Assessment of Correlation between Transcerebellar Diameter and Gestation age in IUGR pregnancies

Abstract: Background: Accurate assessment of the gestational age is very critical in the management of IUGR cases and their associated complications. Present study was done with the objective to evaluate the Correlation between Transcerebellar Diameter and Gestation age in IUGR pregnancies. Material & Methods: This Prospective Cross-sectional study was conducted on antenatal women of gestational age 15-40 weeks with IUGR pregnancies cases attending the antenatal clinic and admitted in the Department of Obstetrics and gynecology, and sent to Department of Radiology KNSH M&C and IGMC Shimla for Antenatal USG Scan. In every patient TCD was measured. Data was analysed by appropriate statistical test using EPI INFO Version 7.2 software. Correlation coefficients were then used to compare TCD with Gestational age in IUGR pregnancies. Results: In this study 120 cases were studied out of which 20 were pregnancies with IUGR. Age distribution of IUGR pregnancies was 20 to 40 years with mean age of 25.6±2.14 years. Maximum number of patients 13(65%) was between 21-25 years followed by 16-20 years 4(20%). Youngest patient was 20 years old and the eldest was 27 years. Maximum number of patients 8(40%) was between 30-36 weeks and 36-42 weeks of gestation and least number of patients 1(5%) were between 24-30 weeks. In third trimester of pregnancy it was observed that TCD shows strongest correlation with gestational age and shows a statistically significant correlation (P<0.001).It was noted that there is a correlation between gestational age and TCD in second trimester of IUGR pregnancies however the correlation was statistically insignificant(P>0.05). Conclusion: TCD is better predictor of gestational age in IUGR pregnancies as it remains nearly unaffected and correlates more closely with gestational age both in second and third trimester of pregnancy.

Keywords: Transcerebellar Diameter, Gestational Age, Prediction, IUGR

Introduction

Antenatal ultrasound is the most important diagnostic tool in modern obstetrics for determining the gestational age and is the most effective way to date pregnancy. Accurate assessment of the gestational age of the fetus, major congenital anomalies, fetal growth, fetal wellbeing and maturity have all been possible due to availability of ultrasound.1,2

Other than estimating the accurate gestational age it is also important to detect intrauterine growth restriction antenatally owing to its association with high perinatal morbidity and mortality.3

In cases of intrauterine growth restriction, the biparietal diameter, head circumference/abdominal circumference (HC/AC) ratio and estimated gestational age can be used to assess fetal maturity only if correct gestational age is known. If the gestational age is uncertain it is difficult to differentiate between appropriate for gestational age and small for gestational age fetus.3 It is also observed that the reliability of almost all the parameters greatly diminishes as gestational age advances. In third trimester, the reliability of any single ultrasound parameter is poor.4-7

Transcerebellar diameter is emerging as a promising indicator for assessment of the Gestational age. Because of less variation and less deformation of cerebellum by extrinsic factors, transcerebellar diameter is a better predictor of Gestation age. Transcerebellar diameter is considered to be more effective as the size of cerebellum is less affected by deviation in fetal growth restriction or growth acceleration.8,9

So the purpose of our study was to assess the mothers with intrauterine growth restriction during the antenatal period to see the accuracy of TCD in predicting gesational age in growth restricted foetuses.
Aims and Objectives
a) To evaluate the Correlation between GA (by LMP) Versus TCD in IUGR pregnancies
b) To derive the Quadratic Equation showing relationship of Gestational age with TCD

Materials and Methods
This study was conducted on 120 antenatal women of gestational age 15-40 weeks, out of which 20 were IUGR cases attending the antenatal clinic and admitted in the department of Obstetrics and gynaecology, and sent to Department of Radiology KNSH M&C and IGMC Shimla for Antenatal USG Scan.

Study Design: Prospective Cross-sectional study

Study duration: One year

Study Place: Department of Radiodiagnosis, Indira Gandhi Medical College, Shimla

Inclusion Criteria: Normal singleton pregnancies of 15 to 40 weeks gestation with known last menstrual period and Clinically& radiologically suspected IUGR pregnancies

Exclusion Criteria: Pregnancies with Congenital Malformations and Multiple pregnancies

Machine Specifications: GE LOGIQ P6. The transducer used was 2-5 MHz convex array transducer.

