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Original Research Paper

Radio- Diagnosis

# COMPARISON OF FETAL CARDIAC SIZE THROUGHOUT GESTATION WITH AGE-A PROPOSED NOMOGRAM

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## ABSTRACT

The four chambered view is now considered to be an integral part of the fetal examination. A normal range for fetal cardiac measurements is a basic need for the sonographer performing fetal sonography .The knowledge of cardiac dimensions in utero plays an important role in the assessment of the fetus with congenital heart diseases, once these conditions can progress during the prenatal period and lead to severe cardiac decompensation ..

**OBJECTIVE**-Construction of an ultrasonographic nomogram of fetal cardiac size throughout gestation

To determine the accuracy of fetal gestational age and weight by substituting femur length by cardiac size in the Hadlock's formula

**Methods and materials**-The present study was conducted in the Department of Radio-diagnosis, Bankura Sammilani Medical College And Hospital, Bankura from January 2018 to march 2018.A total of 96 patients were selected in this cross-sectional study of patients between 14 and 42 weeks of gestation. These patients were referred from Department of Gynecology and Obstetrics antenatal care outpatient department for routine feto-placental profile. These patients were then subjected to our inclusion criteria of well established dates (consistent with earlier ultrasound),singleton, non anomalous fetuses and intact amniotic membranes. As a result, 81 patients were included in the study. An informed consent was taken.

A brief history was elicited. Ultrasound was done on HD7 Philips machine by a curvilinear probe. Sonographic measurements included Femur length (FL), Abdominal circumference (AC), Biparietal diameter (BPD), Head circumference(HC), and sonographically estimated fetal gestational age(AUA) and weight.

Three separate measures of transverse diameter of heart in the four chambered view at the level of atrio-ventricular valves is taken from outer pericardium of one side to inner pericardium of the other. An average of the three have been listed in the master chart and evaluated accordingly. A brief scan was done for any apparent congenital anomaly. The study was done in all pregnancies, irrespective of the sex of the fetus, which was not determined in accordance with the PNDT (Pre Natal Diagnostic Technique-1994, India) act.

Statistical analysis was done using STATA and multiple scatter diagrams were evaluated to show the correlation between cardiac size and FL, BPD, AC, and HC respectively.

## KEYWORDS :

**INTERPRETATION-**

The present study was conducted in the Department of Radio-diagnosis on 81 pregnant women selected for the study. Most of the pregnant mothers were in the age group of 18-21 years(39.5%) ,followed by 21-25 years age group (30.9%).only 45.6% pregnant mothers could recall the exact date of their last menstrual period(LMP).62.7% pregnant mothers had presented to us in the third trimester, followed by 37.3% who presented to us in the second trimester. A strong linear correlation was established between all the variables of the Hadlock's formula (FL, AC, BPD and HC) and cardiac size. The coefficient of correlation between Femur length (FL) in weeks and cardiac size(in mm) was recorded to be 0.9.This is an excellent positive correlation.

**CONCLUSION-**

The present study conducted at Department of Radio-diagnosis, Bankura Sammilani Medical college and Hospital shows an excellent positive correlation between cardiac size(in mm) and Femur length( in weeks).thus providing cardiac size to be an efficient tool for substitution in fetuses where femur length might give a spurious result such as focal limb defects, skeletal dysplasia and conditions where femur length is not easily accessible.

**LIMITATIONS-**

T he present study was conducted on a small sample size. It was conducted on indigeneous patients, in and around Bankura district,so we do not have any other reference to check for variations.

**DISCUSSION-**

Fetal growth assessment, either clinically or by ultrasound evaluation , relies on accurate estimation of gestational age. Fetal growth retardation or macrosomia may be missed or incorrectly diagnosed owing to errors in gestational age assignment. Obstetric management is also dependent on gestational age. Proper decisions regarding presumed preterm labor or postdate pregnancies are only possible when gestational age is accurately estimated. Likewise, timing of repeat cesarean section requires accurate assessment of dates.,Ultrasound is a reliable method for establishing the length of pregnancy and in this way can improve obstetric care. Clearly, the inaccuracies of history and physical examination may limit their usefulness in assessment of gestational age.The advent of ultrasound has allowed a more direct means of assessing fetal structures and development. Measurements of a wide variety of parameters have been devised to establish gestational age. Ultrasound assessment of gestational age is feasible in a majority of pregnancies and may be used to establish gestational age with greater accuracy than physical examination. In the first trimester, gestational sac mean diameter and crown-rump length measurements have become the primary means of evaluating gestational age. ,,,,In the second and third trimesters, fetal head, body, and extremity measurements have been commonly used to assess gestational age. Those parameters most commonly measured include Biparietal diameter, Head circumference, Abdominal circumference, and Femur length. Although numerous other parameters have been measured and related to gestational age, few offer any improvement in the accuracy of gestational age assessment. The accuracy of gestational age estimation by HC measurement is comparable with that of BPD measurement. However, in fetuses with abnormal head shape, either brachycephaly or

