

## Prediction of Gestational age by Last Menstrual Period (LMP) in Comparison to Ultrasonography (USG)

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### Abstract

**Background:** Accurate dating is cardinally important for good pregnancy care. USG provides accurate dating of GA and has now days become an essential part maternal antenatal care. **Objective:** The purpose of the present study was to identify LMP as a better method for predicting the day of delivery than the USG measurement. **Methodology:** This was a Hospital-Based prospective, comparative study conducted at both inpatient and outpatient Department of Obstetrics and Gynaecology at Chittagong Medical College Hospital, Chittagong from October 2007 to September 2008 for a period of one year. The study populations were pregnant women with certain LMP and had dating USG at Nuclear Medicine Centre, Chittagong performed in first or early second trimester 12 - 14 weeks. **Result:** Among the 112 patients, 61 patients delivered within  $\pm 7$  days of EDD based on LMP; whereas 82 patients delivered within  $\pm 7$  days of EDD based on USG. Of these, actual day of delivery of 49 patients correlated with the same gestational week determined by both LMP and USG. Actual day of delivery of 18 among these 112 patients did not correlate with the EDD determined either by LMP or USG and they all delivered beyond  $\pm 7$  days of EDD based on either LMP or USG. **Conclusion:** USG dating during the estimated GA range of 12 to 14 weeks gave a more accurate prediction of delivery date than the estimate based on LMP. (J Shaheed Suhrawardy Med Coll, 2014;6(2):82-86)

**Keywords:** Last menstrual period; expected date of delivery; USG; gestational age

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### Introduction

Reliable information about Gestational Age (GA) is necessary for optimal obstetric management of pregnancy<sup>1</sup>. The first and foremost duty of an obstetrician for a pregnant woman is to date the pregnancy. The estimation of pregnancy date is important for the mother, who wants to know when to expect the birth of her baby and for her healthcare providers, so they may choose the juncture at which to perform various screening tests and assessments, that include serum screening, assessment of maturity and induction of labour for postdate pregnancies<sup>2</sup>. Clinically, knowledge of gestational duration is important because the correct interpretation of many observations is only possible if the duration of gestation at the time of measurement is known<sup>3</sup>. Proper assignment of the Expected Date of Delivery (EDD) is necessary in order to obtain and appropriately interpret laboratory tests, to plan and execute therapeutic maneuvers

and to determine the optimal management in certain difficult situations<sup>4</sup>. Knowledge of GA is needed for optimal obstetric care, including evaluation of fetal growth and management of preterm and post-term pregnancies<sup>5</sup>.

The first day of the Last Menstrual Period (LMP) has been the accepted basis for calculation of the day of delivery. GA has traditionally been estimated from the date of the LMP by Naegele's rule. In woman with regular cycles and certain LMP, the EDD is calculated by adding 7 days to the first day of the LMP and adding 9 months<sup>2</sup>. The LMP has been used to calculate the EDD, assuming duration of pregnancy of 280 days from the first day of LMP to delivery. This work well if women have regular cycles, ovulate on day 14 and can recall the exact date of the first day of their LMP. However, only 30 to 40% of women can do so<sup>6</sup>. Basing GA on the LMP tends to result in an over estimation. The 95% confidence interval of

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menstrual dates is -27 to +9 days<sup>2</sup>. Pregnant women cannot provide useful information about their LMP in 10-45% cases due to inability to remember the exact date, or because of amenorrhoea, irregular menstrual cycles, or bleeding during pregnancy<sup>7-8</sup>. About 18% of women with certain menstrual dates have significant differences between menstrual and USG dating. The accuracy of menstrual history in women with a history of prolong cycle, such as those with polycystic ovarian syndrome, should be questioned. If pregnancy occurred soon following withdrawal of oral contraceptives, the LMP cannot be used because of frequent anovulatory cycles<sup>2</sup>. The Estimated Date of Confinement (EDC) derived from the LMP differs by more than 2 weeks from the actual date of birth in nearly one quarter of pregnancies<sup>9</sup>. USG is the recommended test for determination of GA. Ninety percent of patients deliver within 2 weeks of the due date when GA is determined by early ultrasound<sup>10</sup>.