Method of Examination: The patient was made to lie in supine position after applying the coupling agent.

Methodology for Measurement TCD Parameters: In every patient TCD was measured.

Transcerebellar Diameter: The cerebellar view was obtained by rotating the transducer in the axial plane centred on the thalamus to show the cerebellar hemispheres. This view shows cerebellum, the cistern magna and the cavum septum pellucidi. The cerebellum characteristically appears as two lobules on either side of the midline in the posterior cranial fossa. The widest diameter of the cerebellum is measured. From the above measured parameters gestational age and effective fetal weight was computed by the ultrasound machine based on Hadlock tables by using regression equations from combination of measurements (computation software package). Measured TCD was recorded in millimetres.

Duration of pregnancy in weeks was recorded as menstrual weeks and days and TCD was recorded in one decimal point.

IUGR Cases: IUGR patients (with known LMP) were scanned in the above stated manner and TCD was measured. Combined Gestational age and Effective fetal birth weight was computed in the above stated manner. Criteria used for confirming fetal growth restriction was:
1) estimated fetal weight less than 10th percentile of expected for that gestational age.
2) decreased amniotic fluid volume
3) elevated FL/AC ratio
4) elevated HC/AC ratio

Statistical Analysis: Data was entered into MS excel spread sheet, cleaned and transferred to EPI INFO Version 7.2 software. The qualitative variables were presented as percentages, frequencies and proportions. The quantitative variables were presented as mean & standard deviation. Correlation coefficients were then used to compare TCD with Gestational age in IUGR pregnancies. P values <0.05 was considered significant. Data measured in normal pregnancy patients was then utilized to establish nomograms by taking the 5th, 50th and 95th Percentile values.

Ethical committee clearance: The research procedure was in accordance with the approved ethical standards of Indira Gandhi Medical College and Hospital, Shimla, Ethics Committee.

Results
In this study 120 cases were studied out of which 20 were pregnancies with IUGR. Age distribution of IUGR pregnancies was 20 to 27 years with Mean age of 22.6±2.14 years. Maximum number of patients 13(65%) was between 21-25 years followed by 16-20 years 4(20%). Youngest patient was 20 years old and the eldest was 27 years. Maximum number of patients 8(40%) was between 30-36 weeks and 36-42 weeks of gestation and least number of patients 1 (5%) were between 24-30 weeks. (Table-1)
Table 1. Age & Gestational age distribution of the patients in IUGR pregnancies

<table>
<thead>
<tr>
<th>Number of Patients</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age of Patients (in Years)</strong></td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>4</td>
</tr>
<tr>
<td>21-25</td>
<td>13</td>
</tr>
<tr>
<td>26-30</td>
<td>3</td>
</tr>
<tr>
<td>31-35</td>
<td>0</td>
</tr>
<tr>
<td><strong>Gestational age (in weeks)</strong></td>
<td></td>
</tr>
<tr>
<td>12-18</td>
<td>0</td>
</tr>
<tr>
<td>&gt;18-24</td>
<td>3</td>
</tr>
<tr>
<td>&gt;24-30</td>
<td>1</td>
</tr>
<tr>
<td>&gt;30-36</td>
<td>8</td>
</tr>
<tr>
<td>&gt;36-42</td>
<td>8</td>
</tr>
</tbody>
</table>

It was observed that TCD shows strong correlation with gestational age (0.975) in IUGR pregnancies overall. In third trimester of pregnancy it was observed that TCD shows strongest correlation with gestational age and shows a statistically significant correlation (P<0.001). It was noted that there is a correlation between gestational age and TCD in second trimester of IUGR pregnancies however the correlation was statistically insignificant (P>0.05) (Table 2)(Figure 1)

Table 2: Correlation between GA (by LMP) Versus all Sonological parameters in all normal pregnancies & IUGR pregnancies

<table>
<thead>
<tr>
<th>Variables</th>
<th>Comparison</th>
<th>IUGR patients</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second Trimester</td>
<td>GA Vs TCD</td>
<td>0.931</td>
<td>0.239 NS</td>
</tr>
<tr>
<td>Third Trimester</td>
<td>GA Vs TCD</td>
<td>0.905</td>
<td>&lt;0.001 S</td>
</tr>
<tr>
<td>Overall</td>
<td>GA Vs TCD</td>
<td>0.975</td>
<td>&lt;0.001 S</td>
</tr>
</tbody>
</table>

Statistical Analysis: Karl Pearson’s correlation. Correlation is significant at the 0.05 level.

