Document heading doi: 10.21276/apjhs.2019.6.6 **Original Research Article**

A study to estimate the gestational age by measuring bi-parietal diameter of the foetuses in Gravid Females

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ABSTRACT

Introduction: Monitoring of intra-uterine growth has remained a very important fetal surveillance tool in the care of pregnant women. In wide variety of circumstances of feticide the fetal age determination is important for identification. There are many parameters to determine the age of the fetus during autopsy, which includes measurement of BPD and head circumference in the skull. if during autopsy of a decomposed or mutilated body only skull is present then BPD is useful criteria for estimating age. Biometric values or curves of one population may overestimate or underestimate the fetal age if used for other population with different demographic characteristics. Therefore, this study was undertaken to assess GA with the help of measurement of BPD by ultrasonography. **Methods:** This Prospective Cross Sectional study involved Prior Consent & was found to be within ethical standards. Study was carried out to measure BPD of the fetus in a total of 100 gravid females by using a grey scale real time Sonography Machine employing a 6-3 MHz convex transducer.The fetal head was imaged in an axial section with the fetus in direct occiput transverse position. The instrument was set so that parietal bones measure approximately 3 mm in thickness. The BPD was measured from the outer surface of skull table to the inner margin of the opposite skull table in a transverse plane.**Results:** The study was conducted among 100 Gravid Females. Cubic polynomial regression model was fitted to measure BPD as a function of GA. The models were chosen based on the correlation coefficient, R^2 To illustrate the variability in measurement, the Standard Deviations of each week were computed and regressed on GA using a simple linear equation. In this study, fetal mean BPD showed linear increase from 13 to 36 weeks and statistically significant correlation was found between GA and BPD. Average growth rate of BPD was found to be 0.31 cm/week from 13 to 28 weeks. **Conclusions:** This study substantiates the fact that BPD is one of the useful criteria to predict GA and determine EDD and it was found to be statistically significant. We have been able to generate growth charts and an equation for monitoring growth and estimating GA based on a large sample in an area where many mothers are unsure of the date of their last menses and might be at risk of intra-uterine growth restriction. This we believe will guide antenatal caregivers from under-estimation or over-estimation of GA. Accuracy in measurement and resolution in these parameters are of immense importance.

Keywords: Fetal Biometrics, Bi-parietal Diameter , Gestational Age , Intrauterine Growth.

INTRODUCTION

The neck region not only serves to connect the head with the rest of the body, it also houses structures within it that act as conduits for blood and nerve impulses traveling both to and from the brain. [1]

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Many important structures are crowded together in the neck, such as muscles, glands, arteries, veins, nerves, lymphatics, trachea, esophagus, and vertebrae (within them the cervical segment of the spinal cord); Monitoring of intra-uterine growth has remained a very important fetal surveillance tool in the care of pregnant women. Growth monitoring helps to pick out early cases of abnormal intrauterine growth pattern. This helps the clinician to institute timely interventions with a view to optimizing fetal outcome.

The introduction of ultrasound in Obstetrics made it

easy for various fetal biometric parameters to be used to assess the fetus *in-utero* in different trimesters. The parameters include crown-rump length, abdominal circumference, femur length (FL) and biparietal diameter (BPD) amongst others. These parameters Singly[1,2] or preferably in conjunction [3,4] are used to monitor intra-uterine growth, generate growth curves and as well, date pregnancies. Accuracy in measurement and resolution in these parameters are of immense importance. We have been able to generate growth charts and an equation for monitoring growth and estimating GA based on a large sample in an area where many mothers are unsure of the date of their last menses and might be at risk of intra-uterine growth restriction. This we believe will guide antenatal caregivers from under-estimation or over-estimation of GA.

In a country like India& regions like Chhattisgarh where most females don't keep a record of last menstrual period (LMP) then these parameters are valuable in estimating GA of fetus. BPD is one of the most commonly measured and accurate parameter in determining the age of the fetus up to 36 weeks.[5]

Accurate gestational age (GA) estimation will help the obstetrician avert cases of inadvertent premature delivery or to anticipate the delivery of a premature baby when it becomes inevitable. It also makes it easier to pick out cases of postmaturity. This will go a long way in reducing perinatal morbidity and mortality. Many pregnant women are either uncertain about their menstrual dates or have irregular menstrual cycles. Medico-legal implications of delivering premature, low birth weight and macrosomic babies can be far-reaching.

