

## How Well does Fetal Ultrasound Predict the Date of Birth in Antigua and Barbuda?

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### ABSTRACT

*This study was done to determine the accuracy of fetal ultrasound (US) predicting the estimated date of delivery (EDD) in a primarily Afro-Caribbean population in Antigua and Barbuda. A total of 206 women had retrospective review of fetal ultrasound tests done between July 1994 and January 1996. The EDD based on last menstrual period (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  $10.0 \pm 9.4$  (mean  $\pm$  standard deviation) days off versus  $13.3 \pm 15$  days,  $p = 0.057$ , ( $n = 104$ ), CI:  $-0.1, 6.73$  days. Ultrasound EDD was within ten 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,  $11.8 \pm 9.5$  versus  $11.4 \pm 10.7$  days off (not statistically significant) and the third trimester,  $10.0 \pm 8.0$  versus  $8.1 \pm 7.0$  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.*

## Precisión del Ultrasonido Fetal en la Predicción de la fecha de Nacimiento en Antigua y Barbuda?

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### RESUMEN

*Este estudio fue hecho para determinar la exactitud del ultrasonido fetal (EEUU) en la predicción de la fecha estimada de parto (FEP) en una población principalmente afro-caribeña en Antigua y Barbuda. A un total de 206 mujeres, se les hizo una revisión retrospectiva de las pruebas de ultrasonido fetal, entre julio del 1994 y enero de 1996. La FEP basada en la historia menstrual (UPM) se le calculó a 104 mujeres con fechas, comparándosele luego con la FEP calculada mediante la prueba de ultrasonido. Estas fueron entonces comparadas con la fecha real de nacimiento tomada de los archivos de maternidad. Para las mujeres con datos menstruales inestables (102 mujeres), la FEP basada en ultrasonido fue comparada con la fecha real de nacimiento. La FEP basada en el ultrasonido, mostró una tendencia a ser más exacta que la FEP basada en la historia menstrual, con  $10.0 + 9.4$  (media + desviación estándar) días de diferencia, frente a  $13.3 + 15$  días,  $p = 0.057$ , ( $n = 104$ ), CI:  $-0.1, 6.73$  días. La FEP mediante ultrasonido estuvo dentro de los 10 días de parto 60% del tiempo frente al 57% en el caso de la FEP basada en historia menstrual. El error medio de estimación de la FEP fue de  $+ 1.7$  días para el ultrasonido y  $+ 3.7$  días para la historia menstrual. En mujeres sin datos de historia menstrual ( $n = 102$ ), la FEP mediante ultrasonido fue igualmente exacta tanto en el segundo trimestre,  $11.8 + 9.5$  frente a  $11.4 + 10.7$  días de diferencia, (no significativo estadísticamente) y el tercer trimestre,  $10.0 + 8.0$  frente a  $8.1 + 7.0$  días de diferencia, (no significativo estadísticamente). El ultrasonido fetal es marginalmente mejor en predecir la fecha de nacimiento en comparación con el*

*procedimiento basado en la historia mensual, pero la diferencia no justifica el uso rutinario para ese propósito. Cuando se desconoce la historia menstrual, la FEP mediante ultrasonido es tan exacta como cuando se sabe la historia mensual, lo cual la hace una prueba muy útil.*

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## INTRODUCTION

Ultrasound has been available in the large islands of the Caribbean since the late 1970s (1). The technique is becoming more widely employed in the region. Ultrasound has been used in Antigua and Barbuda since 1987, in St Kitts and Nevis since 1990 and in Anguilla since 1999. Ultrasound can be useful in determining the estimated date of delivery (EDD) based on fetal characteristics such as biparietal diameter of the head, head circumference, femur length and crown-rump length (2–8). The estimates of date of birth have been shown to be reliable for various racial groups in developed countries (1–8). The technique is most reliable early in pregnancy, and is rarely off by more than one week if done in the first trimester, two weeks off if done in the second or three weeks off if done in the third (9,10). This study is a retrospective review of the accuracy of fetal ultrasound in predicting EDD in a primarily Afro-Caribbean population in Antigua and Barbuda.

## SUBJECTS AND METHODS

A retrospective review of obstetrical ultrasound results of women studied between July 1994 and January 1996 was performed in 206 pregnant women. Date of last menstrual period and date of birth were recorded. Estimated date of delivery was calculated based on menstrual history. All 206 women had obstetrical ultrasound performed on a Toshiba Sonolayer V SSA-100A machine (Toshiba Corporation, Tokyo, Japan, 1987) by a single operator (RLM). Estimated date of delivery was calculated based on fetal measurements using established criteria (1–8, 11). The Toshiba machine includes the methods of Hadlock, Hobbins and Campbell (12). The Campbell Method was used and because all studies were done in the second and third trimester, biparietal diameter and femur length were used most often rather than crown-rump length or head circumference (12). The date of the ultrasound was recorded and trimester of pregnancy calculated. For women who had unreliable menstrual history, date of birth and ultrasound prediction of EDD were recorded as well as trimester of the study.

During the study period, there were 2000 live births at Holberton Hospital. There were 400 fetal ultrasound studies done during that time, roughly 400/2000 (20%) of pregnant women having had a study. In 24/400 (6%) of studies, EDD could not be calculated for technical reasons. In 36/400 (9%) cases, the ultrasound report could not be found. In 12/400 (3%) cases, the baby was born low birthweight (< 2.5 kg) and 12/400 (3%) were stillborn, and because these pregnancies did not reach term, they were excluded. A total of 206/400 (51.5%) women undergoing ultrasound in the study period were included in this study. After the random accrual of over

200 cases, data acquisition was stopped. There were 110/400 (27.5%) women undergoing ultrasound studies who were not included in the study. No known selection bias is suspected.