Figure 1: Scattered plot of TCD Vs GA (by LMP)

A quadratic equation is derived where gestational age can be calculated by taking into account TCD in IUGR pregnancies. (Table 3)

Table 3: Quadratic Equation Showing Relationship Of Gestational Age With TCD In Normal Pregnancies & IUGR Pregnancies

<table>
<thead>
<tr>
<th>Equation</th>
<th>Linear regression equation</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUGR</td>
<td>GA (LMP) = 4.74 + 0.8262 TCD</td>
<td>95.14%</td>
</tr>
</tbody>
</table>

Discussion

It is of utmost importance to know the gestational age of the fetus especially in the cases of intrauterine growth restriction. In 1966 Scott and Usher reported that the mortality was nearly 8 times higher in study population when the birth weight was below 10th percentile.

TCD being a stable parameter irrespective of growth status of fetus, provides a basis for its usefulness to predict IUGR and other perinatal outcomes. Thus,
Despite not being a direct marker for IUGR, it can serve as a surrogate marker for detection of IUGR and another adverse perinatal outcome.

In the present study, TCD shows strong correlation with gestational age (0.975) in all the 20 IUGR pregnancies overall. In third trimester of pregnancy it was observed that TCD shows strongest correlation with gestational age and shows a statistically significant correlation (P<0.001). It was noted that there is a correlation between gestational age and TCD in second trimester of IUGR pregnancies however the correlation was statistically insignificant (P>0.05). We noted that there was a good correlation between TCD and gestational age. This could be due to significantly less number of IUGR cases studied in second trimester (4 out of 20) than third trimester. There are many studies which are in concurrence with our observations demonstrating that the TCD is spared in cases of intrauterine growth restriction.

Guan B et al., found curvilinear relationship between TCD and gestational age in symmetric and asymmetric intrauterine growth restricted fetuses. He concluded that the function of the TCD in the evaluation of fetal growth and development is better than any other parameter. The growth of TCD slowed down in primary symmetric IUGR and was unaffected in asymmetric IUGR. Similar results were obtained in present study. We noticed curvilinear relationship between TCD and gestational age.

In another study by Reece EA et al., studied nineteen pregnant women with a clinical suspicion of intrauterine growth retardation in which gestational age was confirmed by early ultrasound examination. A prenatal diagnosis of intrauterine growth retardation was made in all cases based on the transverse cerebellar diameter being consistently correlated with gestational age as predicted by the last menstrual period. They therefore concluded that growth of the transverse cerebellar diameter is unaffected by intrauterine growth retardation; thus this sonographic measurement may serve as an independent and reliable correlate of gestational age against which potential deviations of growth may be compared.

**CONCLUSION**

TCD is better predictor of gestational age in IUGR pregnancies as it remains nearly unaffected and correlates more closely with gestational age both in second and third trimester of pregnancy. Thus, despite not being a direct marker for IUGR it can serve as a surrogate marker for detection of IUGR and other adverse perinatal outcomes. It is thus established that TCD is an independent reliable marker for estimation of gestational age in IUGR pregnancies. The quadratic equation derived from the measured TCD data can be used to calculate the gestational age of the fetus.

**Limitations of the Study**

In our study early dating of pregnancy by ultrasound was not done in all the patients since most of the patients were from rural background where ultrasound facilities are not available. The number of patients studied was less (n=20) as compared to the other studies. The number of IUGR cases observed in second trimester were less (n=4) which could be due to less number of patients studied in second trimester. Moreover, the IUGR secondary to maternal (extrinsic) factors occur in the third trimester and we did not evaluated the patients according to the etiology of IUGR i.e. extrinsic or intrinsic causes. The IUGR due to the intrinsic causes starts early. The IUGR cases in our study could be solely due to maternal causes.

**REFERENCES**