In wide variety of circumstances of feticide the fetal age determination is important for identification. There are many parameters to determine the age of the fetus during autopsy, which includes measurement of BPD and head circumference in the skull. However if during autopsy of a decomposed or mutilated body only skull is present then BPD is useful criteria for estimating age.[6] Prenatal measurements of fetal parameters, estimated size and weight vary among different population [7] depending upon their racial, [8] demographic characteristics and nutrition. [9] Hence, biometric values or curves of one population may overestimate or underestimate the fetal age if used for other population with different demographic characteristics. Therefore, this study was undertaken to assess GA with the help of measurement of BPD by ultrasonography in the Local population in Chhattisgarh and to compare these values with western normograms and other Indian studies.

METHODOLOGY

The study was conducted in Raipur Institute of Medical Sciences, Raipur and attached Health centres of the same , Raipur , Chhattisgarh . This Prospective Cross Sectional study involved Prior Consent & was found to be within ethical standards.

Study was carried out to measure BPD of the fetus in a total of 100 gravid females by using a grey scale real time Sonography Machine employing a 6-3 MHz convex transducer. Other materials used were aqua saline jelly, multiformat camera, single coated sonographic films and transvaginal probe. These women included both of rural and urban area. A completely filled F form (in compliance to Pre-Conception and Pre-Natal Diagnostic Techniques act) duly signed by radiologists and women undergoing sonography was submitted prior to the examination. Gravid women who fulfilled the following criteria were included in the study.

- Healthy females of the age between 18 and 30 years, with a singleton pregnancy and cephalic presentation.
- With known LMP and regular 28-30 days cycles.
- Women who did not develop maternal or fetal complications during pregnancies.
- Women who had normal blood pressure and hemoglobin more than 10 g.
- No history of oral contraceptive use in the three months prior to conception.

Mothers with diseases likely to affect fetal growth such as hypertensive diseases, renal pathology, hemoglob-inopathy, and diabetes mellitus were excluded as well as those unsure of their last menstrual date and babies with congenital malformations. Informed consent was gotten from all the participants.

Fetal head measurements were made in the plane where the continuous mid-line echo is broken by the cavum septi pellucidi, and taken from outer leading edge to the inner leading edge of the fetal skull (outer-inner).[10]

Regarding the Bi-parietal diameter the fetal head was imaged in an axial section with the fetus in direct occiput transverse position. The instrument was set so that parietal bones measure approximately 3 mm in thickness. The BPD was measured from the outer surface of skull table to the inner margin of the opposite skull table in a transverse plane [11]Data was filled in Microsoft Excel & analysed using a computer

software Epi Info version 6.2 (Atlanta, Georgia, USA).P value of 0.05 and less was considered as statistically significant. Results were presented in simple proportions and means (±SD). Correlation was performed between GA and BPD and correlation coefficient (r) was derived.

Two senior staff in Radiodiagnosis department did all the scanning.

Cubic polynomial regression model ($y = a + b \times$ GA $+ c \times$ GA2 $+ d \times$ GA3) was fitted to measure BPD as a function of GA. The models were chosen based on the correlation coefficient, R^2 . We were able to assess the variability in measurements by computing the standard deviation (SD) at each week of gestation and SD values were regressed on GA using a simple linear equation ($y = a + b \times$ GA). The 3 rd , 5 th , 10 th , 50 th , 90 th , 95 th , and 97 th percentiles were generated from the data using the Software Package for Social Sciences (SPSS) software (SPSS Inc., Chicago, IL, USA).

RESULTS

The study was conducted among 100 Gravid Females.

Regression formula and their correlation coefficient (R^2) for BPD were derived as

BPD $= -26.383 + 4.292 \times$ GA$-0.032 \times$ GA $^2 +$ $0.00002375 \times$ GA ^{3} ($R^2 = 98.8$).

To illustrate the variability in measurement, the Standard Deviationss of each week were computed and regressed on GA using a simple linear equation ($y = a + b \times$ GA). The fits for SDs were as follows (all SD in mm and GA in exact weeks):
For BPD: SD $= 0.551 + 0.55 \times$ GA ($R^2 = 88.6$).

