Correlation between Gestational Age and Abdominal Circumference in Second Trimester

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Abstract

Gestational age is age of unborn baby, defined in weeks as beginning from first day of last menstrual period prior to conception. Estimation of gestational age and thereby forecasting Expected Date of Delivery is not only concern of the Individual but it is invaluable in the diagnosis of intrauterine growth retardation of fetus and obstetric planning. Determination of age of a fetus by using various methods is required for medico legal purposes in both civil and criminal matters. In present study we assesses Correlation between gestational age and abdominal circumference in second trimester, The study of Correlation between gestational age and abdominal circumference in second trimester by Ultrasonography was carried out and collected data was tabulated according to weeks of menstrual cycle and were taken in centimeters. Standard deviation of abdominal circumference for each week was calculated. We found that Abdominal Circumference is statistically highly significant and the regression equations derived for growth parameter for estimating gestational age in a normally developing fetus, increase with gestational age, showed good correlation with gestational age.

Keyword*: Gestational age, abdominal circumference, age determination, Ultrasonography, Second trimester.*

Introduction

Human development starts as oocyte from female which is fertilized by the sperm. Cell division, differentiation, growth transfigure the fertilized oocyte into a multicellular adult human being. Most of the changes occur during the early fetal and embryonic period, the development of which divided into pre and postnatal period. There are many changes that occur from the 3rd to 8th week called as embryonic development and changes occur from 9th week to birth into a recognizable human being called a fetus.[1]

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Gestational age is age of unborn baby, defined in weeks as beginning from first day of last menstrual period prior to conception. Trimester is period of three calendar months during a pregnancy. Radiologically the period of gestation is grossly divided into three trimesters. Estimation of gestational age and thereby forecasting Expected Date of Delivery (EDD) is not only concern of the Individual but it is invaluable in the diagnosis of intrauterine growth retardation of fetus and obstetric planning.[2]

The parameters either singly or in combination useful in predicting the gestational age with fair degree of accuracy are Naegeles formula, Date of quickening, Palpation of fetal parts and Auscultation of fetal heart sound.[3]

The methods like physical examination, menstrual history, and laboratory methods have limitations in assessing fetal maturity, development and well being. At the same time Roentgenography like procedures having

hazards of invasive procedure or radiation compelled the research of safer, non-invasive and reliably predictive investigation modality, it was brought forth in the form of Ultrasonography.[4]

Determination of age of a fetus by using various methods is required for medico legal purposes in both civil and criminal matters.[5, 6]

Ultrasonography is non-ionising, non- invasive, safe and accurate method of objectively evaluating the fetal growth in uterus. In any obstetrics case correct assessment of gestational age is keystone. Measurements and fetal characteristics are helpful in estimating fetal age.

To determine the fetal age at the end of 1st trimester the crown rump length is method of choice because of negligible variation in the size of fetus during the period. In second and third trimester, fetus grows sufficiently in size; several structures can be identified and measured ultrasonographically.

Accurate knowledge of age is a keystone in the obstetrical and medicolegal Aspect legally also helpful in successfully managing the antepartum care of the patient and is critically important in the interpretation of antenatal test and successful planning of appropriate therapy and interventions.[7, 8]

Materials and Methods

The study Correlation between gestational age and abdominal circumference in second trimester was carried out at Govt. Medical College and Hospital, Nanded, between July 2011 to July 2013 period. The study included 150 females attending ANC clinic for Ultrasonography screening at Medical College and Hospital. Subjects of the study mainly include urban as well as rural areas in the vicinity.

Inclusion Criteria

Women with known LMP

Women with regular menstrual cycle

Women with singleton and uncomplicated pregnancy

Women having age between 18 and 34 yrs.

Exclusion Criteria

Women with multiple pregnancies

Women with irregular menstrual cycles

Women having diabetes mellitus

Women with diseases like hypertension, chronic renal disease, heart diseases, iron deficiency anemia. Women having Fetus with congenital anomalies.

For collection of the data proper permission was obtained from ethical committee and radiology department. In this study various particulars of the subjects like age, menstrual and obstetric history had been recorded in the Proforma.

The American Institute of Ultrasound in Medicine recommendations were used for measurements of all the fetal parameters.[9]

The fetal Abdominal Circumference (AC) was measured at the skin line on a true transverse view at the level of the junction of the umbilical vein, portal sinus and fetal stomach. The fetal abdomen was identified with the help of digitaliser.

Date of Ultrasonography of subject is recorded and Gestational age of the fetus in terms of weeks was calculated from last menstrual period in the Proforma. The data so collected was then subjected to statistical analysis by expert statistician with the help of SYSTAT Crainsoft version 12 software. Standard statistical methods, parametric methods were used for the evaluation and significance.

Results

The study of Correlation between gestational age and abdominal circumference in second trimester by Ultrasonography was carried out at Govt. Medical College and Hospital Nanded.

