The prediction of delivery date by ultrasonic measurement of fetal crown – Rump length in first trimester

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Abstract   **Introduction:** The establishment of pregnancy dates is important not only for the mother who wants to know when to expect the delivery, but it is also important to calculate the gestational age. Accurate dating decrease the number of labour inductions for postterm pregnancies, prevent iatrogenic prematurity **Aims and Objectives:** To study prediction of delivery date by ultrasonic measurement of fetal crown – rump length in first trimester. **Material and Methods:** This was a cross-sectional study at OBGY department of tertiary health care center during 12 months. Sample size was 200.EDD is calculated by Naegele's rule Obstetric ultrasonography will be performed using Philips ultrasound scanner using a 3.5MHZ convex probe. Data was analyzed statically by chi square test, paired t test and other appropriate statistical tests using SPSS version. P value of <0.05 will be considered statistically significant. **Result**: The maximum cases studied were in age group of 20-24 years i.e., 124 cases (62%) . In EDD of USG, out of 200 cases 22(11%) delivered on predicted day, 61(30.5%) delivered 7 days before, 95(47.5%) delivered after 7 days, 1(0.5%) delivered 8-10 days before, 13(6.5%) delivered 8-10 days after, 0(0%) delivered 11-14 days before, 4(2.0%) delivered after 11-14 days, 1(0.5%) delivered before 15-21 days and 3(1.5%) delivered after 15-21 days in according with EDD calculated by CRL . In LMP-ED Dout of 200 cases, 88(44%) delivered before 5 days, 85(42.5%) delivered from 4 days before to 7 days after, 27(13.5%) delivered after days. Prediction of USG EDD is significantly differed from LMP EDD (Chi –Square =69.7, df =2, P Value   =<0.0000001). **Conclusion:** 89% (178) women delivered within + or − 7 days EDD estimated from LMP 98%(196) women delivered within + or − 14 days of EDD estimated from CRL to conclude, ultrasonographic measurement of CRL (crown Rump Length) between 6-14 weeks of pregnancy is more accurate predictor of EDD as compared to LMP. We recommend the routine use of CRL estimate in the prediction of EDD even if the patient recalls her LMP certainly.
Keywords: Crown – rump length (CRL), Last Menstruation Period (LMP), Naegele's rule.

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INTRODUCTION

The establishment of pregnancy dates is important not only for the mother who wants to know when to expect the delivery, but it is also important to calculate the gestational age. Accurate dating decrease the number of labour inductions for postterm pregnancies, prevent iatrogenic prematurity[1] and to assess foetal growth and interpret maternal serum screening. The knowledge of gestational age is also important for the following reason: The timing of chorionic villous sampling in 1st trimester, genetic amniocentesis in the second trimester and elective induction or caesarean delivery in the third trimester are all based on gestational age, the differentiation between term and preterm labour and characterization of a fetus as postdate depend on gestational age, Knowledge of gestational age is critical in distinguishing normal from pathological fetal development. Midgut herniation is normal up to 11 or 12 weeks of gestation but signifies omphalocele thereafter, the normal size of a variety of fetal body parts depends on gestational age, and the levels

of maternal AFP, human chorionic gonadotropin and estroldepend on gestational age. Estimation of fetal weight alone or in relation to gestational age may influence obstetric management decision concerning the timing and route of delivery. Traditional methods, based on the last menstrual period, early pelvic examination, quickening and fundal height measurement remain major components of routine care. Unfortunately, there is great variation in cycle length in a women. Approximately one third of all cycles, in adult women depart by more than 3 days from the individuals mean cycle lengh.[2]between 10-45% of women do not remember LMP accurately.[3] but even if this date is accurate, the assumption that ovulation or conception occurs 14 days later is unfounded. During the past 40 year diagnostic ultrasound has increasingly been accepted by obstetricians for a variety of clinical uses, the most important being the gestational age assessment. Ultrasonography biometry does have error but it is smaller. In studies of scan in ART (Artifical Reproductive Technique) pregnancies i.e., where the precise date of beginning of pregnancy is known, the random error had a 95% confidence interval of 4-6 days.[4] The EDD has profound personal, social and medical implication for the expectant mother and is a vital yardstick for the doctor who is responsible for the safe delivery of her baby. Its accuracy is therefore of paramount importance especially in high risk pregnancies. With the widespread availability of ultrasonography, most women now have two independently derived estimates, one LMP and another form the scan which may differ from each other. Obstetricians are often confused as to which date should be used. The purpose of this study is to evaluate the efficacy of ultrasonographic measurement of CRL in first trimester (<14 weeks) in prediction of date of delivery as compared to LMP and also the aim is to determine which method is more accurate. CRL (Crown-Rump Length): CRL is the largest demonstrable length of the fetus, excluding the fetal limbs and the calipers are placed in the outer portion of the cephalic pole and the trump. The reproducibility of the measurement fall within +or-1.2 mm. One should use the average CRL measurement from three satisfactory images. The majority of studies on CRL demonstrated that the accuracy of the method in predicting menstrual age was 3 to 5 days (+or-2SD).[5,6] The optimal time for prediction of menstrual age from CRL measurement is between 6 and 9 weeks. In a study by Mac Gregor et al[10] the accuracy of the technique was demonstrated to decrease as pregnancy advanced into the last first trimester. In an effort to simplify the reporting of variability, hadlocketal[7] evaluated variability as a percentage of the predicted age and demonstrated that The variability is relatively uniform at 8% for CRL

