

Sonographic prediction of gestational age: Accuracy of BPD and FL in term pregnancy in predicting gestational age

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Abstract

Background: Predicting gestational age is the most important part of obstetrical management, ultrasound at present is the best available tool for obtaining certain fetal parameters that correlate with gestational age. **Aims and Objectives:** 1) To evaluate the usefulness and accuracy of fetal growth monitoring by comparing a fetal femur length, biparietal diameter in predicting gestational age. 2) Comparison of gestational age as obtained by BPD and FL with the known gestational age as got from LNMP. **Materials and Methods:** The study was conducted in Basweshwar Teaching and General Hospital and Sangameshwar hospital attached to M R Medical College Gulbarga between September 2012 to September 2013. 100 women at term were selected by simple random sampling technique after considering all inclusion criteria in the study. Term pregnancy, Single fetus with vertex presentation with absence of any maternal disease were included in the study. Congenital malformation, Multiple pregnancy, Malpresentation and IUGR were excluded in the study. **Conclusion:** Femur length proves to be a more reliable parameter than biparietal diameter in predicting the gestational age at term.

Key Words: Gestational age, fetal biometry, pregnancy, ultra sonography.

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Received Date: 19/06/2017 Revised Date: 20/07/2017 Accepted Date: 14/08/2017

DOI: <https://doi.org/10.26611/1012324>

Access this article online

Quick Response Code:



Website:
www.medpulse.in

Accessed Date:
17 August 2017

date of LMP is known then it can be useful in corresponding the bi-pariental diameter and FL in gestational age. Making appropriate management decisions and delivering optimal obstetric care requires accurate appraisal of gestational age. For eg, proper diagnosis and management of preterm labor and post term pregnancy requires an accurate estimation of fetal age. Many pregnancies considered to be preterm or post term are wrongly classified. Unnecessary testing such as fetal monitoring and unwarranted interventions including induction for supposed post term pregnancies may lead to an increased risk of maternal and neonatal morbidity. In addition, pregnancies erroneously thought to be preterm may be subject to avoidable and expensive hospitalisation stays^{14,20}. Professor Ian Donald in Glasgow first used ultrasound scanning for obstetrical purpose in late 1950's. There is a tremendous progress in application of ultrasound as a diagnostic modality revolutionising the management towards better care. This is due to non-invasive and non-ionizing nature beside its effectiveness⁸. The last menstrual period in women with regular cycles

INTRODUCTION

Appropriate assessment of gestational age is of paramount importance in obstetric care. Uncertain gestational age has been associated with adverse pregnancy outcome including low birth weight, spontaneous preterm delivery and perinatal mortality¹. Measurement of various fetal body parts is known as fetal biometry. Ultrasoundography is done in every antenatal case for measurement of various fetal parts. If the exact

How to cite this article: Mangala B. Rudrawadi, Paulami Dey. Sonographic prediction of gestational age: Accuracy of BPD and FL in term pregnancy in predicting gestational age. *MedPulse – International Journal of Gynaecology*. August 2017; 3(2): 70-73.
<http://medpulse.in/Gynaecology/index.php>

can be used for calculating gestational age. This criteria has several potential sources of inaccuracy including faulty memory, bleeding in early pregnancy and OCPs^{18,19}. Since 1981 onwards femur length charts for estimation of fetal growth (FL) were established, where many authors consider FL comparable to biparietal diameter (BDP) and head circumferences (HC) in gestational age estimation is even more accurate. The ultrasound uses high frequency sound waves over 20,000 cycles per second (20khz). These waves are produced from a transducer and travel through human tissues at a velocity of 1500metres/second^{1,2,3}. Fetal biometry is a methodology devoted to the measurements of the several parts of fetal anatomy and their growth⁸.

RESULTS

Table 01: Reliability of ga by femur length when compared to ga as obtained by Imp

Accuracy Range In Weeks	No Of Cases
2-0	28
-0.1 to -2	36
-2.1 to 4	32
-4.1 to -6	04

Table 2: Reliability of ga obtained by bpd when compared with ga obtained by Imp

Accuracy Range In Weeks	No Of Cases
2 to 0	12
-0.1 to -2	36
-2.1 to -4	28
-4.1 to -6	16
-6 and above	08

Table 3: Reliability of ga as obtained by mfgp when compared with ga as obtained by Imp

Accuracy Range In Weeks	No Of Cases.
2 to 0	32
-0.1 to -2	31
-2.1 to -4	24
-4.1 to -6	12
-6 and above	1

Table 4: Comparison between the actual gestational age(Imp) and sonographically derived ga by bpd, fl and mfgp.

Accuracy Range In Weeks	No Of Cases By Bpd	No Of Cases By Fl	No Of Cases by Mfgp
2 to 0	12	28	32
-0.1 to -2	36	36	28
-2.1 to -4	28	32	24
-4.1 to -6	16	08	12
-6 and above	08	00	04

Table 5: Comparative study: ultrasonographic study in predicting ga with known Imp in normal pregnancy in third trimester

