

Fetal Age Estimation from Ultrasonic Measurements of Biparietal Diameter

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Abstract: Aim of the study: This study was conducted to obtain the fetal age and to note any deviation from established B.P.D. Methods: Biparietal Diameter of 200 fetuses was measured by ultrasonographic examination in radiology department and this study was compared with published data by F.P.Hadlock, A.B. Kurtz et al, Doubilet P.M., Peler W.Callen. Result: In present study we found that values of BPD are smaller than those in published reports of biparietal diameter values throughout pregnancy. Conclusion: Present study shows that in India particularly in the North Indian population the knowledge of first day of last menstrual period is not reliable. So there are need for antenatal determination of fetal age in our population. Single measurement of BPD in second trimester or serial BPD measurement in third trimester of pregnancy can prevent premature delivery either by elective caesarean section or by induction of labor. In case of unknown LMP one should take serial measurement of BPD for ideal time of intervention in case of intra uterine growth retardation (I.U.G.R). [Anita NJIRM 2017; 8(6):87-91]

Key Words: Biparietal Diameter (B.P.D.), fetal age, antenatal, last menstrual period, ultrasonographic examination.

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Introduction: Fetal age estimation is an important factor for fetal growth and development. It can influence obstetric decisions concerning the timing and route of delivery.

In India particularly in the North Indian population the knowledge of first day of last menstrual period is not reliable (recalled by the patient).

Carol M. Rumack et al¹ Where the pregnancy cannot be dated accurately by clinical evaluation, sonography is accepted as the most useful and accurate tool for estimating gestational age. Ultrasound has made its greatest contribution in obstetrics for monitoring the pregnancy.

Kremkau WF (1983), Graber P (1984), Stark CR (1984), Woo Joseph (2006). Sonography is a noninvasive diagnostic procedure and safe for fetus unlike radiographs.²

Kurtz AB, et al (1980). The BPD is measured leading edge to leading edge at the level of the thalamus and cavum septum pellucidum.³

The biparietal diameter of the head is measured after 13 weeks. It increases from 2.4 cm at 13 weeks to about 9.5 cm at term. Different babies of the same weight can have different head size, therefore dating in the later part of the pregnancy is generally considered unreliable.¹

Daya S. et al (1993).Ultrasound dating is more accurate when done earlier in pregnancy. When the

due date has been set it should not be changed by a subsequent scan. For example, if another scan done 6 or 10 weeks later says that one should have a new due date which is further away, one should not normally change the date but should rather interpret the finding as that the baby is not growing at the expected rate.⁴

Method: The work “Fetal age estimation from ultrasonic measurements of Biparietal diameter in North Indian population” carried out at Department of obstetrics & gynaecology, and ultrasonographic examination was done in Radiology Department of Katihar Medical College and Katihar, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly between 2008-2016. This is an Original Research work passed from ethical committee. The study group consisted of 200 pregnant women coming for antenatal checkup. We have done hospital based cross-sectional study. This study is conducted with real time gray scale ultrasound with transducers of frequency 3 to 5 MHz, using ultrasound machine – logic P5 (GE).

The study was done in two groups: 1st group – 50% patient, in control group were included those cases who gave definite history of first day of last menstrual period. BPD of fetal skull were measured by ultrasonography from second trimester to term. The comparison of result with standard BPD charts were done.

2nd group – 50% patients in unknown group were included in this group who were not able to give definite history of last menstrual period. Biparietal

Diameter were measured by ultrasonography to determine the gestational age. After delivery determination of gestational age by clinical examination of neonates and comparison of ultrasonically determined gestational age with neonatal age was done.

Measuring BPD: The principal steps in technique are listed below: The head is seen as an ovoid shape with a complete midline echo in its longest axis.

Identification of thalami and septum pellucidum as landmark for measuring BPD.⁵

The BPD is measured leading edge to leading edge (from the outer edge of temporoparietal bone to inner edge of the further temporoparietal bone) at the level of thalamus. The soft tissues outside the calvarium are not included.^{3,5}

Ultrasonic beam is then placed at right angle to the midline echo across the maximum convexity of parietal bone and measurement were taken.⁵

Fetal age determination from ultrasonic BPD of unknown age group Patients who conceived during post partum amenorrhoea or just after abortion or delivery, patients having menstrual cycles of long duration or irregular cycles, were not knowing their L.M.P.

After clinical examination of these patients measurement of biparietal diameter was taken by ultrasound and fetal age was estimated and correlated with clinical finding. Comparison of results with available BPD chart. After delivery neonatal age were compared with ultrasonically determined gestational age.