Ultrasound is a widely available, non-invasive, accurate and safe diagnostic imaging modality<sup>11</sup>. Fetal biometry is of great importance in obstetrical practice. Though the date of LMP for the estimation of GA has traditionally been used by Naegele's rule, but because of variation of time of ovulation, variation of cycle length changing from cycle to cycle the error in GA estimation can be much greater and results in a unreliable method of choice for predicting the date of delivery, when dating is based on first day of LMP<sup>12</sup>. Accurate estimation of GA is of extreme importance for estimating the EDD, assessing fetal size and monitoring of fetal growth. GA is not only important for the expecting mother, but also for healthcare providers, so they may plan various screening tests and assessments<sup>13</sup>. The present study has been conducted amongst the pregnant population with certain LMP dates. Dating USG was carried out in their 12-14 weeks of gestation.

### Methodology

This was a Hospital-Based prospective, comparative study conducted at both inpatient and outpatient Department of Obstetrics and Gynaecology at Chittagong Medical College Hospital, Chittagong from October 2007 to September 2008 for a period of one year. The study populations were pregnant women with certain LMP and had dating USG at Nuclear Medicine Centre, Chittagong performed in first or early second trimester 12 - 14 weeks. Pregnant women with the age group of 20-35 year at any parity were included in this study. Presence of congenital malformation of fetus, presence of serious medical diseases during pregnancy like diabetes mellitus, heart disease, hypertensive disorder, chronic renal diseases, use of oral contraceptives within 3 Months of LMP and Rh negative Blood group women were excluded from this study. Pregnancy is considered 'at term' when gestation attains 37 complete weeks but is less than 42 which was between 259 and 294 days since LMP. It is a standard way of calculating the due date for a pregnancy. In woman with regular cycles and certain LMP, the EDD was calculated by adding 7 days to the first day of the LMP and adding 9

months. The 95% confidence interval of menstrual dates is -27 to +9 days. Ultrasound is a widely available, non-invasive, accurate and safe diagnostic imaging modality. The term 'ultrasound' refers to the Ultra-High Frequency (UHF) sound-waves used for diagnostic scanning. It is a technique that uses sound-waves to show a picture of a baby (fetus) in the uterus. A fetal age study, also called biometry, is a non-invasive sonographic fetal assessment tool. The study uses USG to take measurements of several fetal anatomic structures such as fetal CRL, BPD and FL. These measurements are used to estimate the GA of the fetus. The most reliable assessment of gestational duration currently available is early ultrasound fetometry. At 12 weeks the 95% confidence interval of gestational estimation using Crown Rump Length (CRL) fetometry was  $\pm 4-5$  days. In the second trimester, BiParietal Diameter (BPD) and Femur Length (FL) were measured, and depending on the formula used, 95% confidence intervals of  $\pm 6-14$  days had been reported. The length of the embryo on the longest axis excluding the yolk sac constituted the CRL. The BPD was among the most accurate 2nd trimester measures of gestational age (GA). Measured from the beginning of the fetal skull to the inside aspect of the distal fetal skull at the level of the Cavum Septum Pelucidum. The FL was a repeatable measurement with accuracy similar to the BPD. FL has been used most commonly, because it is the longest and is usually the easiest to visualize and measure. The study procedure and purpose were explained to all potential candidates. Only those who agreed were finally selected as study subjects after taking their informed written consent. Trans Abdominal Sonography (TAS) was the choice for detection of accuracy of USG in the prediction of EDD compared to certain LMP. TAS for all pregnancies was carried out by same qualified personnel at their 12 to 14 weeks of gestation. One hundred and twelve patients started labour pain spontaneously at term (38 to 42 weeks) and their subsequent effectuation of normal vaginal delivery/caesarean section, the happening of the events was evaluated and reviewed to ascertain the fact whether the predicted day of delivery as forecasted by first day of LMP was close to the actual day of delivery. Data were collected in case record form by investigator herself to avoid inter-observer variation. Diagnostic Ultrasound System was used to perform the USG (Siemens Medical Solutions USA, Inc). Collected data were compiled, checked and edited. Data processing and analysis were done with the help of computer using statistical software SPSS version 12.0 for windows. The hypothesis was tested on the basis of probability to draw an inference about the population from where samples were drawn. Sample results of this study were tested on the basis of Student's 't' test. Student's 't' test was used to make a comparison between estimated GA predicted by LMP and also by USG. Considering the USG as gold standard, analysis was done to determine sensitivity, specificity and predictive value of LMP. The study protocol was forwarded to the ethical committee of Chittagong Medical College for ethical consideration and proper permission was obtained. All the subjects selected for this study were informed about the

purpose and procedure of study and also the importance of knowing accuracy of Gestational age (GA). Regarding the procedure every woman was assured that she and her baby would be safe because of absence of intervention.

