

Ultrasonographic Study of Fetal Parameters in Second and Third Trimester

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Research Article

Abstract: Assessment of gestational age by a reliable method is very important in clinical obstetrics, because, with the advent of better neonatal facilities, of children who are found to be normal at birth, it is possible to create a table and curves of fetal growth. A prospective cross sectional study was carried out on 100 antenatal patients (18-32 years age) between 14-36 weeks of pregnancy attending the OPD for routine ultrasonographic (USG) examination. USG measurements of BPD (biparietal diameter), FL (femur length), AC (abdominal circumference) were done and compared with available data. From regression analysis, there was a strong correlation with gestational age. These parameters are useful for assessment of gestational age in all patients and particularly in those patients who are not sure about their last menstrual period.

Key words: Fetal parameters (BPD, FL, AC), gestational age, USG

Introduction

A human development is a continuous process that begins when an oocyte (ovum) from female is fertilized by a sperm (spermatozoon) from a male. Cell division, programmed cell death, differentiation, growth and cell rearrangement transform the fertilized oocyte into a multicellular adult human being. The most developmental changes occur during the embryonic and early fetal periods. The human development divided into prenatal (before birth) and postnatal (after birth) period. There are many changes that occur from the 3rd to 8th week (calculated from the date of fertilization) called as embryonic development. Changes occur from 9th week to birth is meaningful because it signifies that the embryo has developed into a recognizable human being called a fetus. For calculating gestational age from last menstrual period (LMP), we need to add two weeks [1]. In fetal life, the skull is developed from mesenchymal connective tissue. The primary areas are two frontal eminences, two parietal eminences, the occipital bone and chondrocranium. The thalamus is an important landmark in fetal sonography. It is the centre of the cranium and is crossed transversely by the biparietal diameter. Sonographically, the two halves of thalamus appear hypoechoic relative to cerebral cortex.[4] Clinically, the gestational period is divided into three trimesters, each lasting three months. At the end of the first trimester, all the major systems are developed. In the second trimester, the fetus grows sufficiently in size, so that good anatomic detail can be

visualized during ultrasonography. At the beginning of the second trimester, the abdominal organs have attained their adult position: the liver, stomach and kidney can be identified. The large bowel is better seen in the third trimester. By the beginning of the third trimester, the fetus can survive if born premature. The fetus reaches a major developmental landmark, like 2.5 kg of weight, at 35 weeks of gestation.[1] That is why we can measure the biparietal diameter (BPD), femur length (FL), abdominal circumference (AC) during pregnancy. The aim of the study was to ascertain the reproducibility of BPD, FL, AC measurements and to assess the accuracy of the parameter in estimating gestational and to compare these data with the available data.

Material and Method

The study data were obtained from 100 pregnant women routinely examined in obstetric clinic. For this study, patients with known last menstrual period (LMP) were selected and patients with any medical problem such as hypertension, diabetic mellitus, tuberculosis, etc and any obstetrical complications such as previous premature labour, premature rupture of membrane, placenta previa, abruptio-placentae, twin gestations, post-term gestation, pregnancy induced hypertension, uncertain date of last menstrual period, etc. were not considered in this study. Patients with evidence of intrauterine growth retardation and anomalies were also not taken into consideration. For each fetus only one routine USG examination between 12th – 36th weeks of pregnancy was used for analysis. Fetal measurement were made by real time USG machine. The transducer was placed longitudinally over the pubic symphysis and rolled over the abdomen up to the fundus. First, the position, lie and presentation of fetus is seen. The axial section was recognized when the shape of the fetal skull was ovoid and midline echo from the falx cerebri is interrupted by cavum septi pellucidi and the thalami. Measurements were made from the outer table of the proximal skull to the inner table of the distal skull. The biparietal diameter was measured with the electronic caliper. The biparietal diameter measurement was followed by displacing and moving the transducer on the maternal abdomen so that find the fetal

craniovertebral junction. Vertebral column of the fetus was traced to its termination. A projection was found that showed a transverse section of one of the long bones. Then scan was turned by 90 degrees to this, to obtain a longitudinal section. This was followed by the image of the iliac crest, which appeared as two short bright echoes along the bladder. A short distance further, a bright echo appeared close to the iliac crest, which was femur. On rotation, the femoral echo increased in length. Measurement was made from one end of the bone to other end. For measurement of the abdominal circumference, stomach gas was identified first and at that level, with the help of computer, a circle

was drawn over the abdomen and measurement was done.