measurement between 2 mm and 12 cm. Since anatomical land marks are somewhat obscure before 7 weeks, CRL is less reliable before this period. So also after 12 weeks since the fetus curves on its long axis. Some authors have found that there are many pit falls in the technique of measurement that can be obtained due to fetal flexion, inclusion of yolk sac or lower limb. Tangential section of trunk, which may all lead to errors.

MATERIAL AND METHODS

This was a cross-sectional study at OBGY department of tertiary health care center during 12months. Sample size was 200. Sample size was calculated by using the software open-Epiinfo, version 2.3.1 the formula used is [DEFF*Np (1-p)] / [d2/z2 1-a/2 *(N-1) + p (1-P)]. DEFF – Design effect, N- infinite population, P-60% (among all deliveries 60% are normal excluding caesarean section and all high risk pregnancies) Is fixed at 0.05 with 95% confidence interval (2sided), d- 7%-absolute allowable error sample size turned out to be 189.5% is taken to take care of non-responders or drop outs or any technical error. Sampling technique: simple random sampling. Pregnant women who fulfill the inclusion and exclusion criteria will be selected and data will be collected according to the proforma. EDD is calculated by Naegele's rule by adding 9 calender months and 7 days to the first day of last menstrual period (LMP). Alternatively one can count back, 3 calender months first. Day of LMP and add 7 days to gets the EDD. Obstetric ultrasonography will be performed using Philips ultrasound scanner using a 3.5MHZ convex probe.CRL is the largest demonstrable length of the foetus in first trimester (<14 weeks) excluding the foetal limbs and the calipers are placed in the outer portion of the cephalic pole and the rump. Data was analyzed statically by chi square test, paired t test and other appropriate statistical tests using SPSS version. P value of <0.05 will be considered statistically significant.

RESULT

Table 1: Age wise distribution of cases

Age	Number of cases	Percentage	Cumulative frequency
<19	9	4.5	4.5
20-24	124	62.0	66.5
25-29	60	30.0	96.5
30 or>30	7	3.5	100.0
Total	**200**	**100**	

The total number of cases studied were 200. The maximum cases studied were in age group of 20-24 years i.e., 124 cases (62%) . the minimum cases studied were in age of 30 and above years i.e., 7 cases (3.5%). The patients in age group <19 years were 9(4.5%), 25-29 years were 60(30%).

Table 2: Deliveries according to EDD calculated by CRL

Delivery before and after EDD by CRL	Number of cases	Percentage	Cumulative frequency
On predicted day	22	11.0	11
7 days before	61	30.5	41.5
7 days after	95	47.5	89.0
8-10 days after	1	0.5	89.5
8-10 days after	13	6.5	96.0
11-14 days before	0	0.0	96.0
11-14 days after	4	2.0	98.0
15-21 days before	1	0.5	98.5
15-21 days after	3	1.5	100.0
Total	**200**	**100**	

Out of 200 cases 22 (11%) delivered on predicted day, 61 (30.5%) delivered 7 days before, 95 (47.5%) delivered after 7 days, 1(0.5%) delivered 8-10 days before, 13(6.5%) delivered 8-10 days after, 0 (0%) delivered 11-14 days before, 4 (2.0%) delivered after 11-14 days, 1 (0.5%) delivered before 15-21 days and 3 (1.5%) delivered after 15-21 days in according with EDD calculated by CRL.

