Original Article

Ultrasonic assessment of gestational age from multiple foetal biometeric parameters

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Abstract

Accurate pregnancy dating helps obstetrician in appropriate counselling of women who present late in third trimester and may not keep the menstrual record properly and are at risk of preterm delivery. The present study was carried out to assess gestational age in second and third trimesters with the help of ultrasonic measurement of fetal parameters in local population of Uttar Pradesh and also to evaluate the efficacy of foetal biometric parameters in prediction of gestational age by ultrasound. A study was conducted on 100 pregnant females between 13 weeks and 38 weeks of gestation referred from antenatal clinics to department of Radio diagnosis in association with the department of Anatomy from 2015-2016. All singleton pregnant women aged between 15 and 35 years for routine antenatal ultrasound were included. Patient more than 35years with maternal diseases were excluded. These females were subjected to single exposure for estimation of mean gestational age using multiple foetal parameters. Then a comparison was made between menstrual gestational age and ultrasonic gestational age. The foetal parameters were also compared for accuracy and reliability with each other by linear regression. Biparital diameter and femur length were found to be best in predicting gestational age in second and third trimester. In this study 95% of cases had a difference of 2 weeks in second and third trimester. Hence, this study validates that multiple foetal parameters should be used to improve the accuracy and precision of foetal dating in both second and third trimester.

Keyword: Last Menstural Period, Ultrasonography, Foetal Parameters.

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INTRODUCTION

The accurate dating of pregnancy is critically important for management from first trimester to delivery. It is particularly important for determining the viability of foetus in both premature labour and post dates deliveries[1]. Prior to use of ultrasound, gestational age has been estabilised by a combination of the historical information and physical examination[2]. In past predictions were based on menstural history, maternal sensation of fetal movements, bimanual examination, uterine fundal height and detection of fetal heart by Doppler[3]. However assesing gestational age using LMP is inaccurate as 10-40% of females have no knowledge of LMP or a history of irregular mentural cycle or have been on OCPS within two months of their LMPS[4]. Similarly other methods of determination gestational age by palpating fundal height of uterus is sub-optimal as it may be affected by uterine fibroid and maternal body habitus[5]. Therefore in most of pregnancies the date of conception cannot be accurately predicted by other methods. Thus, In recent time the obstetric ultrasonography has proven invaluable in pregnancy dating and detection of fetal anomalies[6]. In absence of LMP or where fundal height does not agree with date, Foetal biometry is valuable in estimating gestational age and in evaluation of fetal growth and detection of intrauterine growth retardation**.** The most commonly used foetal parameters are Crown rump length, Biparital diameter, Head Circumference, Femur

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Length to determine gestational age in different trimester[7].

Previously various workers gives standard foetal charts and tables to evaluate the dimensions of growth parameters. The prenatal measurement of foetal parameters and estimated size and weight vary among different populations depending upon racial, demographic characteristic and nutrition. Therefore the present study was taken to assess the gestational age in second and third trimester with the help of sonographic measurement of fetal biometric parameter in local population of Uttar Pradesh. The study also aimed to find out the accuracy of gestational age determined by ultrasonographic.

MATERIAL METHOD

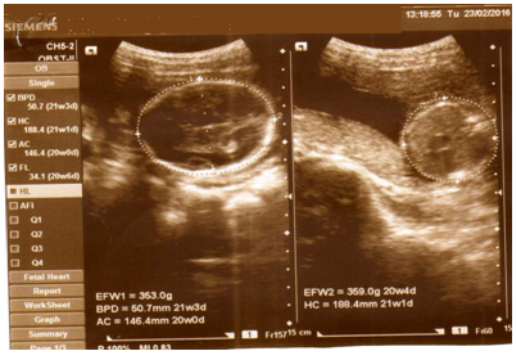
A study was conducted on observations collected from 100 normal pregnant females between 13 weeks and 38 weeks of gestation referred from antenatal clinics to department of Radio diagnosis in association with the department of Anatomy from Jan 2016 to May2016. All singleton pregnant women aged between 18 and 35 years with history of regular menses and known last menstrual period were included Inclusion. Patient more than 35 years, Multiple pregnancy Congenital anamolies of fetus, Maternal diabetes, Placenta praevia andplacenta abruptia were excluded.

Technique

Study was carried out on seimen Acuson 300 machine with low frequency tranducer 3.5MHZ convex probe, other material used were aquasaline jelly and single coated sonographic films. A completely filled form F in compliance to PCPNDT Act duly signed by radiologist conducting sonography. Each sonography was done after complete antenatal check up by obstetrician and maternity laboratory investigations. Patient was placed supine in position with arms above the head. Privacy of patient was maintained. Examination was carried out after consent of patient and after approval of medical ethical committee. Then, following fetal biometric parameters were measured in different planes to assess gestational age.