**Results**

Among 31 out of 112 patients LMP was better predictor, the mean difference in GA from the actual day of delivery was 5.55(±3.62 SD). 59 out of 112 patients in which USG was better predictor, the mean difference in GA from the actual day of delivery was 3.73(±3.40 SD) days. Student's 't' test was done and was found that the mean difference was statistically significant (P<0.05).

**Table 1: Comparison between LMP versus USG Dating Mean Deviation, Standard Deviation (SD) of USG and LMP Dating.**

Methods	Mean Deviation	Unpaired 't' Test	P Value
LMP	5.55	2.360	<0.05
USG	3.73		

\*\* P<0.05 in Unpaired 't'.

For the women with a reliable LMP date and regular cycles, the LMP estimated date of delivery was later than the USG estimate for 41 women (36.6%) and earlier for 49 women (43.8%). In 22 cases (19.6%), there was same deviation from the actual day of delivery by both methods, no difference between the estimates.

**Table 2: Estimation of EDD by LMP vs USG**

Estimation of EDD by USG vs LMP	Frequency	Percentage
LMP Estimated EDD Earlier than USG Estimate	49	43.8
LMP Estimated EDD Later than USG Estimate	41	36.6
LMP Estimated EDD Same as USG Estimate	22	19.6
<b>Total</b>	<b>112</b>	<b>100.0</b>

Among the 112 patients, 61 patients delivered within ± 7 days of EDD based on LMP; whereas 82 patients delivered within ± 7 days of EDD based on USG. Of these, actual day of delivery of 49 patients correlated with the same gestational week determined by both LMP and USG. Actual day of delivery of 18 among these 112 patients did not correlate with the EDD determined either by LMP or USG and they all delivered beyond ± 7 days of EDD based on either LMP or USG.

**Discussion**

There is a normal variation in the timing of ovulation of the order of plus or minus 2 days even in patients with normal 28-day menstrual cycles. It therefore follows that the time interval in which conception may take place will be at least 4 days and possibly even 5 days when the survival time of the ovum in the female genital tract after ovulation is considered<sup>11</sup>. The use of USG in such cases has been of great value. The accuracy of this technique is

limited, however, because of the relatively wide biological range of normality, which increases from plus or minus one week in the second trimester of pregnancy to at least plus or minus 2 weeks towards term. It therefore follows that the earlier a measurement is performed the more reliable should be the estimation of maturity. Pursuing this line of argument it is logical to expect that the biological range of fetal criteria should be even smaller in the first trimester of pregnancy, and thus the potential of more accurately determining maturity should be correspondingly higher<sup>12</sup>. Studies of basal body temperature and second trimester ultrasound biometry indicate that menstrual dating is often inaccurate and can lead to induction of labour for a presumed but inaccurate diagnosis of post-term pregnancy. It is now widely accepted that a more precise method of determining GA is the first trimester measurement of the CRL of the fetus. By using this measurement, an estimate of the EDD can be determined with an error of ±4.7 days. Systematic overestimation of GA can be problematic because it can result in unnecessary induction, dysfunctional labour and caesarean delivery<sup>13</sup>.

The study also found that the percentage of women who delivered within 7 days of the predicted day were 61 % and 56% for the ultrasound and LMP estimations respectively. It stated that in 51.8% cases, USG was the best method and the LMP was best in 46.4% cases. They were equally good in 1.8% cases. In this present study it was found that USG was the best method in 37.5% and 30.5% cases when delivery occurred within -7 and +7 days respectively of the predicted day. LMP was the best method in 27.7% and 21.4% cases when delivery occurred within -7 and +7 days respectively of the predicted day. USG was best in 52.7% women and the LMP was best in 27.7%. They were equally good in 19.6 % cases. The women with a reliable LMP, regular cycles, the USG estimate of the day of delivery was later than the LMP estimate in 59.7% women and earlier in 33.1 % women<sup>14</sup>. In 7.2% there was no difference between the estimates. When there was a difference between the two methods in predicting the day of delivery, USG was a better predictor than the LMP<sup>2</sup>. This study corresponds to the above studies in which the USG estimated EDD later than LMP estimate in 43.8% of women and USG estimated EDD earlier than LMP estimate was in 36.6% of women. USG estimated EDD was same as LMP estimate in 19.6% of women. The routine USG examination showed a discrepancy between the LMP estimate and the USG estimate in predicting the day of delivery; furthermore the day estimated by USG was later more than 1 week in 17.5% of the women and earlier more than 1 week in 2.4% cases<sup>14</sup>.