Table 3: Cumulative results comparing interval between EDD by CRL and actual days of delivery

EDD by CRL	Number of cases	Percentage	Cumulative frequency
Within+or-7 days	178	89	89
Within+or-8-10 days	14	7	96
Within+or-11-14 days	4	2	98
Within+or-15-21 days	4	2	100
Total	**200**	**100**	

Out of 200 cases, 178 (89%) cases delivered within+or-7 days, 14 (7%) cases delivered within+or-8-10 days4 (2%) cases delivered within+or-11-14 days4 (2%) cases delivered within +or- 15-21 days.

Table 4: LMP-EDD and actual date of delivery

Number of days from EDD by LMP	Number of cases	Percentage	Cumulative frequency
<=-5	88	44	44.0
-4 to 7	85	42.5	86.5
8+	27	13.5	100
Total	**200**	**100**	

Out of 200 cases, 88(44%) delivered before 5 days, 85(42.5%) delivered from 4 days before to 7 days after, 27(13.5%) delivered after days.

Table 5: USG –EDD and actual of delivery

Number of days from EDD by LMP	Number of cases	Percentage	Cumulative frequency
<=-5	18	9	9
-4 to 7	16	80	89
8+	22	11	100
Total	**200**	**100**	

Out of 200 cases, 18 (9%) delivered before 5 days, 160 (80%) delivered from 4 days before to 7 days before to 7 days after, 22 (11%) delivered after 8 days.

Table 6: Chi- square R by C- table

Number of days from EDD by LMP	LMP EDD	USG EDD	
<=-5	88	18	**P**
-4 to 7	85	160	**Value=<0.0000001**
8+	27	22	
Total	**200**	**200**	

(Chi –Square =69.7, df =2, P Value =<0.0000001)
Prediction of USG EDD is significantly differed from LMP EDD (Chi –Square =69.7, df =2, P Value =<0.0000001)

DISCUSSION

Dating policies have important clinical implications, the accurate estimation of the EDD is very essential in the management of all the pregnancies. Many a times, lifesaving decisions are dependent on the exact gestational age of the fetus. The procedure adopted for estimating the foetal maturity must be without risk for fetus and mother. Real time imaging has contributed in a large measure to the utility and application of ultrasound in modern obstetrics. Although there is a biological variation in the time of onset of labour even at term, this end point is chosen for analysis as it is a clearly defined date and the only truly ascertainable method of comparing ultrasound and menstrual prediction. Both waldenstrom et al [8] and Campbell et al[9] defined an optimal menstrual history as-" a normal LMP with a safe record of the first day. The last bleeding not a withdrawal bleeding after contraceptive pills. No unusual bleeding since the LMP." Their criteria, however differed in the variation of the cycle length, Campbell et al limited the variation to less than 5 days, study regular cycles of a variation of up to 14 days. In the present study regular cycles of a variation up to 14 days were included and the EDD corrected accordingly. To evaluate the effectiveness of various dating techniques for the prediction of EDD, only those pregnancies resulting in a live birth of a term infant after the spontaneous onset of labour were considered.

Table 7: Predicted EDD CRL measurement with accuracy of ± 14 days

Study	Percentage of deliveries within + or − 14 days
Laurent J. salmon et al (2010)[10]	90
Present study	98

In 2010, Laurent j.salmon et al[10] in their study included 3738 examinations. About 90% of the births fell within 14 days of predicted day of delivery, with a median error of 6 days. In present study, 98% of the births fell within 14 days of predicted day of delivery according to CRL measurements.

Table 8: Prediction of term, post pretermm deliveries based on

Study	Term 37-42 weeks	Post-term >42 weeks	Preterm <37 weeks
Sahota D.S (2009)	94.7%	1.3%	4.1%
Present study	98.5%	1.5%	0%

