 |
| TCD | 0.493 | 0.00001 |
| Birth weight | 0.558 | 0.00001 |
| APGAR 1st min | −0.061 | 0.548 |
| APGAR 5th min | 0.122 | 0.225 |

AC, abdominal circumference; AF, amniotic fluid; AFI, amniotic fluid index; HC, head circumference.

Nevertheless, no statistically significant variance was found among groups concerning BPP ($P > 0.05$) (Table 3).

This Table showed statistically significant lower TCD and TCD/AC in the group with IUGR than the group without IUGR ($P < 0.05$) (Table 4).

This table showed statistically significant higher NICU admission in the group with IUGR than the group without IUGR ($P < 0.05$). Nevertheless, no statistically significant variance was found amongst groups concerning APGAR score at first and fifth min ($P > 0.05$) (Table 5).

This Table showed significant positive correlation between TCD/AC ratio with AC, BPD, TCD, birth weight of the studied groups (Table 6).

This table and following figure showed that at cutoff point 12.4 TCD/AC levels has sensitivity of 74% and specificity of 70% for predicting IUGR in neonates (Fig. 2).

*Table 6. Sensitivity, specificity of transcerebellar diameter/AC for prediction of intrauterine growth restriction in neonates.*

| Cutoff point | Area under curve | Std. Error | Sensitivity% | Specificity% | Asymptotic 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| ≤12.4 | 0.728 | 0.054 | 74% | 70% | 0.622 | 0.834 |

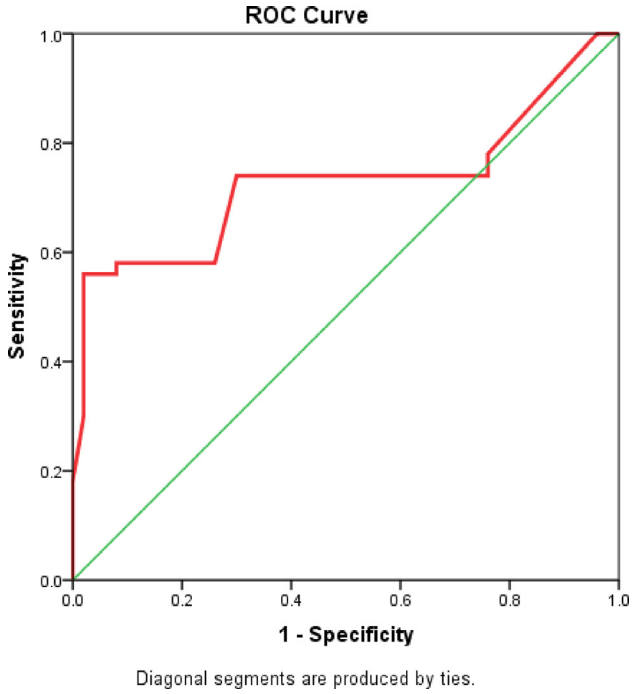


*Fig. 2. Receiver operating characteristic curve for transcerebellar diameter/AC for prediction of intrauterine growth restriction in neonates.*

## 4. Discussion

Accurately determining a pregnant woman's GA is crucial for the treatment of the pregnancy. There is no denying the significance of accurately estimating the duration of a pregnancy for crucial choices like whether to induce labor or perform a cesarean operation. Fetal biometric characteristics such as fetal development and real menstrual age confound the regularly used BPD, HC, AC, and FL, making them unclear. Patients whose exact gestational age is unknown have a much higher risk of perinatal death. Preterm birth, low birth weight, and delayed maturation are all linked to ambiguous gestational ages. Naegele's rule, a popular approach for calculating the day of delivery that relies only on the LMP, has limitations since some women have trouble properly recalling their LMP.[8]

The main outcomes of the study were as following:

This study was done on 100 pregnant females with GA 32–33weeks at time of assessment. Their mean age value 27.27 ± 3.89 years; 5% were PG, 32% were P1, 38% were P2 and 25% were P3. There was statistically significant higher previous abortion in the group with IUGR than the group without IUGR ($P < 0.05$). no statistically significant difference was showed among groups concerning maternal age, BMI, gravidity, type of labor, GA at assessment and GA at birth ($P > 0.05$).

