Original Article

Ultrasonographic Evaluation of Foetal Binocular Distance in Second and Third Trimester and its Correlation with Gestational Age

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ABSTRACT:

Introduction: *An accurate assessment of gestational age is vital to the obstetricians in order to come to a decision regarding the time of termination of pregnancy and rout of delivery. Ultrasonography plays an important role in determining gestational age when it cannot be dated from menstrual history.* ***Objective:*** *To find out the role of sonographically measured foetal binocular distance for determination of gestational age in second and third trimester of pregnancy.* ***Methods:*** *This cross sectional observational analytic study was carried out among 100 purposively selected pregnant women between 12 to 40 weeks of gestation according to inclusion and exclusion criteria at Mymensingh Medical College Hospital (MMCH) over a period of 12 months from January 2010 to December 2010. Foetal Binocular Distance (BD) was measured sonographically and gestational age was determined on the basis of Biparietal Diameter (BPD), Femoral length (FL) and an average of these two. These parameters were correlated with gestational age determined according to Last Menstrual Period (LMP). Analysis was done to know the correlation between gestational age and foetal binocular distance.* ***Results:*** *Majority (39.0%) of the respondents were within 21 to 25 years' age group. Mean age was 24.81±5.02 years. Majority (53.0%) respondent's height was 150 to 154 cm with a mean of 152.56±3.21cm. Majority (65.0%) were housewife. A strong positive correlation was found between foetal binocular distance and gestational age as predicted by Biparietal Diameter (r=0.99), Femoral Length (r=0.99) and average of Biparietal Diameter & Femoral Length (r=0.99), which was statistically significant (p<0.01). There is a relation between gestational age and mean foetal binocular distance (r=.98, p< 0.01).* ***Conclusion:*** *Measurement of foetal binocular distance by ultrasound is an effective way to detect gestational age during second and third trimester even when some other methods are failed to measure gestational age accurately.*

Key words: *Binocular distance, Biparietal diameter, Femoral length, Ultrasonogram, Gestational age.*

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INTRODUCTION:

The pregnancy begins from the date of fertilization. But it is not possible to know the actual date of fertilization in spontaneous conception. In clinical practice the duration of pregnancy is calculated from the first day of last menstrual period (LMP) by assuming that the ovulation and subsequent fertilization occurs around 14 days after LMP. This is known as gestational age.[1] So assessment of gestational age and foetal growth assessment is very important to the neonatologist and obstetrician. Reliably assessing gestational age and the growth of the fetus has long posed a challenge to all who care for pregnant women. With

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recent advances in diagnostic imaging, foetal age and growth can now be assessed with high accuracy. No single parameter is perfect in predicting gestational age. Estimation of foetal age improves significantly when two or more parameters are used simultaneously.[2]

Gestational age can be determined by the following methods, such as Pregnancy calendar, Clinical dating, Radiological dating and Ultrasonographic dating. Ultrasound plays an important role in assessing the gestational age. The procedure is based on the measurement of foetal parts. Any variable that changes with increasing age may be used to establish gestational age by ultrasonography. The traditionally used methods are Diameter of gestational sac, crown rump length (CRL), Biparietal diameter (BPD), Corrected biparietal diameter (CBPD), Head circumference (HC), Abdominal circumference (AC), Femoral length (FL) etc.[3] One author used the technique of averaging the biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC) and Femoral length (FL) to determine gestational age.[4]

Orbital architecture has become increasingly important in the evaluation of gestational age and craniofacial anomalies. The fetal orbital measurement is the most interesting parameter useful in predicting gestational age. Binocular distance (BD), the ocular diameter (OD) and inter-ocular distance (IOD) can be measured through ultrasound and gestational age can best be predicted from BD.[5] This measurement is more strongly related to BPD and gestational age than other orbital parameters.[6]

Transvaginal sonography is able to visualize and measure orbital diameters with accuracy in early pregnancy.[7] Foetal ocular biometry has been previously established to predict foetal age from the binocular distance.[8] The relation between foetal binocular distance and menstrual age was determined by cross sectional analysis using real-time sonography. Binocular distance can be used as an adjunct in estimating menstrual age and EDD and may be useful in the diagnosis of some abnormalities e.g. hypotelorism or hypertelorism.[9]

The standard measurement for dating pregnancies, the biparietal diameter, is virtually impossible to obtain when the foetal head is facing straight up or down. However, the orbits can be identified and measured in an occipito-posterior position. So, binocular distance could be used to date pregnancies in lieu of bi-parietal diameter measurements.[6] So the study has been conducted to evaluate the ultrasonographic measurement of the fetal binocular distance for determination of foetal age in correlation with gestational age determined by other traditionally used parameters.