In a study by sahota D.S.et about of 394 cases. 372(94.7%) delivered at term. 16(4.1%) delievered at <37 weeks and 5(1.3%) delivered post-term (>42 weeks) in according to EDD calculated by CRL measurement. In present study, out of 200 cases, 197(98.5%) delivered at tem and 3(1.5%) delivered post-term (>42 weeks). These findings are similar to Many studies evaluating menstrual dating, compared with US dating, in the first and second trimesters have found US dating superior for predicting the actual date of delivery.[11, 12] No study has shown that it is inferior to menstrual dating. Menstrual dating underestimates the US-based EDD by an average of 2 to 3 days. Ultrasound dating alone was significantly better in predicting the actual date of delivery than any of the dating policies using menstrual dates alone or in combination with US. [15] Many studies document that the use of US dates reduces the rate of post-dates pregnancy by about 70% even in the face of certain menstrual history.[11,12,13,15,16] The most recent Cochrane systematic review found reduced rates of induction for post-term pregnancy (OR 0.59; 95% CI 0.42 to 0.83) among women who underwent routine US in early pregnancy (< 24 weeks) and concluded that early pregnancy US enables better gestational age assessment, as well as conferring other benefits.[17]

CONCLUSION

89% (178) women delivered within + or − 7 days EDD estimated from LMP98%(196) women delivered within + or − 14 days of EDD estimated from CRL to conclude, ultrasonographic measurement of CRL (crown Rump Length) between 6-14 weeks of pregnancy is more accurate predictor of EDD as compared to LMP. We recommend the routine use of CRL estimate in the prediction of EDD even if the patient recalls her LMP certainly.

REFERENCES

1. Mongelli M, wong YC venkat A, Chus TM, induction policy and missed post-term pregnancies: a mathematical model, Aust N Z J ObstetGynaecol 2001; 41:38-40
2. Geirsson RT, Busby-Earle RM, Certain dates may not provide a reliable estimated of gestational age, Br J obstetGynaecol 1991;98:108-9
3. Geirsson RT, Have G. comparison of actual and USG estimated second trimester gestational length in invitro fertilized pregnancies, actaobstetgynaecolscand 1993; 72:344-46.
4. Robinason HP. Sonar measurement of fetal crown-rump length as means of assessing maturity in first trimester of pregnancy, BMJ 1973;4:281
5. Drumm JE, Clinch J, Mackenzie G. the ultrasonic measurement of fetal crown-rump length as a method of assessing gestational age. Br J obstetGynaecol 1976;83:417-21
6. Hadlock FP, shah YP, kanon DJ et al, Fetal crown –rump length: reevaluation of relation to menstrual age (5-18 weeks) with high resolution real time. Us radiology 1992; 182:50-5.
7. Waldenstrom U, Axelsson O, Nilsson S: A comparison of the ability of a sonographically measured biparietal diameter and the last menstrual period to predict the spontaneous onset of labourobstetGynaecol 1990; 76:336-38
8. Campbell S, warsof SL, Little D, cooper DJ. Routine ultrasound screening for the prediction of gestational age.ObstetGynaecol 1985;65:613-20;
9. Lauret J salmon, Costanza pizza, Antonio Gasparrini, Jean pierre Bernard. Yves Vills. Prediction of the date of delivery based on first trimester ultrasound measurement: An independent method from estimated date of conception. Journal of maternal-Foetal and Neonatal Medicine 2010 jan; 23(1): 1-9
10. Mongelli M, Wilcox M, Gardosi J. Estimating the date of confinement: ultrasonographic biometry versus certain menstrual dates. Am J ObstetGynecol 1996; 174:278–81.
11. Waldenström U, Axelsson O, Nilsson S. A comparison of the ability of a sonographically measured biparietal diameter and last menstrual period to predict the spontaneous onset of labor.ObstetGynecol 1990; 76:336–8.
12. Kieler H, Axelsson O, Nilsson S, Waldenström U. Comparison of ultrasonic wseameasurement of biparietal diameter and last menstrual period as a predictor of day of delivery in women with regular 28 daycycles. ActaObstetGynecolScand 1993; 72:347–9.
13. Backe B, Nakling J. Term prediction in routine ultrasound practice. ActaObstetGynecolScand 1994; 73:113–8.
14. Taipale P, Hiilesmaa V. Predicting delivery date by ultrasound and last menstrual period in early gestation. ObstetGynecol 2001; 97:189–94.
15. Blondel B, Morin I, Platt RW, Kramer MS, Usher R, Breart G. Algorithms for combining menstrual and ultrasound estimates of gestational age: consequences for rates of preterm and postterm birth. BJOG 2002; 109:718–20.
16. Whitworth M, Bricker L, Neilson JP, Dowswell T. Ultrasound for fetal assessment in early pregnancy. Cochrane Database Syst Rev 2010; 4:CD007058.