



ACCURACY OF ULTRASOUND TO DETERMINE GESTATIONAL AGE BY MEASUREMENT OF BIPARIETAL DIAMETER IN KASHMIRI POPULATION.

Anatomy

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ABSTRACT

Background: Determination of gestational age (GA) by biparietal diameter (BPD) on Ultrasonography is an important tool, especially in our part of world, where last menstrual period (LMP) of most of the patients is unknown.

Aims and objectives: This study was carried out to assess gestational age by ultrasonography on the basis of BPD in comparison to GA by LMP.

Materials and methods: A total of 99 normal pregnant females were studied with known last menstrual period. GA was determined by fetal BPD measurement in 2nd and 3rd trimester of pregnancy, with real time ultrasonography. GA by LMP and GA by BPD measurement were statistically correlated using paired t-test and Bland and Altman graph analysis.

Observation and results: In this study GA in weeks by LMP was compared with GA in weeks by BPD. It was observed there is strong similarity in GA by LMP and GA by BPD in second trimester up to 29 weeks of gestation. It was determined by comparison of the gestational age by LMP and by BPD in study patients with p value 0.2433 and by difference between gestational age by the two methods stratified by gestational age by LMP [≥ 30 weeks had p value 0.112 and > 30 weeks had p value 0.0003].

Conclusion: Bi-parietal diameter is one of the useful criteria to measure GA and to predict expected date of delivery, especially up to 29 weeks of gestation.

KEYWORDS

Antenatal, Biparietal diameter (BPD), Expected date of delivery, Gestational age, Ultrasonography, Last menstrual period

1. Introduction

The accurate dating of pregnancy is critically important for pregnancy management from the first trimester to delivery and is particularly necessary for determining viability in premature labor and in post-dated deliveries. Prior to the widespread use of ultrasound, caregivers relied on a combination of history and physical examination to clinically determine gestational age. Age of an unborn baby during intra uterine life is determined in terms of gestational age.¹ One of the reliable and accurate methods of determining gestational age of fetus is ultrasonography.² Gestational age is also important for obstetric management. Ultrasonographic determination of gestational age by Bi-parietal diameter (BPD) measurement provides information about expected date of delivery (EDD) or postdated pregnancies; also in cases of previous cesarean section it provides accurate assessment of dates.³ The knowledge of gestational age is pivotal for successful antepartum care and successful planning of appropriate intervention or treatment. The sonographic studies of fetus also provide information about fetal growth, fetal weight and to diagnose growth abnormalities. All ultrasonographic biometric parameters help to determine gestational age (GA).⁴ Bi-parietal diameter (BPD) and femur length provides information not only about age but also fetal weight and growth of the fetus.⁵ In a place like Kashmir where most of the females do not keep a proper record of last menstrual period (LMP), ultrasonographic determination of these parameters are valuable in estimating GA of fetus and EDD. BPD is one of the most commonly measured and accurate parameter in determining the age of the fetus up to 36 weeks and has proven to be very effective and accurate up to 30 weeks of GA.^{6,7} Above all, ultrasound has proved superior in precision in determining exact dates of EDD and gestational age, to suggest that dating a pregnancy using ultrasound measurements is clinically superior to using menstrual dating with or without ultrasound and this has been overwhelmingly advocated and adopted.⁸⁻¹² Ultrasound biometric measurements determine gestational age based on the assumption that the size of the embryo or fetus is consistent with its age. Biological variation in size is less during the first trimester than in the third trimester. Ultrasound estimation of gestational age in the first trimester is therefore more accurate than later pregnancy. Ultrasonography is used for determining gestational age in the first and second trimesters (≤ 23 weeks) in spontaneous conceptions and it is the best method for estimating the EDD.⁸

It is in this context that present research was under taken to explore the accuracy of ultrasonic measurement of biparietal diameter (BPD) in

assessing gestational age in second and early third trimester of pregnancy, so as to determine whether ultrasound dating provides more accurate gestational age assessment than menstrual dating.

2. Materials and Methods

This prospective cross sectional study was conducted in the Department of Radiodiagnosis and Imaging, Government Medical College Srinagar, J&K, India. The study was carried out on 99 gravid females, who came for routine ultrasonography from Lala Ded hospital (department of Obstetrics and Gynecology). BPD of their fetuses was carried out using a grey scale real time Sonography machine, employing a 6.3 MHz convex transducer. These women included both from rural and urban area. The research was cleared by Institutional Ethical Committee, and a completely filled F form (in compliance to Pre-Conception and Pre-Natal Diagnostic Techniques act) duly signed by radiologists and women undergoing sonographic studies. Gravid women who fulfilled the following criteria were included in the study: healthy females of the age between 20 and 35 years, with a singleton pregnancy and cephalic presentation, with known LMP and regular 28–30 days cycle; women who did not develop maternal or fetal complications during pregnancies; women who had normal blood pressure and hemoglobin not < 10 g; no history of oral contraceptive use in the three months prior to conception. Biparietal diameter measurement of each foetus was recorded and tabulated.

Bi-parietal diameter

The fetal head was imaged in an axial section with the fetus in direct occiput transverse position. The instrument was set so that parietal bones measure approximately 3 mm in thickness. The BPD was measured from the outer surface of skull table to the inner margin of the opposite skull table in a transverse plane.¹³ [Figure 1]. Correlation was performed between GA and BPD.