METHODS AND MATERIALS:

This cross sectional observational analytical study was carried out from January 2010 to December 2010, among 100 purposively selected pregnant women between 12 to 40 weeks of gestation referred to the department of Radiology and Imaging at Mymensingh Medical College Hospital (MMCH). This study was conducted to find out the role of sonographically measured foetal binocular distance for determination of gestational age in second and third trimester of pregnancy. All subjects were selected purposively between 12-40 weeks' gestation with apparently normal fetuses, and who gave informed voluntary consent, and evaluated by detailed history and clinical examinations with special emphasis on obstetrics. Foetal Binocular Distance (BD) was measured sonographically and gestational age was determined on the basis of Biparietal Diameter (BPD), Femoral length (FL) and an average of these two. These parameters were correlated with gestational age determined on the basis of LMP. Mother who did not gave consent were not enrolled. All information was noted in a predesigned data collection sheet. Data were analyzed by computer software SPSS-16 for Windows, to know the correlation between gestational age and foetal binocular distance. Level of significance was expressed as p value and p value <0.05 was taken as a significant measure. Ethical clearance was obtained from the institutional review board of Mymensingh Medical College.

Procedure of sonographic measurement of foetal Binocular distance: Measurement of

binocular distance was performed by utilizing gray scale real time ultrasound scanner Toshiba & Fukuda with 3.5 and 5 MHz transducer of ultrasound scanner. The lengths of binocular distance were measured.

1. A longitudinal scan was carried out to determine the position of orbits.
2. The probe follows the orbits till it is traced completely then transverse scan was done.
3. The distance of orbits (outer border to outer border) was measured by electronic calipers.

Good imaging of the orbits was obtained in a plane slightly more caudal than the BPD. The orbits are accessible in every head position except the occipito-anterior position (i.e., face looking down). All measurements should be taken from outer border to outer border.[10]

The foetal outer binocular distance was identified in the occipito-transvers or occipito-posterior foetal positions. With the head in occipito-transverse position the transducer can be placed in two possible planes: (1) Along the coronal plane, approximately 2cm posterior to the glabella-alveolar line or (2) Along the orbitomeatal line, approximately 2-3 cm below the level of the biparietal diameter. In both of these views, the midline, orbital rings nasal processes, and portion of the maxillae can be demonstrated. With the head in the occipito-posterior position, the transducer was placed in a plane that transected the occiput, orbits, and nasal processes. Measurements were obtained only when the foetal face was directly perpendicular to the uterine wall. In these condition the foetal binocular distance were directly open to sonographic exploration and measured the outer and inner orbital diameters in number and graph form.[6]

The foetal orbit should be measured in a plane slightly more caudal than the BPD. The orbits are accessible in every head position except the occipito-anterior position (i.e., face looking down). All measurements should be taken from outer border to outer border.[5]

Imaging of the foetal orbits was less satisfactory in cases where face of the foetus faces posteriorly or laterally in the maternal flank and breech became difficult because the orbits gets either out of optimal access due to bowel gas shadows or crowding of its hampers its assessment. To obtain meaningful assessment of foetal orbits the patient was turned on side and the probe was placed in maternal flank thereby avoiding the difficulties.

Procedure of sonographic determination of gestational age: Gestational ages were determined on the basis of biparietal diameter (BPD) and femoral length (FL) in weeks by standard technique. BPD measurements were obtained by outer margin of proximal skull to inner margin of the distal skull on a standard trans-axial plane passing through the widest portion of the skull with midline echo from the falx cerebri was interrupted by cavum septum pellucidi and thalami. For measurement of femoral length, the femur was first located. Then measurement was made along the long axis of diaphysis disregarding the curvature of the medial border and also non-ossified proximal and distal cartilages. All measurements were obtained in mm and these parameters were correlated with the gestational age based on LMP.

RESULTS:

Among 100 purposively selected pregnant women between 12-40 weeks' gestation, majority 39(39%) were between 21-25 years' age group followed by 26-30 years (27%), 16-20 years (21%), 31-35 years (10%), only 3% were between 36-40 years' age group. Mean age was 24.81±5.02 years. Majority (53%) of the respondent's height was between 150-154 cm, 18% were <150 cm and 29% were >154 cm. Mean height was 152.56±3.21 cm.

Majority (43%) of the respondent's weight were between 55-59 kg, 35% between 50-54kg, 11% between 45-49kg, 8% between 60-64kg and only 3% had a weight >64kg. Mean weight was 55.05±4.12 kg. Regarding occupation of the mother, 65% were housewife, 19% were student and 16% were service holder.

