Antenatal fetal age estimation by measuring Crown-Rump Length, Bi-Parietal Diameter and Femur Length

Sarita Kumari[1,*], Padamjeet Panchal[2], Bheem Prasad[3]

[1]Senior Resident, [2,3]Assistant Professor, Dept. of Anatomy, AIIMS, Patna, Bihar

*Corresponding Author:
Email: tripathiksarita@gmail.com

Abstract

Introduction: The gestational age estimation is an essential part of the care and management of pregnant women. A number of methods have been used for fetal dating and ultrasonography have become as an integral part of Obstetrics. Objective of this study is to determine whether Ultrasonography (USG) based Expected date of delivery (EDD) is better or Last menstrual period (LMP) based EDD.

Materials and Method: This study was done on randomly selected 50 pregnant women. Cases were selected from those attending antenatal clinic, labour room, Indoor and outdoor of the Department of Obstetrics and Gynaecology, at medical college and hospital Kolkata. The parameters like Crown-Rump Length (CRL), Bi-parietal Diameter (BPD), and Femur Length (FL) were used to determine Gestational Age (GA) during 1st, 2nd and 3rd trimester with help of USG.

Result: The CRL was better parameter to determine GA in first trimester and BPD and FL was better parameters to determine GA in second and third trimester for gestational age estimation. The CRL, BPD and FL parameters together give the best assessment of GA in Uterus.

Conclusion: USG is a better diagnostic tool for estimation of EDD than the LMP method.

Keywords: Bi-parietal Diameter, Crown-Rump Length, Femur Length, Gestational age, Pregnancy, Ultrasonography.

Introduction

Accurate determination of gestational age is essential in the care and management of pregnant women. Since ancient times various methods have been used to predict expected date of confinement. In "CHARAK SAMHITA" the normal duration of pregnancy was stated to vary between 9 to 11 months. Since then, a continuous search is going on to find out the most reliable method for fetal dating and a large number of methods have been devised. When the menstrual cycle is normal i.e. of 28 days (±5 days) the duration of pregnancy is considered to be of 280 days from the first date of last menstrual period (LMP). According to Naegele's formula expected date of delivery (EDD) = first date LMP +9months+7days, but it varies if the cycle length varies and in that condition it can't be ascertained. In the past few years, ultrasonography (USG) has gained popularity for this purpose and it is being used increasingly. The use of Naegele's formula may not be effectively useful in predicting EDD in case of women having variable menstrual cycle length, not sure of their LMP and women who conceived during lactational amenorrhoea. With the help of USG in such cases the EDD and duration of gestation can be ascertained with much more surety. In addition to this use, USG has many uses in the field of obstetrics. By first trimester USG we can determine if there is any abnormal pregnancy like blighted ovum, ectopic pregnancy, multiple pregnancy, placentation etc., in second trimester we scan for any congenital anomaly, amount of amniotic fluid, growth of the fetus etc. and in third trimester we can assess the overall fetal wellbeing. Thus USG has become an integral part of obstetrics so much so that it is difficult to imagine an obstetrics unit without USG.

Materials and Method

The present study comprise of 50 pregnant women. Cases were selected from those attending antenatal clinics, labour room, Indoor and outdoor of the Department of Obstetrics and Gynaecology, Medical College Kolkata, Kolkata, West Bengal. They were scanned in the Department of Radiology and followed up till delivery. The study was conducted in association with Department of Anatomy and Radiology within a period of one year. The female patients were included in this study irrespective of their age, parity and religion. Written consent was taken and ethical clearance was taken from ethical committee of the hospital. However, only those women, who were sure of the date of their LMP and had normal menstrual cycle, were included in this study. Women taking oral contraceptive pills and/or with menstrual cycle longer than 40 days prior to conception were not included. Women having any obstetrical and/or medical complications were also excluded. For ultrasonic estimation of gestational age, various fetal parameters were studied with real time ultrasound (Philips, Netherlands), curvilinear probe with transducer frequency of 3.5 MHz was used.

Results

The patients came for USG for first time during different trimesters. During the first trimester, 22 cases were scanned, 38 cases were scanned during second trimester out of which 22 cases were re- scanned for

EDD during follow-up and 16 were newly reported cases who came for the first time and In third trimester 50 cases were scanned out of which 38 cases were re-scanned during follow up and 12 were new cases who came for the first time during third trimester (Table 1). In 62% of cases EDD predicted by USG done first time and LMP almost correspond to each other within a range of one week. In 82% of cases Actual Date of Delivery (ADD) was within 7 days of predicted date by USG, which is significantly greater than the percentage of women delivering within one week of LMP based EDD (52%) (Table 2). Expected date of delivery predicted on the basis of first trimester scan and second trimester scan did not differ much but EDD predicted by third trimester scan differ significantly from that predicted by 1st trimester (Table 3). Only 54% of the subjects delivered within 7 days of EDD when only bi-parietal diameter was used to predict the expected date of confinement in 3rd trimester scan which is almost equal to the EDD predicted by FL (56%) (Table 4).