dolicocephaly, HC may be a more accurate predictor of fetal age than BPD. Biologic variation and technical factors may contribute to the inaccuracy of AC measurements. Of particular note, the abdominal circumference is the growth parameter most commonly affected in pregnancies complicated by abnormal fetal growth patterns. A macrosomic fetus will have increased AC relative to gestational age, and an asymmetrically growth-retarded fetus will have diminished AC measurements. Variation in AC measurements in macrosomic and growth-retarded fetuses is due to differences in liver size and width of subcutaneous tissue in these two types of abnormal growth patterns. Thus, estimation of gestational age by AC will lead to inaccuracies in fetuses displaying either of these growth patterns. All the fetal long bones can be adequately examined and measured by ultrasound; however, the femur is the largest of the long bones, least moveable, and easiest to image. The femur may be adequately visualized from 14 weeks' gestation until delivery. Femur length (FL) measurements may be used to accurately predict gestational age between 14 weeks' gestation and term. Most observers consider the accuracy of the FL and BPD measurements to be similar in the third trimester. Although there is controversy regarding the accuracy of the FL prior to 26 weeks' gestation, the accuracy of gestational age prediction based on FL is greatest in the second trimester and least near term.

Variation may lead to inaccuracies of FL measurements in a manner similar to that of the other fetal growth parameters. In addition, several technical factors are potential sources of error in the measurement of the femur. Tangential section of the femur, failing to visualize the entire length of the shaft, leads to underestimation of FL and, therefore, of gestational age. Artifactual bowing of the femur may also occur on ultrasound imaging and lead to a shortened FL measurement. The distal femoral epiphysis becomes echogenic in the third trimester and is separated from the distal end of the diaphysis, the osseous portion of the shaft. Inclusion of the distal epiphysis will falsely overestimate

Gestational age assessment by FL is particularly useful when head measurement is difficult to obtain due to fetal position. The femur length may also be compared with the biparietal diameter (FL/BPD) as an age-independent ratio.

A single parameter (CRL, BPD, HC, AC, or FL) may be used to assess gestational age. The accuracy of a single parameter is dependent on the gestational age at the time of ultrasound examination . Several methods have been employed to improve the accuracy of gestational age assessment compared with the use of a single parameter. Hadlock and co-workers combined several measurements in an effort to increase the accuracy of gestational age assessment. The rationale for employing multiple parameters for fetal dating is that when two or more parameters predict the same end point, the probability of correctly predicting that end point is increased. The BPD, HC, AC, and FL measurements were obtained and the mean gestational ages of combinations of these parameters were averaged to obtain a mean gestational age. The use of multiple parameters improved the accuracy of gestational age assessment compared with any single parameter . If the gestational age estimates derived from all of the parameters are similar, assignment of gestational age from the average of all the parameters will improve accuracy. However, if gestational age estimates of the various parameters are quite different, averaging multiple parameters will decrease the accuracy of the best predictor(s). Averaging of fetal growth parameters should be avoided when certain conditions are suspected, such as fetal macrosomia, intrauterine growth retardation (both symmetric and asymmetric), and congenital anomalies (skeletal dysplasias, hydrocephalus and others).

The knowledge of cardiac dimensions in utero plays an important role in the assessment of the fetus with congenital heart diseases,once these conditions can progress during the prenatal period and lead to severe cardiacdec omp ensation.the four chambered view is now considered to be an integral part of the fetal examination.a normal range for fetal cardiac measurements is a basic need for the sonographer performing fetal sonography.

Actual measurements of the cardiac size are not done routinely.however ,in case an abnormality is suspected, measurenents can be useful in confirming altering the further course of evaluation and management by the sonologist, obstetrician and pediatrician.these are the conditions where a nomogram is mandatory.

## OBSERVATIONS AND ANALYSIS-

**Table 1-Distribution of pregnant mothers included in the study-(total=81)**

| age | frequency | Percentage% |
|---|---|---|
| 18-20years | 32 | 39.5 |
| 21-25 years | 25 | 30.9 |
| 26-30 years | 19 | 23.5 |
| 31-35 years | 5 | 6.2 |
| >35 years | 0 | 0 |

**Chart 1-showing distribution of pregnant mothers including in the study**

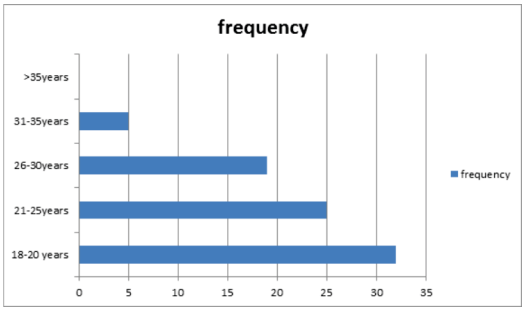



**Table 2-distribution of pregnant women who could recall their last menstrual period (LMP)**

| | FREQUENCY(TOTAL-81) | Percentage (%) |
|---|---|---|
| Could recall LMP | 37 | 45.7 |
| Could not recall LMP | 44 | 54.3 |