	BPD	FL
Sabhaga and Hughey(1978) single reading of BPD for assessment of GA.	at 29-40 weeks \pm 21 days	-
Queenlan <i>et al</i> (1982) studied 125 cases (14-36 weeks) found strong correlation between FL and GA with 95% confidence \pm 7 days		
Yeh <i>et al</i> (1982) studied 145 cases(16-42 weeks) single USG reading with known LMP	Lower correlation coefficient ($r=0.648$)	higher correlation coefficient 0.955
Egley and Seeds JW <i>et al</i> (1985) third trimester single scan with known LMP	More than \pm 2 weeks	Less than \pm 2 weeks
Wolfson R N, Pisner <i>et al</i> (1986) studied single ultrasound in third trimester	1.BPD and FL are equal estimators of GA in normal pregnancy.	2. FL is a more stable estimator of GA when fetal growth deviates from normal
Carol, Benson, Carol, B Carol, Benson, carol B Doubilet(1991)	95% confidence limits 4.1 95% confidence limits 4.1 weeks	3.5 weeks
Chervenak <i>et al</i> (1998)	random error 4.26 days	4.35 days
Sagvan kh.Hidayat(2009)	SD was more i.e 5.89 and the mean GA (in weeks) was 1.43 weeks greater with BPD than FL measurements.	SD was less 5.73
PRESENT STUDY(2013)	\pm 2 weeks variation in 48% and $>$ 4 weeks variation in 24%	\pm 2 weeks variation in 64% whereas $>$ 4 weeks variation in only 4%

DISCUSSION

The various parameters for fetal biometry was FL, BPD, HC and AC. This study was done to compare the efficacy of BPD and FL in determining the gestational age at term (38-42 weeks). BPD- It measures the maximum distance

between the two parietal bones taken from the leading edge of the skull to the leading edge i.e from outer to inner table¹⁵. It can also be measured d=from outer to outer table⁸. It is measured at the level of thalamus and cavum septi pellucid¹⁶. Measurements should be taken from

outer edge of proximal skull to inner edge of distal skull^{8,15} FL: long bone measurements are easily obtainable from 12 weeks gestation and are particularly useful when lie of the fetus makes accurate head measurements difficult. Long bones are best imaged when perpendicular to the beam and the transducer should be rotated until the longest possible image of the bone is achieved and both cartilaginous ends are seen as blunt ends with a strong acoustic shadow posterior to the shaft. The FL should be measured along the diaphyseal shaft, excluding the DFE(distal femoral epiphysis)¹⁶. The present study is undertaken with the aim to study the predictive value of BPD and FL and comparison of gestational age as obtained by BPD, FL, MFGP with that obtained from LMP at term.

All 100 patients were singleton pregnancies with unengaged head, with no malpresentation and any other medical disorder. From the results above following conclusions were derived: In this study 44%patients fell in the age group of 20-23years, 36% between 24-26 years, and only 20% in the age group of 27-30years. Out of 100patients 48% were primigravida, 48%being multiparas and only 4%being grand multiparas.96%of cases were booked and only 4 % were unbooked out of 100 patients. Our study shows that, average accuracy of gestational age in weeks when LMP was compared with FL and BPD are \pm 1.62 and \pm 2.14 weeks showing that FL is a better predictor of gestational age at term than BPD. Table 1 shows that 64% of the patients come under the accuracy range within \pm 2 weeks and only 4%had a difference in gestational age of $>$ 4weeks when gestational age obtained from FL was compared to that obtained from LMP. Whereas when the comparison was done between GA obtained from BPD and LMP (Table 02), 48%patients were in the accuracy range of \pm 2weeks, but 24%had a difference of $>$ 4weeks gestational age. When the same comparison was done between gestational age obtained from multiple fetal growth parameters (FL, BPD, AC and HC) [table 08] with that of LMP, 16% of the patients had a difference of $>$ 4weeks. Table 1, 2, 3, 4 signifies that FL is the most accurate among all the three parameters {FL, BPD, MFGP} in determining the gestational age of fetus at term. Table 5 shows the results of the similar studies conducted in the past: Sabhaga *et al* 1978 used single reading of BPD for assessment of GA (9,12,13), showed a variation of \pm 21 days from 29 to 40weeks.Queenlan *et al* 1981 studied 125 cases (14-36 weeks)found strong correlation between FL and gestational age with 95% confidence limits of \pm 7days¹⁰. Yeh *et al* 1982 studied 145 cases, single USG reading with known LMP, serial observations showed a significantly higher correlation coefficient of the relationship of GA v/s FL(0.955) as compared to GA v/s

BPD ($r=0.648$)and that FL is a dependable variable as contrasted with BPD(5,6,9). Egley and Seeds J W *et al* 1985studied third trimester single scan with known LMP; gestational age by BPD shows variation of more than \pm 2weeks and FL $<\pm$ 2weeks⁷.

Wolfson R N *et al* 1986 studied single ultrasound in third trimester showed

- BPD and FL are equal estimators of GA in normal pregnancy.
- FL is a more stable estimator of GA when fetal growth deviated from normal.

Carol *et al* 1991 showed that GA obtained from BPD measurements had a 95% confidence limits of 4.1 weeks compared to 3.5 weeks when GA was obtained from FL¹⁸. Chervenak *et al* 1998 in a study showed that when GA was calculated from BPD, random error was 4.26 days compared to 4.35 days when obtained from FL^{14,17}. Sagvan kh. Hidayat in 2009 showed that the mean GA as obtained by FL had a SD (5.73) less than that of BPD(5.89) and the mean GA in weeks was 1.43 weeks greater with BPD than FL measurements(4).The present study 2013 shows 64% patients have \pm 2weeks variation in GA when FL was compared with LMP and $>$ 4weeks variation seen only in 4% whereas when GA was compared between BPD v/s LMP, only 48% had variation of \pm 2weeks and 24% had variation of $>$ 4weeks.The present study reflects that FL is a more accurate predictor of gestational age than BPD at term.

CONCLUSION

24% cases were found to have gestational variation of 4 weeks in BPD group compared to only 4% cases in FL group. Minimum variation in gestational age i.e. \pm 2 weeks is found in most of the cases when gestational age is calculated using FL. Femur length proves to be a more reliable parameter than biparietal diameter in predicting the gestational age at term.

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Source of Support: None Declared
Conflict of Interest: None Declared