Observation And Result: The present study was undertaken on ultrasonographic measurements of the fetal biparietal diameter to obtain the growth pattern of BPD in North Indian population and to note any deviation from established B.P.D. chart.

The study was limited in 14th week of gestation to term. Measurements were obtained from 200 pregnant women. The study was grouped under following heading:

1st group - 100 patients, in control group, who gave definite history of L.M.P.

2nd group – 100 patients, in unknown group, who were not able to give definite history of L.M.P.

Out of 100 pregnant women of unknown LMP, 30 pregnant women were conceived during Lactational amenorrhoea, 60 pregnant women were not sure of their dates and having difference of more than two weeks between period of amenorrhoea and height of fundus, 10 women were conceived following prolonged and irregular cycle. The observations have been recorded in the table in subsequent pages.

Table 1: Showing the B.P.D. length against menstrual maturity of 14 week to 20 week.

Menstrual Maturity (in week)	No. of Scanning	B.P.D. (in mm)		
		Max	Minim	Mean
14	6	25	24	24
15	6	31	30	30
16	6	34	32	33
17	8	37	35	36
18	8	42	39	40
19	10	45	43	42
20	8	48	46	47

Table 2: Showing the BPD length against menstrual maturity of 21 week to 27 week.

Menstrual Maturity (in week)	No. of Scanning	B.P.D. (in mm)		
		Max	Minim	Mean
21	8	52	49	50
22	6	55	52	53
23	6	57	56	56
24	6	61	59	60
25	8	63	62	62
26	8	66	65	66
27	10	69	67	68

Table 3: Showing the B.P.D. length at the menstrual age of 28 week to 34 week.

Menstrual Maturity (in week)	No. of Scanning	B.P.D. (in mm)		
		Max	Minim	Mean
28	8	71	70	70
29	8	73	72	72
30	8	76	74	75
31	8	79	77	78
32	8	81	79	80
33	8	84	82	83
34	8	86	84	85

Table 4: Showing the BPD length against menstrual age of 35 to 40 weeks.

Menstrual Maturity (in week)	No. of Scanning	B.P.D. (in mm)		
		Max	Minim	Mean
35	8	88	86	87
36	8	90	89	89
37	6	92	91	91
38	6	94	93	93
39	6	96	94	95
40	6	97	95	96

Table 5: Showing numerical values for different BPD charts from Europe United States, Canada and Australia (BPD in mm and weeks of gestation).

Weeks	FP Hadlock 1984	A. B. Kurtz et al 1980	Doubilet PM 1993	Peter W. Callen 2000	Present Study
14	27	29	28	29	24
15	31	33	32	33	30
16	34	36	35	36	33
17	38	40	39	40	36
18	41	43	42	43	40
19	45	46	46	47	42
20	48	49	49	50	47
21	51	53	52	53	50
22	55	56	55	56	53
23	58	59	58	59	56
24	61	62	61	62	60
25	64	65	64	65	62
26	67	67	66	68	66
27	69	70	68	70	68
28	72	72	71	73	70
29	75	75	74	75	72
30	77	77	76	78	75
31	79	79	78	80	78
32	82	82	80	82	80
33	84	84	82	84	83
34	86	86	84	86	85
35	88	88	86	88	87
36	89	90	88	90	89
37	91	92	89	92	91
38	92	93	91	94	93
39	93	95	93	96	95
40	94	97	95	97	96

In Present study BPD values from 14 weeks to 40 weeks are slightly less then in comparison with deferent charts of BPD from Europe United States, Canada and Australia.

Discussion: Our approach in this investigation is to obtain the fetal age by measuring BPD and to note any deviation from established BPD chart, in North Indian population . The present work has been conducted in 200 pregnant women, and biparietal measurements were made by using real time gray scale ultrasound.

According to the literature Kurtz AB et al (1980), Rosenmary M Lunt, Stuart Campbell et al (2005) Biparietal measurements determined in normal pregnancies gives reliable estimates of fetal age.³

Robinson HP, et al (1975). Measurement of crown-rump length (CRL) can be made between 7 to 13 weeks and gives very accurate and excellent means to establish gestational age before the other parameter are readily usable⁶

Measurement of the BPD become more accurate then CRL, because CRL reflects errors associated with fetal flexion and extension. BPD is the only measurement of fetal head which can be made independently of the presentation or degree of flexion or extension.⁷

Rahman, Anika et al (June 1998) Some countries count gestational age from fertilization instead of LMP.⁸