Observation and results

Biparietal diameter, femur length, and abdominal circumference were recorded with the help of a radiologist. The gestational weeks 12-36 weeks were divided into 6 months- (4, 5, 6, 7, 8 and 9). Mean of gestational weeks was calculated and means of BPD, FL, AC were calculated and a graph was plotted against the calculated mean and gestational age. The graph showed a line which is ascending gradually.

Table 1: Shows Mean Biparietal Diameter, Femur Length, Abdominal Circumference (Mm) and Period

Mean gestational age	No. of cases	biparietal diameter	Femur length	abdominal circumference
14.1	8	31.3	19.3	100.5
18.1	21	43.7	28.0	143.2
22.5	21	61	43.8	205.8
27.0	21	71.3	53.4	243.0
30.4	18	79.4	58.9	272.8
34.3	11	84.6	66.9	303.0

Table 2: Coefficients: Dependent variable = Gestational Age (Weeks)

Coefficients (a)	Coefficients (a)			T- test applied	
	Unstandardized		standardized	t- value	p- value
Model = 1	B	std.error	Beta		
Constant	4.560	0.917		4.972	2.83E-06
Study BPD	0.316	0.014	0.916	22.638	1.10E-18

a Dependent Variable : Study Gestational Age (weeks)

Table 3:

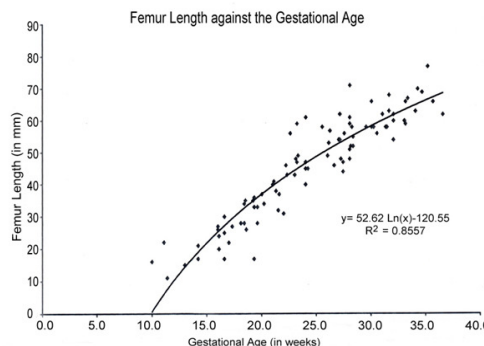
Coefficients (a)	Coefficients (a)			T- test applied	
	Unstandardized		Standardized	t- value	p- value
Model = 1	B	std.error	Beta		
Constant	7.718	0.709		10.884	1.10E-18
Study FL	0.366	0.015	0.930	25.071	1.10E-18

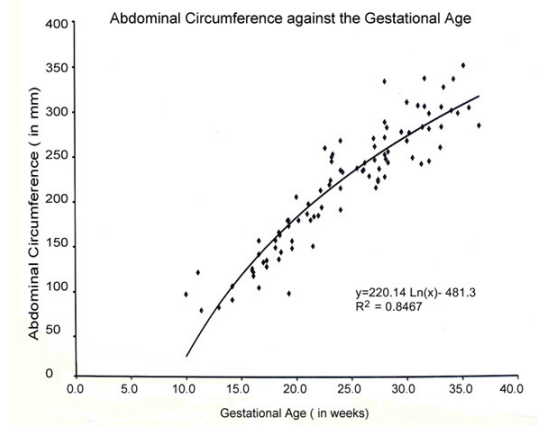
a Dependent Variable : Study Gestational Age (weeks)

Table 4:

Coefficients (a)	Coefficients (a)			T- test applied	
	Unstandardized		Standardized	t- value	p- value
Model = 1	B	std.error	Beta		
Constant	5.860	0.797		7.3	4.75E-11
Study AC	0.087	0.004	0.927	24.5	1.10E-18

From regression analysis, a strongly significant relationship has been observed between fetal parameter (BPD, FL, and AC) and gestational age





When an individual parameter was studied in relation to gestational period in weeks, a linear relationship was seen between them. The relationship has been shown in the scatter diagram.

Discussion

Accurate knowledge of gestational age is a keystone in the obstetrical ability to successfully manage the ante partum care of the patient and is critically important in the interpretation of antenatal test and successful planning of appropriate therapy and intervention.[8] A

number of methods can be used to attempt to determine an accurate gestational age. But an accurate assessment of gestational age is one of the important functions of diagnostic ultrasound. Ultrasound not only determines the accurate gestational age but a single USG examination during pregnancy could exclude many potential complications of pregnancy including placenta previa, multiple gestations and gross congenital abnormality.