Another study compared the dates of delivery predicted by LMP, CRL and BPD with the actual date of delivery in a population of pregnant women divided into those with certain and those with uncertain LMP. Results were the median prediction errors estimated by USG in the first and second trimesters and by corrected LMP according to cycle length were 2.32, 0.16 and 3.00 days respectively, in

women with certain LMP, and 1.71, 0.00 and 3.00 days respectively, in women with uncertain LMP. The median GA at delivery estimated by USG in the first and second trimesters and by corrected LMP according to cycle length was 282, 280 and 283 days respectively, in both groups. Having an uncertain LMP does not affect the USG prediction of date of deliver<sup>15</sup>. In this present study, the mean gestational age was 278.35 days by USG and 278.40 days by LMP. The result was average discrepancy (error) between predicted date of delivery from BPD and LMP and date of spontaneous delivery was 7.96 and 8.63 days respectively. Adding 282 instead of 280 days to the first day of the LMP reduced the error of the LMP method from 8.63 to 8.41 days, reduced the percentage of classified post-term deliveries from 7.9 to 5.2% and increased the pre-term births from 3.96 to 4.48%. No models of combined use of LMP and BPD were superior to the use of BPD alone. So, it can be inferred that if both BPD and LMP are available, BPD should be used to predict term. If only LMP is available, term should be calculated as the first date of the LMP plus 282<sup>14</sup>.

A study was done to determine the accuracy of fetal ultrasound predicting the EDD amongst 206 women, who had retrospective review of fetal ultrasound tests. The EDD based on LMP was calculated for 104 women with dates and compared with EDD calculated from ultrasound test.

These were then compared with actual date of birth from maternity records. For women with unreliable menstrual data (102 women), ultrasound EDD was compared with actual date of birth. Ultrasound EDD demonstrated a trend toward being more accurate than menstrual history EDD, being 10.0±9.4 (mean ± standard deviation) days off versus 13.3±15 days,  $p = 0.057$ , ( $n = 104$ ), CI: -0.1, 6.73 days. Ultrasound EDD was within 10 days of delivery 60% of the time versus 57% for menstrual history EDD. The average error in estimating EDD was + 1.7 days for ultrasound and +3.7 days for menstrual history. In women without menstrual history data ( $n=102$ ), the ultrasound EDD was just as accurate in both the second trimester, 11.8±9.5 versus 11.4±10.7 days off (not statistically significant) and the third trimester, 10.0±8.0 versus 8.1±7.0 days off (not statistically significant). Fetal ultrasound is marginally better at predicting the date of birth compared with menstrual history but the difference does not justify routine use for that purpose. When menstrual history is unknown, ultrasound EDD is just as accurate as when menstrual history is known, making it a very useful test<sup>16</sup>.

A study was conducted on the length of human pregnancy as calculated by USG measurement of the fetal BPD. Pregnancy length was calculated from ultrasonic measurement of the fetal BPD in the second trimester and compared with the corresponding length calculated from the LMP in 86.5% women with exactly 28-day cycles and spontaneous onset of labour. The mean pregnancy length was 280.6 days when based on BPD and 283.4 days when based on LMP. The corresponding median values were 281 days and 284 days, respectively<sup>9</sup>. This current study

was carried out in women with optimal menstrual histories and found that early dating USG estimate of the EDD was better than the LMP estimate. Mothers, midwives and physicians are often uncertain as to which method should be used and this may lead to considerable parental confusion. A uniform dating policy would reduce much of the uncertainty in pregnancy dating.

### Conclusion

In this study it was found that USG dating during the estimated GA range of 12 to 14 weeks gave a more accurate prediction of delivery date than the estimate based on LMP. So reliance on LMP as the sole method for gestational dating is problematic. Using USG scanning to either correct LMP assignment or simply routinely substituting USG scanning appears to be beneficial.

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