The collected data was tabulated according to weeks of menstrual cycle and were taken in centimeters.

Standard deviation of abdominal circumference for each week was calculated. The mean of each parameter calculated statistical for each week. The completed week considered as the week of gestation. For e.g., 13th week refers to 13.00 to 13.86 weeks of menstrual age. 7 days =

1week, hence 1day = 0.14 weeks. Like this subsequently for each day.

Ultrasongraphic Abdominal Circumference was measured in a total of 150 subjects. The observations of week wise mean values and standard deviation of fetal Abdominal Circumference are shown in (Table 1).

Table 1: Mean and Standard deviations of fetal Abdominal Circumference (Week wise).

Menstrual age in weeks	No. of cases	Mean	Standard deviation
13	8	8.35	0.73
14	11	8.9	1.13
15	10	9.92	0.84
16	7	11.0	1.07
17	12	12.08	0.76
18	9	12.84	0.27
19	7	15.90	1.32
20	11	14.28	0.65
21	10	15.53	1.07
22	12	16.30	1.51
23	10	17.35	2.56
24	10	18.85	1.28
25	8	19.30	2.92
26	12	19.78	2.46
27	4	21.05	0.30
28	9	22.04	1.44
Total	150		

Regression output for 2nd trimester (13 to 28 weeks)

Constant = 6.36

Standard error of Y ests = 0.5639

Coefficient Of determination (R) = 0.9451

No. of observations = 150

Degree of freedom = 148

X coefficients = 0.956

Regression equation:

G.A = 6.36 + 0.956 x AC

From the above equation it is clear that during the second trimester, for every 1cm increase in AC, the gestational age (G.A) increases by 0.956 weeks.

As the value of R is 0.9451 the variation in fetal growth on the basis of Abdominal Circumference during second trimester can be explained to the extent of 94.51%.

The value of R is highly significant (Student's 't' test value = 113.04,

$p<0.0001$, very highly significant) showing that there is statistically highly positive or strong positive association between Gestational age and Abdominal Circumference.

Discussion

Ultrasonography is key imaging technique in the assessment of fetal growth because of its low cost, availability, and without any adverse effects. Ultrasonography can detect the fine observations of the chorionic sac and its contents during the various stages of fetal and embryonic period. Along with this technique can also detect anomalies abnormality various presentations related fetus at a very early stage. Therefore various advances in Ultrasonography have made this technique a crucial tool for prenatal diagnosis which is a most reliable method for the growth of the fetus.

It is observed that upper extremities almost reach to development by the end of 12th weeks, compare to lower extremities. Appearance of primary ossification centre for cranium and long bones develop by the end of 12 weeks. Various ossification centers can be observed during this period along with bones on Ultrasonography. Fetal abdominal, body and extremity measurements have been widely reported and found to be used in second and third trimester.10

After 10th week of gestational period one can differentiate soft and hard tissues after which measurement of various parameters like abdominal circumference other Parameter can be done by Ultrasonography which can be recommended.

The differentiation between hard and soft tissues of the embryo is possible after about 10th week of gestation when other parameters like Abdominal circumference, length of long bones can be measured and become more important than the crown rump length. Measurements of fetal parts during routine Ultrasonography screening have been recommended.[11]

Tamura RK et al found that fetal abdominal circumference added another dimension to the interpretation of cephalic growth particularly in indentifying macrosomic fetuses. The study also revealed that AC was significant in assessment of fetal size in those, who were for obstetric reason had to be delivered in the latter part of second trimester or early third trimester.[12]

Juozas K et al Found linear correlation of gestational age with abdominal circumference .[13] Similarly Jain ND et al found that parameters increased progressively through the 2nd and 3rd trimester. These parameters were reliable indicators of menstrual age.[14]

Johsen SL et al Analysed that abdominal circumference at 10–24 Weeks of gestation. And the effect of fetal size at 10–24 weeks of gestation on pregnancy duration was assessed. Fetal size in the second trimester is a determinant of birth weight and pregnancy duration support a concept of individually assigned pregnancy duration according to growth.[15]

Bhusari PA et al found that Second trimester Abdominal Circumference Shows linear growth as gestational age advances and are strongly correlated with each other. The study was comparable to other studies carried out on aborted fetuses taking actual measurements. Thus accuracy and reliability of ultrasonographic measurements was established.[16]

Conclusion

Sonographically measured parameters during second trimesters of pregnancy were subjected to statistical analysis by simple linear regression. The regression was done separately for each parameter and for each week. Abdominal Circumference is found to be statistically highly significant. The regression equations derived for growth parameter for estimating gestational age in a normally developing fetus, increase with gestational age, showed good correlation with gestational age. Assessment of gestational age helped in calculating the EDD (expected date of delivery) in all patients, thus improving the antepartum management. Gestational ages are fairly accurate predictors of fetal growth. In Present study, in second trimester abdominal circumference is the sensitive parameter and results of present study was comparable with previous studies.

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