Table No-I: Relationship of the foetal binocular distance with gestational age

Attributes	Number (n)	Pearson's correlation co-efficient
Gestational age predicted by Biparietal Diameter (BPD)	100	0.99*
Gestational age predicted by (FL)	100	0.99*
Gestational age predicted by Binocular Distance (BD)	100	0.98
Gestational age predicted by BPD & FL	100	0.99
* statistically significant (p= < 0.01)		

Table-II shows that a strong positive correlation was found between foetal binocular distance and gestational age as predicted by Biparietal Diameter (r= 0.99), Femoral Length (r= 0.99) and average of Biparietal Diameter & Femoral Length (r= 0.99). Statistically this result was highly significant (p= <0.01).

Table No-II: Mean foetal binocular distance at 12- 40 weeks of gestation with Standard Deviation (SD) (n= 100)

Gestational age(Weeks)	Number of observation (n)	Mean foetal binocular distance (mm)	±SD
12	03	15.80	0.60
13	03	18.00	0.34
14	03	21.90	0.70
15	03	23.63	0.45
16	02	26.00	0.28
17	04	27.53	0.34
18	04	31.53	0.38
19	03	32.63	0.64
20	03	34.70	0.17
21	04	36.95	0.64
22	04	38.85	0.99
23	03	40.77	0.38
24	03	42.57	0.40
25	04	44.00	0.66
26	08	45.94	0.56
27	03	47.07	0.38
28	02	48.00	0.85
29	02	48.45	0.35
30	03	51.07	0.99
31	05	51.96	0.54
32	05	52.68	0.19
33	02	53.70	0.14
34	04	54.65	0.13
35	05	55.68	0.19
36	04	56.90	0.62
37	02	57.60	0.28
38	04	58.75	0.13
39	03	59.40	0.20
40	02	60.20	0.14
	Total= 100		

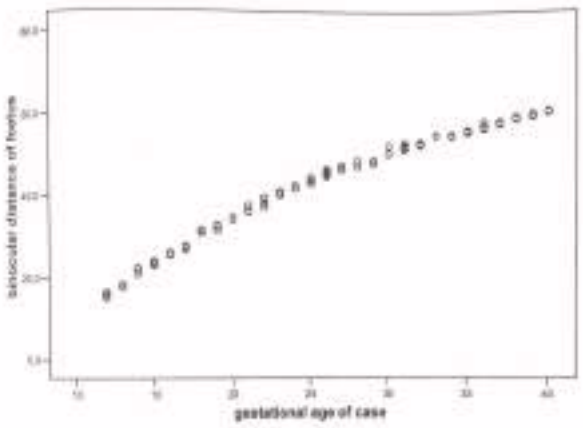

Figure No-1: Correlation between mean foetal binocular distance and gestational age (n=100)

Figure-1 shows that there is a relation between gestational age and mean foetal binocular distance (r=.98, p-<0.01).

DISCUSSION:

Strong positive correlation was found between the foetal binocular distance and gestational age predicted by BPD, FL and an average of these two.

Fewer studies are done throughout the world till date. Jeanty *et al*.[8] found that foetal binocular distance increases with advancing gestational age. Merz *et al* did a same prospective cross-sectional study on 1090 pregnant women and showed the time dependent change in the length of binocular distance throughout the pregnancy, which is similar with the findings of this research.[11]

This study revealed that there is a linear correlation between binocular distance and gestational age (r=0.99), the BPD (r=0.99). Another study conducted by Jeanty *et al*. on 188 pregnant women from 12 to 40 weeks showed that there is linear correlation between binocular distance and gestational age (r=0.95), the BPD (r=0.96). These findings are almost similar with this study.[12]

In this study it is found that mean binocular distances at different gestational age was increased gradually. At the 12th week it was 15.80 mm, at 24th week it was 42 mm and at the 40th week it was 60.20 mm. Almost same findings was observed by Jeanty and Mayden in their study. They found 16 mm at 12th week, 42 mm at 24th week and 60 mm at 40th weeks.[5, 6]

CONCLUSION:

Various parameter have been proposed to established gestational age by ultrasonography and all are useful in first and second trimester but few are effective in advanced pregnancy. Foetal binocular distance is clearly related with gestational age throughout the pregnancy period. If binocular distance is measured accurately with high resolution ultrasound scanner it can be used reliably as an additional parameter during pregnancy in conjunction with other established parameter. Even when other parameters fail to assess gestational age, binocular distance can be used effectively on that situation.

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