1. Biparital diameter –It is measured from outer surface of the skull table to the inner margin of the opposite skull table and fetal head was imaged in direct occiput transverse position
2. Head circumference –It is measured from outer perimeter of the calvarium using electronic diziter.
3. Abdominal circumference – It is measured on the transverse image of the fetus at the level of liver.
4. Femur length –It is measured along the long axis of diaphysis using a straight line from the tip of greater trochanter to lateral epicondyle.

The gestational age and expected date of delivery were calculated using traditional LMP method. The mean ultrasonic gestational age were measured with respect to each parameter along with standard deviation.



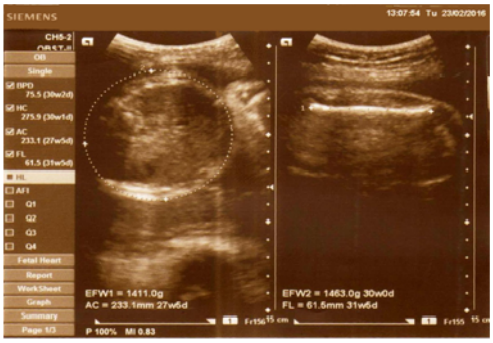


Figure 1: Showing measurement of bpd, hc andac in second trimester
Figure 2: Showing measurement of ac and fl in third trimester

RESULT

A study of 100 antenatal singleton normal pregnancies of 13th weeks to 38th weeks was conducted. Ultrasonic measurement of multiple foetal parameters along with gestational age were taken and compared with mean menstural age. Various observations and results are tabulated and depicted as

Table 1: Distribution of cases according to age groups

Sr. No.	Age in Groups	No. Of Cases	% of Cases
1	18-20	32	32
2	21-23	30	30
3	24-26	20	20
4	27-29	12	12
5	30-35	6	6

Table 1 shows that maximum number of cases in our study were found between age group 18-20 and21-23 yrs i.e.32 and 30 cases and. minimum number of cases were found in age group of 30-32 yrs i.e. 6 cases.

Table 2: Distribution of cases into groups according to gestational age

Sr. No.	Gestational Age (Weeks)	No. Of Cases	% of Cases
1	14-18	20	20
2	19-23	17	17
3	24-28	16	16
4	29-33	23	23
5	34-38	24	24

Table 2 shows distribution of cases into groups according to gestational age as 50 cases are from second trimester and 50 cases from third trimester.

Table 3: Determination of Gestational age using multiple foetal parameters (Bi-Parietal Diameter, Headcircumference, Abdominal circumference, Femur Length)

Sr. No	Weeks	Mean BPD (mm ± SD)	Mean HC (mm ± SD)	Mean AC (mm ± SD)	Mean FL (mm ± SD)
1	14	25.03±0.92	126.26±57.01	112.4±55.46	14.2±0.346
2	15	27.18±4.13	105.8±6.19	105.5±43.44	15.98±01.29
3	16	31.82±1.78	120.85±08.27	101.6±07.00	19.62±02.05
4	17	37.35±01.99	134.00±05.96	109.02±05.36	24.17±01.08
5	18	40.07±0.95	152.96±02.03	125.13±05.11	26.06±0.59
6	19	43.56±02.60	162.66±04.82	134.4±10.87	28.93±0.80
7	20	45.60±02.77	167.43±03.57	146.96±08.70	34.5±03.83
8	21	47.75±05.02	184.75±07.07	162.9±08.20	35.01±01.27
9	22	52.53±01.59	192.58±04.78	165.03±08.36	37.28±01.68
10	23	56.09±01.87	210.96±04.33	180.4±05.71	41.30±0.88
11	24	60.15±02.75	222.45±14.21	192.65±05.75	44.85±02.75
12	25	61.76±01.48	226.8±04.08	196.23±05.99	44.12±02.98
13	26	64..12±01.97	237.02±06.75	203.65±10.59	44.95±01.70
14	27	63.34±01.90	234.5±13.29	207.35±07.99	47.05±05.09
15	28	68.23±03.09	250.16±10.69	216.66±07.70	49.07±02.30
16	29	71.97±02.08	262.00±08.57	242.07±11.94	54.03±03.84
17	30	75.03±02.20	280.65±05.59	235.65±23.51	58.55±04.98
18	31	77.05±04.01	289.08±02.98	256.26±06.35	58.16±02.37
19	32	80.23±04.10	298.05±02.16	264.63±20.52	60.53±04.67
20	33	83.23±03.04	304.72±04.36	281.85±09.18	63.97±01.95
21	34	87.26±03.01	380.56±07.53	302.03±07.55	65.40±08.52
22	35	86.96±03.04	319.82±05.17	304.16±10.16	68.83±04.77
23	36	88.48±01.53	322.51±06.29	316.76±03.40	69.48±03.10
24	37	92.12±01.73	328.07±02.76	318.20±05.11	72.25±01.27
25	38	91.63±06.01	335.96±12.41	329.03±08.03	76.00±02.91