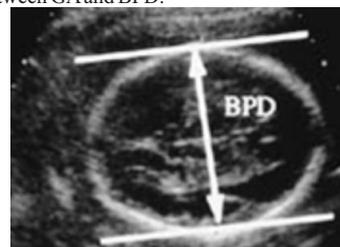


Figure 1 Showing measurement of Biparietal diameter

3. Results

The aim of our study was to find out the agreement between gestational age as determined by BPD and LMP. The average age of patients in our study was 26 years (range 20 to 35 years).

Table 1: Comparison of the gestational age by LMP and BPD

	N	Mean	S.D	95% CI	p-value
GA by LMP	99	29.3	8.28	27.6 to 30.9	-
GA by BPD	99	29.1	7.93	27.5 to 30.7	-
Difference [GA by LMP-GA by BPD]	99	0.18	1.54	-0.13 to 0.49	0.2433

ICC=0.982 (0.973 to 0.988).

Table 2. Difference between gestational age by the two methods, stratified by gestational age by LMP [≥30 weeks and > 30 weeks].

	GA ≥ 30weeks			Ga> 30 weeks		
	Mean ± SD	95%CI	P value	Mean ±SD	95%CI	P value
GA by LMP	21.8 ± 4.88	20.4to23.2	—	36.5±2.16	35.9to37.1	—
GA by BPD	22.2 ±5.30	20.7to23.7	—	35.8±2.13	35.2to36.4	—
Difference [GA by LMP-GA by BPD]	-0.37±1.59	-0.82to0.09	0.112	0.72±1.29	0.35to1.09	0.0003

Table 1 compares the gestational age by LMP and by BPD. The average difference in the gestational age as computed by two methods was 0.18 ±1.54 weeks [95% CI - 0.13 to 0.49 weeks]. Paired samples t-test revealed a p-value of 0.2433 suggesting that the average difference in the gestational age computed by the two methods was not statistically significantly different from the null value of zero. Same results were reflected when the reliability of BPD to assess gestational age was assessed [Intra-class correlation coefficient = 0.982, 95% CI 0.973 to 0.988].

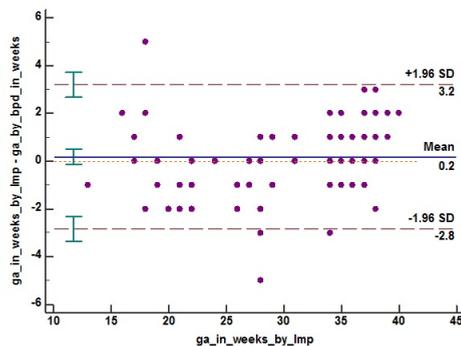


Figure 2 Bland and Altman graph with GA in weeks by LMP on X-axis and GA in weeks by LMP - GA by BPD in weeks on Y-axis

Figure 2 shows the relationship between the gestational age as computed by two methods [LMP minus BPD] versus the gestational age by LMP. There was a 'fair' but significant correlation between the difference in gestational age by the two methods. Gestational age by LMP [Pearson's correlation coefficient, $r = 0.318$, $p=0.001$]. BPD seems to overestimate gestational age till around 30 weeks of gestation. After 30 weeks BPD seems to underestimate gestational age. Table 2 shows the difference between gestational age by the two methods stratified by gestational age by LMP [≥ 30 weeks and > 30 weeks]. There was a significant difference in the gestational age as computed by the two methods after 30 weeks of gestation [$p=0.0003$]

4. Discussion

Assessment of GA by ultrasonography is of high clinical importance for diagnosis, investigation and treatment of fetus in utero. Appropriate assessment of GA by ultrasonography is of great importance in prenatal care, during pregnancy and planning of termination of pregnancy and delivery because even in women with

reliable menstrual dates, the error in GA calculation can occur. Therefore, prediction from ultrasound should be reliable in precision. This study presents ultrasonographically derived measurements of fetal BPD growth from local population and compares it with Indian studies and other international studies. In comparison with other studies, it was observed that all the mean values of this study are lower than those of Campbell,¹⁴Sabbagha et al.,¹⁵Wexler et al.¹⁶ and Machado et al.¹ with a very few exceptions. However, the observations by Hadlock et al⁴ are in close agreement with our study. In our study almost all of the patients had Ultrasonographic measurements of gestational age by BPD almost parallel to gestational age by LMP measurement up to 29 weeks. The difference was seen after >29 weeks of gestation in terms of over estimation of gestational age. This means that the accuracy of BPD measurement is less effective after >29 weeks of gestation.^{17,18} In our study, we observed gestational age by ultrasonography, using BPD as measurement parameter in second trimester to early third trimester, is an accurate tool of measurement. The limitations of gestational age by BPD are in determining gestational age in intrauterine growth retardation (IUGR) which makes the biparietal growth slow or patient comes in the last weeks of third trimester i. e. "passed 30 weeks"; in such situations BPD is less reliable and it becomes less accurate with increasing gestational age.¹⁹ In comparison to Indian studies, the mean BPD growth rate in this series compared well with results obtained by Rajan et al²⁰ and Vaidya et al²¹ The reasons for difference in BPD with some studies may be attributed to ethnic and nutritional causes.^{22,23,24}

5. Conclusion

The present study substantiates the fact that BPD is one of the useful criteria to predict GA and determine EDD and it was found to be statistically significant. We observed BPD is a reliable tool in measuring gestational age in second trimester and early third trimester. The perinatal mortality and morbidity can be reduced by properly estimating GA and EDD using serial ultrasonography of fetus. In our country, where most of the women do not keep menstrual record properly, gestational age by BPD provides us accurate measure to cater the demands with precision.

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