The resulting data were compiled, and descriptive and comparative analyses were carried out using the SPSS statistical package version 20.0 (SPSS Inc., Chicago, IL, USA). The statistical difference among groups was studied using Chi-squared tests.

To enable us compare our new biometric measurements with previously published studies we used the method described by Salomon *et al*. [12] By following this method, the 50 th percentiles of these published works were calculated for each of the GAs 14-40 weeks by using their reference equations. The data were then expressed as Z-scores calculated with our reference equations using the formula: Z-score = (XGA − MGA)/SDGA, where XGA is data from these other population at a known GA, MGA is the mean value for our population calculated from the reference equations at this GA, and SDGA is the SD associated with the mean value at the same GA from our population. To enable visual comparison on these works, the results were presented graphically across the different GAs.

In this study, fetal mean BPD showed linear increase from 13 to 36 weeks and statistically significant correlation was found between GA and BPD (r = 0.38). Mean BPD showed increase of 2.38 cm in 13-20 weeks, 2.18 cm between 20 and 27 weeks and only 1.72 cm from 27 to 34 weeks. Average growth rate of BPD was found to be 0.31 cm/week from 13 to 28 weeks which then later reduced to 0.23 cm/week from 28 to 36 weeks of gestation.

DISCUSSION

A Prospective cross-sectional study was conducted among 100 Gravid Females.
Estimation of GA by ultrasonography is of high clinical importance for diagnosis, investigation and treatment of fetus in vitro. Accurate assessment of GA by sonography is of great importance in prenatal care during pregnancy because even in women with reliable dates, the error in GA calculation can occur. Therefore, prediction from ultrasound should be more accurate. This study presents sonographically derived measurements of fetal BPD growth from local population and compares it with Western studies and other Indian studies. In comparison with foreign studies it was observed that all the mean values of this study are lower than those of Campbell, [13] Sabbagha et al.,[14] &Wexler et al. [15] with a very few exceptions. However, the observations by Hadlock et al. [16] are in close agreement with present study with few exception. The pattern of curve being the same with a gradual increase in curve and flattening at the end. There is linear rise in mean BPD values up to 34 weeks and thereafter growth rate is less.
When compared to Indian studies, the mean BPD growth rate in this series compared well with results obtained by Rajan et al. [17] and Vaidya et al.[18] However, Buckshee et al., [19] Raval et al. [20] and Garg et al. [21] obtained higher series of mean BPD than the present study. The reasons for difference in BPD growth charts with other regional studies may be attributed to ethnic and nutritional causes. [22,23] Some genetic and environmental factors are also thought to be responsible for this. The Changes in shape of head as in dolichocephalic, [24] due to prematurity, in breech

and transverse position may lead to underestimation of gestation age. [25 ,26] A deviation from normal growth can occur in cases like e.g., intra uterine growth retardation and in multiple pregnancies therefore BPD would be different for the same GA. In such cases, other foetal parameters may be used to determine the GA. GA reference charts derived from a reliable, population-specific growth curve can improve obstetric management. [27]

CONCLUSION

We have been able to generate growth charts and an equation for monitoring growth and estimating GA based on a large sample in an area where many mothers are unsure of the date of their last menses and might be at risk of intra-uterine growth restriction. This we believe will guide antenatal caregivers from under-estimation or over-estimation of GA. Accuracy in measurement and resolution in these parameters are of immense importance. This study substantiates the fact that BPD is one of the useful criteria to predict GA and determine EDD and it was found to be statistically significant. Our analysis confirmed that fetal anthropometric measurements significantly differ among different population group due to racial, genetic and ethnic factors. Thus, biometric curves of one population may overestimate or underestimate GA and EDD when used for other racial or ethnic groups. Hence, a large scale study at national level in other Indian population is required to generate population-specific reference tables and further studies are recommended to support the above mentioned findings. The perinatal mortality and morbidity can be reduced by properly estimating GA and growth using serial ultrasonogrphy of fetus.In our country where most of the women may not keep menstrual record properly, GA assessment by ultrasonography can be of immense value.

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