Chervenak, et al (1998) In a large study by Chervenak et al that evaluated pregnancies conceived by in vitro fertilization and thus had known conception dates, head circumference was found to be the best predictor of gestational age compared with other commonly used parameters. The HC, is less accurate as predictor of gestational age as a result of variation in head shape.⁹

David Sutton, B.I. Churchill Livingstone (2003) Determining gestational age from the palpated dimension of the uterus may be affected by uterine fibroids, multiple pregnancies. Fundal height estimation does not provide a reliable guide to predicting gestational age.¹⁰

Campbell et al (1985), Demonstrated 45% of pregnant women were not certain about there LMP. Dating by last menstrual period may be inaccurate because of variability in length of menstrual cycles (early or late ovulation occurs in approximately 20% of population), recent exposure to oral contraceptive or bleeding during early pregnancy.¹¹

Chiazze, et al (1968) Found 77% of women have average cycle length between 25 and 31 days.¹²

Hall MH et al (1985) Appropriate assessment of gestational age is paramount in obstetric care. Uncertain gestational age has been associated with low birth weight, spontaneous preterm delivery and perinatal mortality. Induction for supposed post-term pregnancies may lead to an increased risk of maternal and neonatal morbidity.¹³

Robinson HP, et al (1975), wiser J et al (1994), Drumm JE et al (1976), Chervenak FA et al (1998) In the first trimester, an estimated date of confinement (EDC) based on the LMP. In cases with a discrepancy of more than 7 days in the second trimester, the sonographic biometric prediction should be given preference, provided there is no anomaly or severe growth delay^{6,9}

Geirsson RT (1991) (1997), Mul T, Mongelli M et al (1996) If the LMP and clinical finding suggest a gestational age within 5 days of the first trimester scan, no further investigation is necessary. If the initial first or second trimester sonographically determined gestational age is outside these ranges, the due date should be changed.^{14,15,16}

In the control group (1st group) we studied normal pregnant women who gave definite history of first day of last menstrual period.

In present study we found that values of BPD are smaller than those in published reports of biparietal diameter, values throughout pregnancy. This is due to the fact that our fetal population is usually of small BPD fetus. From our present study we feel that BPD chart based on Indian population should be prepared. The standard BPD charts are from population of Europe, the United States, and Australia. Mothers of such fetuses were more than the average height, weight, nutrition and all were on upper side of social class.

Growth of fetal BPD is linear from 13 weeks till term, according to the findings of N.J. Secher, P. Kern Hansen. In our study we also found the growth of BPD is linear.

Benson CB, et al (1991) Found that standard ranges in BPD at 14 to 20 weeks is ± 1.2 weeks, at 20 to 26

weeks the range is ± 1.9 weeks, at 26 to 32 weeks the range ± 3.3 weeks, at 32 to 42 weeks the range is ± 3.8 weeks.¹⁷

In our study we found the standard range estimation of fetal age from ultrasonic biparietal diameter before 24 weeks is ± 7 days, at 36 weeks ± 14 days and at term ± 14 days.

In study of 2nd group patients, who were not able to give definite history of last menstrual period. Biparietal diameters were measured by ultrasonography and along with clinical findings, average gestational ages were determined. Comparison of the accuracy of ultrasonic measured BPD was made by physical examination and weight of neonates, delivered by normal delivery or by elective caesarean section.

In this study prediction of fetal maturity is correct in 84 patients out of 100 cases i.e 84% cases with range of ± 14 days. Campbell et al (1969) found accuracy of 84% with range of ± 9 days in ultrasonic fetal maturity of 39 weeks in normal cases.

Ultrasonography has provided measurements for estimation of fetal age in patients with doubtful and unknown menstrual history. BPD measurement alone with clinical findings is reliable and assist obstetricians in counseling women who are at risk of a preterm delivery.

Conclusion: Sonography is accepted as the most useful and accurate tool for estimating gestational age. B P D is the only measurement of fetal head which can be made independently of the presentation or degree of flexion or extension.

Early ultrasound measurement are more accurate. The variation of ultrasound dating increases with gestational age. The standard range in the accuracy of estimation of fetal age from ultrasonic biparietal diameter before 24 week is ± 7 days, at 36 weeks ± 14 days and at term ± 14 days. Pregnant women who were not able to give definite history of last menstrual period, ultrasonographic measurement of BPD is very helpful.

In present study we found that values of BPD are smaller than those in published reports of biparietal diameter values throughout pregnancy. This is due to

the fact that our fetal population is usually of small BPD fetus. From our present study, we feel that BPD chart based on Indian population should be prepared.

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