The results of El Nafrawy et al., who stated on a similar split of participants, supported our own. Group A consists of women who are 14–40 weeks along in their pregnancies and who present for standard prenatal sonography. Their fetuses are morphologically normal. Group B: clinically suspected IUGR patients. Maternal age, BMI, and number of children showed no statistically significant variances amongst the groups. When matching the prevalence of hypertension, diabetes and gynecological history, the groups showed significant difference.[9]

Also, in the study of Singh and colleagues 500 cases were analyzed out of which 424 were normal pregnancies and 76 were IUGR pregnancies. Age distribution of both normal and IUGR pregnancies was the same ranging from 21 to 29 years with no statistically significant variance ($P$ value $= 0.697$). Among the 424 normal pregnant patients, 236 (47.2%) were primigravida, 133 (26.6%) were gravida 2, 32 (6.4%) were gravida 3, 21 (4.2%) were gravida 4, and 2 (0.4%) were gravida 5.[10,11]

In this study, researchers discovered no significant differences in amniotic fluid (AF) volume or amniotic fluid index (AFI) across the groups. The IUGR group has significantly lower BPD, FL, HC and AC than the non-IUGR group does (P 0.05). There was no significant change in BPP across the groups ($P > 0.05$).

Consistent with our findings, El Nafrawy et al. found significantly decreased HC, AC, and TCD in IUGR matched to controls.[9]

Compared with the control group, the IUGR group had significantly reduced TCD and TCD/AC ($P < 0.05$), as shown by the present study.

Hassan et al. found a statistically significant difference among the two groups tested ($P < 0.001$), with the mean TCD/AC × 100 in the control group being 13.436 ± 1.0396; and the mean in the IUGR group being 15.998 ± 0.9497.

Furthermore, opposite to the present findings, Roy and colleagues found substantially decreased HC, AC, and TCD in IUGR compared with controls. The TCD/AC ratio was also considerably greater in the IUGR group than in the control group.[12]

In the current study, NICU admission was significantly greater in the IUGR group matched to the control group ($P < 0.05$). The APGAR scores at 1 and 5 min did not differ significantly ($P > 0.05$) between the groups.

Consistent with the findings of von Beckerath and colleagues who found that IUGR was associated with preterm birth (35 weeks vs. 38 weeks), increased risk of death (8.0% vs. 1%; OR, 8.3), and more perinatal problems (24.4% vs. 1.0%; OR, 31.6). Neurodevelopmental impairment (24.7% vs. 5.6%;

OR, 5.5) and growth delay (21.2% vs. 7.4%; OR, 3.4) were associated with a worse long-term prognosis.[13]

TCD/AC ratio was positively correlated with AC, BPD, TCD, and birth weight across all groups we analyzed.

George and colleagues discovery that *trans*-cerebellar diameter is strongly correlated with other traditional metrics such BPD, femur length, and belly circumference corroborated our findings. The *trans*-cerebellar diameter is positively correlated with femur length. The TCD correlates highly with maternal age, with an R2 of 0.995 ($P < 0.001$).[14]

Patil and colleagues also noted that *trans*-cerebellar diameter has been proven to correlate substantially with gestational age and may thus serve as a new measure for predicting gestational age.[15]

Patil et al. also noted that *trans*-cerebellar diameter has been proven to correlate substantially with gestational age and may thus serve as a new measure for predicting gestational age. Those of Ravindernath et al., who found that the TCD correlates well with other parameters and emphasizes the importance of the TCD in calculating GA in cases of aberrant skull shape such excessive molding.[15]

Using the receiver operating characteristic curve for TCD/AC to predict IUGR in newborns, the current research found that a cut-off points of 12.4 TCD/AC levels had a sensitivity of 74% and a specificity of 70%.[1]

El Nafrawy et al.'s study employing receiver operating characteristic curve analysis of TCD/AC to predict IUGR found that the cutoff point of 13.2 was significant for predicting IUGR with a sensitivity of 97.3%, specificity of 86.5%, PPV of 63.3%, and NPV of 99.3%.[9]

Hassan and colleagues found that a cutoff value of TCD/AC 100 of 13.75 was the most effective, with a total of sensitivity [100%] and specificity [63.33%]. Since the TCD/AC ratio was not dependent on GA, they came to the conclusion that it was useful in spotting aberrant fetal development regardless of GA.[11]

The current study had some limitations. Limited sample size is the main limitation and single center study, also another limitation. Because just one radiologist performed the ultrasonography, any potential for inter-observer variance was eliminated.