Table 3 shows recording of mean gestational age, Bi-Parietal Diameter, Head circumference, Abdominal circumference, Femur Length of 100 cases along with mean and standard deviation. The results of correlation coefficient between parameters are highly interrelated and statistically significant. (<0.0001). It shows that accuracy of foetal parameters in second trimester is BPD 68% HC 57% AC33%FL 65%.as compared to third trimester BPD 32% FL 31% AC 14% HC 19%, BPD is the most accurate parameter in predicting gestational age in both parameters.

Table 4: The mean difference in weeks between mean menstrual age and actual ultrasonic gestational age according to groups

Sr. No.	Difference from age	Group - I		Group – II		Group - III		Group - IV		Group - V	
	In Weeks	No. of Cases	%	No. of Cases	%	No. of Cases	%	No. of Cases	%	No. of Cases	%
1	0	7	33	6	35.3	4	25	7	30.4	8	33.3
2	+1	9	42.8	7	41.2	8	50	9	39.2	12	50
3	+2	3	15	4	23.5	3	18	5	21.7	3	12.5
4	+3	1	5	-	-	1	6	2	8.6	1	4.16

Table 4 Shows the mean difference in weeks between mean menstrual age and actual ultrasonic gestational age Group I is 91%, Group II is 80%, Group III is 93%, Group IV is 91%, Group V is 96%.

Table 5: The mean difference in weeks between mean menstrual age and actual ultrasonic gestational age for all groups

Sr. No.	Mean difference from actual gestational age in weeks	No. of Cases	% of Cases
1	0	32	32%
2	+1	45	45%
3	+2	18	18%
4	+3	03	03%

Table 5 The mean difference in weeks between mean menstrual age and actual ultrasonic gestational age for all groups. In our study, 32 % of patients the mean gestational age coincided with actual gestational age,45% with a difference of one week and 18% with a difference of two weeks.

DISCUSSION

Fetal anthropometric measurements vary significantly among different population group due to racial, genetic and ethnic factors. So various researchers work on correct estimation of gestational age by using multiple foetal biometric parameters. In present study we found that accuracy of each foetal parameters decreases as pregnancy advances and our observations shows that the multiple foetal parameters are most accurate in predicting gestational age in both second and third trimester, this finding were supported by Hadlock *et al* [8-10] as they also stated that combination of multiple foetal parmeters provided age estimates were significantly better than using single parameters as it leads to significant reduction in maximum observed error [11-18]. Our study confirms that BPD 68% is most reliable parameter before 26 weeks of gestation and is statistically significant as in accordance with previous studies done by Sabbagha *et al*[19] similarly Stuart Cambell and Berman[20] also show 84% accuracy of BPD. Head circumference is an important measurement of neonatal head growth, as it is more shape dependent than BPD. In present study accuracy of head circumference is 57% in second trimester with variability of ±1 week. Similar to our study Callen, Rossavek and Fishburne also demonstrated that head circumference can predict gestational age to within ±1 week before 20 weeks of gestation[21]. Benson *et al*[22] demonstrated that abdominal circumference was more accurate than other basic measurement of ultrasound but in our study it was found that AC is only 33% accurate in second trimester. Femur length is easy to measure as it is preferred over other long bone. In present study FL is 65% accurate in second trimester. Our study shows that FL is almost equal to BPD in determination of gestational age, hence FL is also acceptable indicator of gestational age as shown by Hadlock *et al*[23]. Sumit babuta *et al*[24] in their study showed that BPD is 53% accurate parameter followed by HC 42 %, FL 40% with AC being least accurate parameter in second trimester which is almost similar to our study. Using all four parameters Bakliwal M shows 96% of predicted ages were within 2 weeks of true menstrual age simialarly in our study 95 % cases had a difference of 2 weeks from actual gestational age[25]. Thus, there are many studies evaluating menstrual dating, compared with Ultrasound dating, in the first and second trimesters have found Ultrasound dating is superior for predicting the actual date of delivery[26].

SUMMARY AND CONCLUSION

Accurate dating of gestational age is essential for better care and management of mother and fetus as most of the women does keep menstrual record properly in our country. But biometric curve of one population may overestimate or underestimate the gestation age when used for other racial groups, hence large scale study at national level is required to generate population specific tables and regression equation for more precise reporting of gestational age by ultrasonography on the basis of various fetal biometric parameters.

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