**Chart 2-showing percentage of mothers who could recall the date of the last menstrual period**

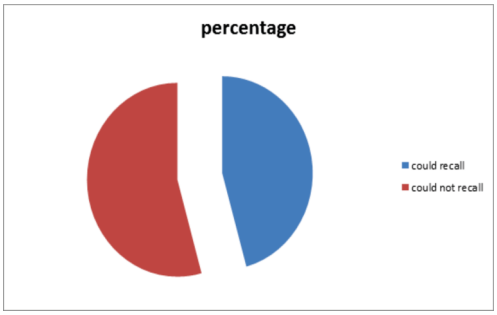
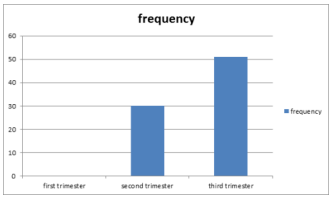
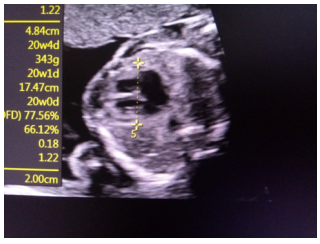



**Table 3- Distribution according to sonographically determined period of gestation.**

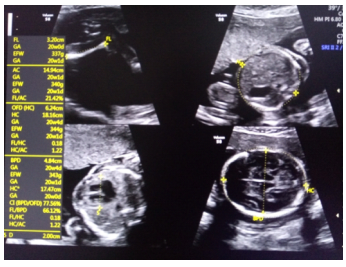
| PERIOD OF GESTATION | FREQUENCY | Percentage (%) |
|---|---|---|
| FIRST TRIMESTER(1-12 WEEKS) | 0 | 0 |
| SECOND TRIMESTER(13-27WEEKS) | 30 | 37.3 |
| THIRD TRIMESTER(28-40WEEKS) | 51 | 62.7 |

**Chart 3-distribution according to period of gestation-**

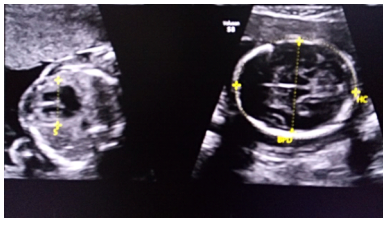



**Measurement of transverse diameter of the heart in the four chambered view at the level of atrio-ventricular valves.**

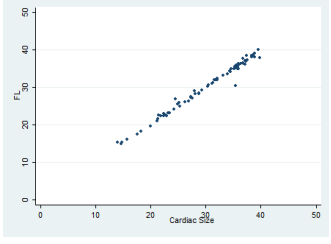


**Measuremet of all the fetal growth parameters along with the cardiac size.**



**Measurement of cardiac size along with BPD and HC.**

**Chart 4-scatter plot showing correlation between femur length (in weeks) and cardiac size (in mm)**




As femur length(in weeks) and cardiac size(in mm) are both continuous variable, correlation has been shown by means of a scatter plot .correlation coefficient of 0.9935 is seen

**Chart 5-scatter plot showing relation between period of gestation(in days) and cardiac size(in mm)**

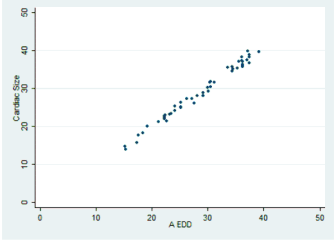



**Chart 6-scatter diagram showing correlation between femur length (in weeks) and period of gestation (in weeks)**

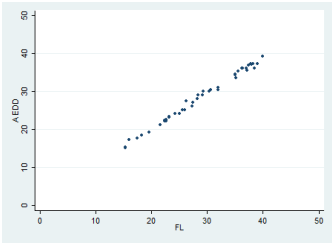



**Chart 7-scatter plot between Biparietal diameter and cardiac size**

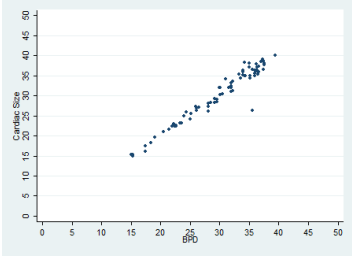
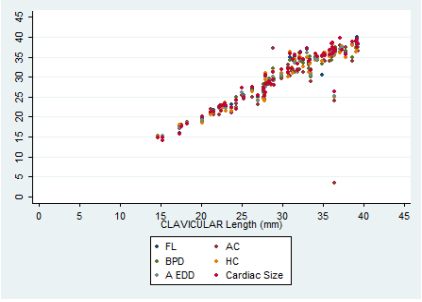



**Chart 8- scatter plot showing correlation of cardiac size with all the Hadlock's variables (FL,AC, BPD and HC)**

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