### 4.1. Conclusion

Fetal TCD was less affected than fetal HC in IUGR newborns, which may be explained by the preferential preservation of cerebellar development relative to other cranial structures. The TCD/AC ratio was useful in assisting in the diagnosis of prenatal growth problems. Because it was not dependent on the age of the mother, this ratio did not change regardless of GA.

## Conflict of interest

There are no conflicts of interest.

## References


1. ML R, Reddy M, Reddy N. Accuracy of transverse cerebellar diameter measurement by ultrasonography in the evaluation of foetal age. *Int J Adv Med*. 2017;4:836.
2. Scott JA, Hamzelou KS, Rajagopalan V, et al. 3D morphometric analysis of human fetal cerebellar development. *Cerebellum*. 2012;11:761–770.
3. Mourya S, Mourya HK, Makwana M, et al. Evaluation of transverse cerebellar diameter to abdominal circumference ratio in prediction of intrauterine growth retardation. *Int J Reprod Contracept Obstet Gynecol*. 2017;6:2466–2470.
4. Goel P, Singla M, Ghai R, et al. Transeverse cerebellar diameter - a marker for estimation of gestational age. *J Anat Soc India*. 2010;59:158–161.
5. Naseem F, Ali S, Basit U, Fatima N. Assessment of gestational age: comparison between transcerebellar diameter versus femur length on ultrasound in third trimester of pregnancy. *Prof Med J*. 2014;21:412–417.
6. Dashottar S, Senger KP, Shukla Y, et al. Transcerebellar diameter: an effective tool in predicting gestational age in normal and IUGR pregnancy. *Int J Reprod, Contracep Obstet Gynecol*. 2018;7:4190–4197.
7. Khan N, Chaudhri R, Nazir T. Role of transverse cerebellar diameter in diagnosis of asymmetrical fetal growth restriction. *J Rawalpindi Med Coll (JRMC)*. 2013;17:231–233.
8. Gouda AG, El Nafrawy MA, El Mashad AI, Edris YS, Amer WM. Fetal trans-cerebellar diameter and fetal trans-cerebellar diameter to abdominal circumference [tcd/ac] ratio in assessment of gestational age for the prediction of normal fetal growth and intrauterine growth restriction. *Benha J Appl Sci*. 2022;7(8):47–54. https://doi.org/10.21608/bjas.2022.269904.
9. El Nafrawy MA, et al. *Fetal Trans-cerebellar Diameter and Fetal Trans-cerebellar Diameter to Abdominal Circumference [tcd/ac] Ratio in Assessment of Gestational Age for the Prediction of Normal Fetal Growth and Intrauterine Growth Restriction*. 2022:1–5.
10. Singh J, Thukral CL, Singh P, et al. Utility of sonographic transcerebellar diameter in the assessment of gestational age in normal and intrauterine growth-retarded fetuses. *Niger J Clin Pract*. 2022;25:167–172.
11. Hassan Ahmed Mohamed Ibrahim I, Mohamed Mera AEH, ElMonsef SA. Ultrasound measurement of trans-cerebellar diameter [TCD]/abdominal circumference [AC] ratio in normal and growth restricted fetuses above twenty weeks of gestation. *AlAzhar Med J*. 2021;50:1933–1944.
12. Roy J, Sanyal P, Saboo V, et al. Role of the ratio of trans cerebellar diameter and abdominal circumference in detecting asymmetrical intra uterine growth restriction. *J Evol Med Dent Sci*. 2019;30:3858–3863.
13. von Beckerath AK, Kollmann M, Rotky-Fast C, Karpf E, Lang U, Klaritsch P. Perinatal complications and long-term neurodevelopmental outcome of infants with intrauterine growth restriction. *Am J Obstet Gynecol*. 2013 Feb;208(2):130.e1–130.e6. https://doi.org/10.1016/j.ajog.2012.11.014.
14. George R, Amirthalingam U, Hussain MRK, et al. Can transcerebellar diameter supersede other fetal biometry in measuring gestational age? A prospective study. *Egypt J Radiol Nucl Med*. 2021;52:197.
15. Patil S, Patil M, Gaikwad S. Transverse cerebellar diameter—an ultrasonographic parameter for estimation of gestational age and grading of fetal cerebellar growth. *Int J Anat Res*. 2018;6:4947–4950.