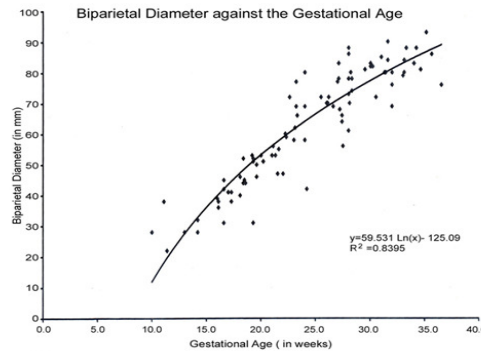


Table 5: Mean Biparietal Diameter of This Study and Other International Studies

Mean gestational age of our study	Present study	Jeanty [12]	Hadlock [12]	Shepard[12]
14.1	31.3	29	27	35
18.1	43.7	43	40.5	47.5
22.5	61.0	57.5	54.5	60.5
27.0	71.3	69.5	66.5	72.5
30.4	79.4	78.5	75.5	81.5
34.3	84.6	87.5	84.5	90.5

Table 6: Shows Comparison between the Femur Length of This Study and Other International Studies

Mean gestational age of our study	Present study	Jeanty[12]	Hohler [12]	Hadlock[12]
14.1	19.3	15.0	17.0	15.0
18.1	28.0	26.5	28.5	28.0
22.5	43.8	39	40.5	40.5
27.0	53.4	50	51.0	51.0
30.4	58.9	58.5	59.0	59.0
34.3	66.9	67.5	67.5	67.5

Table 7: Comparison between the Abdominal Circumference of This Study and Other International Studies

Mean gestational age of our study	Present study	Jeanty [12]	Deter [12]	Kurmanavicius [11]
14.1	100.5	75.0	82.0	77.0
18.1	143.2	119.1	128.1	125.3
22.5	205.8	168.0	177.0	169.8
27.0	243.0	215.0	227.0	221.7
30.4	272.8	248.0	264.0	252.0
34.3	303.0	281.0	307.0	289.5

Comparison of this study with international studies

In case of BPD, at mean gestational age 22.5 and 27 weeks, BPD were more than other studies. In case of femur length, at mean gestational age 22.5 and 27 weeks, the femur length were more than other studies. In case of abdominal circumference, at all mean gestational ages, abdominal circumference were more than other studies.[12] When we assess gestational age from 15 to 28 weeks, according to Jeanty the most accurate indicators are BPD and femur length. If both parameters are measured, it could avoid interoperator and intraoperator error. Here the gestational age was derived by measuring the BPD. According to Jeanty, 27 mm of BPD corresponds to the gestational age 13 weeks. but according to Hadlock 15±4 weeks and according to Shepard 13±1 weeks. In our study 27 mm of BPD corresponded to 13 weeks We can derive the gestational age from using the length of the femur. Standard deviation of the gestational age obtained from the femur is smaller than that of gestational age obtained from BPD which is a good argument in favor of femur predicted gestational age.

After 28 weeks:

According to the literature, one should not rely on the BPD alone after 28 weeks. One should verify that the measured BPD is correct by evaluating the cephalic index, which is ratio of BPD to OFD (occipito frontal diameter). The cephalic index does not change throughout the pregnancy and remains equal to 0.80. The confidence limit is from 0.75 to 0.85. If the BPD value falls outside this range, the BPD should not be used to estimate gestational age. Despite of their limitation, our study showed that in second trimester, BPD strongly correlated with gestational age. We continue to measure the BPD after 28 to 30 weeks to pick up abnormal BPD growth for a reasonable amount of information concerning the brain and other abnormalities incidentally acquired during the measurement, e.g. presence of abnormal intracranial/extra cranial structure etc.

Conclusion

In a normally developing fetus, all these parameters (BPD, FL, and AC) increase with gestational age. These parameters showed good correlation with gestational age. Out of these parameters, femur length is closest to accurate assessment of gestational age and is not much influenced by nutritional status of mother and ethnic race. Accurate assessment of gestational age helped in calculating the EDD (expected date of delivery) in all

patients thus improving the antepartum management. These parameters assess the development and fetal growth of head, limbs and abdomen.

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