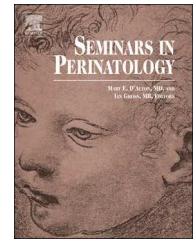


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Should a first trimester dating scan be routine for all pregnancies?

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ABSTRACT

Accurate pregnancy dating is important for diagnostic and management decisions during pregnancy. Dating by last menstrual period is less reliable than dating by ultrasound, since the former has memory-related and other sources of inaccuracy. Dating by first trimester ultrasound, via the crown-rump length, has a 95% confidence range of ± 5 days, slightly better than the ± 8 days for dating by second trimester ultrasound at 14–20 weeks. This small difference appears to be too small to justify a routine first trimester scan for the purpose of dating the pregnancy.

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Pregnancy dating information—gestational age (GA) and due date—is important for numerous management decisions during pregnancy. Knowledge of the due date is a key factor in the diagnosis and management of preterm labor and postterm pregnancy. Accurate dating is a key element in diagnosis of entities that involve comparisons with gestational age, such as fetal growth disturbances (growth restriction or macrosomia, diagnosed by assessing estimated fetal weight in relation to gestational age), abnormalities of individual fetal parts (e.g., dwarfism or microcephaly, diagnosed by comparing long bone or head size to norms for gestational age), or aneuploidy (e.g., prediction of trisomy 21 based on the femur being small for gestational age). Knowledge of the GA is also valuable for scheduling diagnostic tests and procedures that are intended to be done at a specific time during pregnancy, such as chorionic villus sampling, genetic amniocentesis, nuchal translucency measurement, and maternal serum tests for aneuploidy.

For most of human history, the only way to date a pregnancy was the time elapsed since the first day of the woman's last menstrual period (LMP). Since the interval between LMP and conception was unknown until recently, “gestational age” (as the term has historically been, and still is, used) does not measure the time since the start of gestation but instead is approximately 2 weeks more than that.

Beginning 30–40 years ago, ultrasound emerged as an alternative way to date pregnancies. This is most commonly

done using the crown-rump length (CRL) in the first trimester^{1–3} or head measurements [biparietal diameter (BPD) or head circumference] in the second trimester.^{3–5}

Dating by LMP, unlike ultrasound, incurs no cost, but may be less accurate. In addressing the issue of whether a first trimester dating scan should be routine for all pregnancies, we consider three questions: (i) is ultrasound dating superior to dating by LMP? (ii) Is first trimester dating superior to second trimester dating (at 14–20 weeks)? (iii) If the answers to the above two questions are “yes,” are the advantages of first trimester over second trimester dating sufficient to justify a routine first trimester dating scan? We will limit our purview to pregnancies conceived naturally, excluding those achieved via in vitro fertilization (IVF) or other assisted reproductive technologies.

1. Is ultrasound dating more accurate than dating by LMP?

Dating by LMP has inherent as well as memory-related sources of inaccuracy. Inherent factors include variable menstrual cycle length—varying from woman to woman and, in a given woman, from cycle to cycle—and variable time from beginning of the period to implantation.⁶ An even greater contributor to inaccuracy of LMP dating is the fact that many women have poor recollection of the date that their last

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Table 1 – Precision of first trimester dating vs. second trimester dating.	
Study	Precision (95% confidence range)
First trimester dating via crown-rump length	
Robinson et al. ¹	±4.7 days
Robinson et al.: reassessed in Sladkevicius et al. ^{11a}	±5.0 days
Hadlock et al. ²	±8% (±6.2 days at 11 weeks)
Hadlock et al.: reassessed in Sladkevicius et al. ^{11a}	±5.3 days
Tunon et al. ^{3a}	±5.0 days
Second trimester dating via head size (BPD or HC)	
Doubilet and Benson ⁴ : BPD	±8.4 days (at 14–20 weeks)
Doubilet and Benson ⁴ : corrected BPD	±7.0 days (at 14–20 weeks)
Hadlock et al. ⁵ : BPD or HC	±8.4 days (at 12–18 weeks)
Tunon et al. ^{3a} : BPD	±8.4 days (at ~18 weeks)
Abbreviations: BPD = biparietal diameter; HC = head circumference.	
^a In vitro fertilization pregnancies.	

period began. In one study, women who recorded their LMP dates and were asked to recall the date several weeks later tended to overestimate the time interval since LMP.⁷ Another indicator of faulty memory is that women tend to over report days 1, 5, 15, and 20 of a month (e.g., June 15) when asked to recall their LMP, despite the fact that all days should be equally represented.⁸

While ultrasound dating also has sources of inaccuracy, including measurement errors and biological variability in fetal size at a given GA, a number of studies support the conclusion that it is superior to LMP dating. In particular, ultrasound dating is better than LMP at predicting delivery date. Furthermore, LMP classifies more pregnancies as being postdates: 10–12% by LMP dating vs. 3% by ultrasound dating.^{8,9}

2. Is first trimester dating superior to second trimester dating at 14–20 weeks of gestation?

There are two metrics that can be used to measure accuracy of prediction: bias and precision.¹⁰ Bias refers to the mean error of prediction, while precision refers to the variability of prediction. In the context of predicting gestational age, bias is measured by the average difference between predicted and true gestational age, while precision is measured by the 95% confidence range (i.e., ±2 standard deviations) of predicted age.

Bias can be measured using a study population of women with pregnancies achieved via IVF, since GA is known with certainty in this setting. Using the gold standard of GA in IVF pregnancies, most published ultrasound prediction formulas and tables have been shown to have minimal bias.¹¹ Even the Robinson–Fleming CRL dating table, devised almost 40 years ago, has been found to have a mean error (“bias”) of only 1.3 days.

Since ultrasound prediction of GA has little bias, assessment of sonographic dating accuracy focuses on precision. Table 1 presents the precision of a number of published methods for predicting GA by ultrasound in the first and second trimesters (the latter at 14–20 weeks of gestation). Overall, the 95% confidence range is approximately ±5 days

for first trimester dating, somewhat better than the range of ±8 days for dating done in the second trimester. (Note: This indicates that one standard deviation is 2.5 days for first trimester and 4 days for second trimester GA prediction.)

Another way of comparing first and second trimester dating is in their accuracy at predicting delivery date. Here, the results are mixed, with at least two studies finding that both are equivalent in this regard^{9,12} and one finding first trimester dating to be superior.¹³

3. Are the advantages of first trimester over second trimester dating sufficient to justify a routine first trimester dating scan?

As noted above, first trimester sonographic dating is somewhat more precise than second trimester dating, with a 95% confidence range that is lower by 3 days (±5 days vs. ±8 days). It is debatable whether a difference of 3 days is clinically significant, but it is important to note that an error of more than 5 days with second trimester dating applies only to the minority of cases toward the tails of the distribution curve. Since over two-thirds (~68%) of cases fall within one standard deviation of the mean, most women dated via second trimester sonography will have an estimated GA within 4 days of the true GA. Further evidence that there is only a small benefit of first trimester dating is the finding that prediction of delivery date is little or no better via first than second trimester sonography. Overall, the advantages of first trimester dating over second trimester dating would appear to be too small to justify a routine scan for the purpose of assigning GA.

4. Summary and conclusion

Accurate knowledge of GA is valuable for pregnancy management. Pregnancies can be dated based on LMP or ultrasound, with the latter being clearly superior. First trimester GA prediction is more accurate than second trimester prediction, but the difference is small and of minimal clinical

significance. A routine first trimester scan does not appear to be justified if dating is the sole (or major) reason for the scan, since a second trimester scan at 16–20 weeks gestation can give reliable dating information while providing a more detailed fetal anatomic assessment.

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