Table 1: Trimester wise distribution of cases

Trimester	Total no. of cases scanned	No. of cases scanned for first time
First	22	22
Second	38	16
Third	50	12

Table 2: Difference in predicted value of EDD of cases by different methods (USG, LMP and ADD)

Difference (in days)	USG and LMP		USG and ADD		LMP and ADD	
	No.	Percent (%)	No.	Percent (%)	No.	Percent (%)
Nil	4	8	6	12	3	6
1-7	27	54	35	70	23	46
8-14	17	34	6	12	18	36
More than 14	2	4	3	6	6	12
Total	50	100	50	100	50	100

Table 3: Difference in EDD predicted by USG in different trimesters in the same subject

Difference (in days)	No. of cases with difference in EDD Predicted on the basis of 1st and 2nd trimester scans	No. of cases with difference in EDD Predicted on the basis of 1st and 3rd trimester scans
Nil	3 (13.6%)	1 (4.5%)
1-7d	16 (72.75%)	10 (45.5%)
8-14d	3 (13.6%)	8 (36%)
15d and above	-	3 (13.6%)
Total	22	22

Table 4: Difference in EDD predicted by BPD, FL in 3rd trimester and ADD

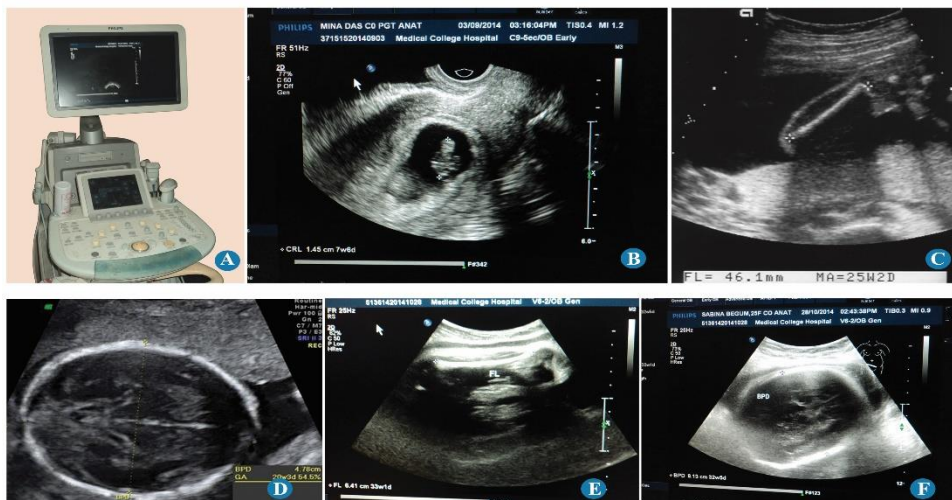| Difference between EDD and ADD	BPD and ADD		FL and ADD	
	No.	%	No.	%
0-7	27	54	28	56
8-14	16	32	17	34
More than 14	7	14	5	10
Total	50	100	50	100

Fig. 1: Photograph showing USG machine (A), USG plate showing Crown-Rump-Length in first trimester (B), USG plate showing Femur Length in second trimester (C), USG plate showing Bi-Parietal diameter in second trimester (D), USG plate showing Femur Length in third trimester (E), USG plate showing Bi-Parietal diameter in third trimester (F)

Discussion

A comparative study was carried out on fifty pregnant women to assess the accuracy of term prediction by ultrasound scan as compared to that by LMP. In our study first trimester scanning is more accurate in term prediction (82% delivering within a week) as compared to third trimester scans. Second trimester scans are also quite reliable for fetal dating. 84% subjects delivered within one week of predicted date. Women who were subjected to serial scanning in all the three trimesters did not show any improvement in the ultimate accuracy of term prediction. Moreover third trimester scans differed significantly from first trimester scan regarding term prediction. Thus there is no advantage of subjecting the women to several scans for the sake of fetal dating once it has been ascertained reliably. Use of individual fetal parameters considered separately for dating the pregnancy during the third trimester, decreases the accuracy of term prediction. Predictive value of Bi-parietal diameter and femur length is almost equal. All the fetal parameters considered together i.e. assessment of composite gestational age during third trimester was a better predictor of expected date of delivery.

Robinson and Fleming (1975) have also found similar results taking fetal crown rump length in consideration.[1] McConon and Bowman (1985) compared the use of ultrasonography and last period in prediction on expected date of confinement. They found that in many of the cases these two dates correspond to each other.[2] Kramer et al. (1988) and Verburg BO (2008) also compared these two dates and concluded that in some cases, they correspond to each other and the actual date of delivery; but in others ultrasonically derived date was found more accurate.[3,4] The present study closely resemble these observations.

Becke and Nakling (1994) observed that most of the deliveries were significantly closer to the ultrasound predicted term than the term calculated from last menstrual period.[5] In the present study 82% of the subjects delivered within ± 7 days of ultrasound predicted EDD which is significantly higher than the percentage of patients delivering within one week of LMP based EDD. Kalish (2004), MacGregor et al. (1987), O"Brien et al. (1980), Savitz (2002) and Sahota DS (2009) have scanned their patients during first trimester of pregnancy and have found correlation between crown rump length and gestational age.[6,7,8,9,10]

Conclusion

Hence from this study it was concluded that the estimation of gestational age of the fetus in the uterus was more accurate and reliable as compared to gestational age derived from the LMP. Among all the parameters used the crown-rump-length taken in first trimester was better than other parameters in second and third trimester for fetal dating. All parameters taken together give the best assessment of gestational age in uterus. So we can say that ultrasound has come up as a boon to the obstetric field and it is the most reliable method in measuring the fetal age. Owing to its safety, reliability and widespread availability it can be used routinely and easily in patients coming for antenatal check-up.

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