Holberton Hospital is the only full service public hospital in Antigua and Barbuda, performing over 90% of the deliveries (about 1100 per year). It serves a population of 65 000, per capita income \$5000 per year, 65% from tourism. From the census of 1990, the population is described as African ethnicity 90%, racially mixed 8%, other ethnic groups 2% (Ministry of Health, Antigua and Barbuda).

The actual date of birth was compared with calculated EDD based on menstrual history data and/or fetal ultrasound data. Using the actual date of birth as the 'gold standard', estimates of EDD by menstrual history or ultrasound were added or subtracted, giving the number of days by which the estimated EDD differed from the actual date of birth. The results are reported as "days away from birth date" or error in days of either estimate. Pooled data for each subset are reported as mean "days away from birth date" with standard deviation given for the subset. Comparison of data from menstrual history EDD and fetal ultrasound were compared using two sample Students t test on STAT101 software (13) and p values over 0.10 are reported as not significant (ns).

## RESULTS

Out of 2000 pregnancies, a total of 400 (20%) women had fetal ultrasound study done. Of these 400, 206 (51.5%) were included in the study. A total of 104 had studies performed in the second trimester and 102 in the third trimester. A total of 104 women (50%) had reliable menstrual history data.

A comparison of ultrasound predicted date of birth and date of birth based on menstrual history data revealed that US was more accurate, being off by  $10.0 \pm 9.4$  days vs  $13.3 \pm 14.9$  days,  $p = 0.057$  ( $n = 104$ ), confidence interval:  $-0.1$  to  $6.73$  days, an insignificant trend (Table 1). In looking at each trimester separately, the ultrasound EDD prediction was better for the third trimester, off by  $8.1 \pm 7.0$  days vs  $13.4$

Table 1: Comparison of the accuracy of estimated date of delivery (EDD) from menstrual history and ultrasound study in predicting the date of birth in Antigua.

	Menstrual EDD (days away from birth date)	Ultrasound EDD (days away from birth date)	p value
All pregnancies (n = 104)	$13.3 \pm 15.0$	$10.0 \pm 9.4$	0.057
Second trimester (n = 60)	$13.6 \pm 15.0$	$11.4 \pm 10.7$	.360
Third trimester (n = 44)	$13.0 \pm 14.3$	$8.1 \pm 10.0$	0.047

$\pm 14.0$  days,  $p = 0.047$  ( $n = 44$ ), confidence interval: 0.1 to 9.7 days, compared with that for the second trimester, 11.4 days  $\pm 10.7$  vs 13.6  $\pm 15.0$  days,  $p = 0.36$  ( $n = 60$ ). The second trimester studies were not significantly more accurate than the third trimester studies, 11.4  $\pm 10.7$  vs 8.14  $\pm 7.0$  days,  $p = \text{ns}$ . The average error in estimating the EDD was + 1.7 days with ultrasound and + 3.7 days with menstrual history.

The second trimester ultrasound predicted EDD was within two weeks 77% of the time compared with historical EDD within two weeks 75% of the time (Table 2). The third

Table 2: Comparison of accuracy of birth date prediction by menstrual history data and ultrasound study by trimester in Antigua.

	Second trimester (n = 104) (Per cent within two weeks of birth date)	Third trimester (n = 102) (Per cent within three weeks of birth date)
EDD* by menstrual history	75%	84%
EDD* by ultrasound (known menstrual history)	77%	93%
EDD* by ultrasound (unknown menstrual history)	75%	91%

\* EDD = estimated date of delivery

trimester estimate of the date of birth was within three weeks 93% of the time compared with historical EDD within three weeks 84% of the time. For both second and third trimesters, ultrasound EDD was within ten days of the date of birth 60% of the time and historical EDD within ten days 57% of the time.

In women lacking reliable menstrual data ( $n = 102$ ), a comparison of ultrasound EDD and actual date of birth was performed. For those done in the second trimester, the ultrasound EDD was 11.8  $\pm 9.5$  days away from the date of birth. Compared with those women for whom menstrual data was available, there was no difference in accuracy: 11.8  $\pm 9.5$  days vs 11.4  $\pm 10.7$  days,  $p = \text{ns}$ . Ultrasound EDD was within two weeks of date of birth 75% of the time. For those done in the third trimester, the ultrasound EDD was 10.0  $\pm 8.0$  days away from the date of birth. Compared with those women for whom menstrual data was available, there was no difference in accuracy: 10.0  $\pm 8.0$  days vs 8.1  $\pm 7.0$  days,  $p = \text{ns}$ . Ultrasound EDD was within three weeks of the date of birth 91% of the time.

## DISCUSSION

Fetal ultrasound has been a very valuable tool in the assessment and monitoring of pregnancy in the Caribbean (1). The technique is useful in dating pregnancy, assessing fetal and placental location and providing a survey of fetal anatomy

(11,14,15). This study demonstrates that accurate prediction of estimated date of delivery is possible in the Caribbean: ultrasound prediction of the date of birth was more accurate than prediction based on menstrual history in this primarily Afro-Caribbean population. Fetal ultrasound has been found to be more accurate than menstrual history in over 50% of cases in the United Kingdom (16). In Antigua and Barbuda, fetal ultrasound EDD was within ten days of the actual day of delivery 60% of the time, compared with 57% for menstrual history EDD. For second trimester fetal ultrasound study in developed countries, the fetal ultrasound EDD was within seven days of the actual day of birth 61% of the time compared with 56% for menstrual history EDD in one study (17) and within seven days 55% of the time compared with 50% of the time in another study (18). The fetal ultrasound was within ten days in 70% compared with 64% for menstrual history EDD (18).

The estimated EDD by fetal ultrasound in Antigua was more accurate than menstrual history EDD by an average of 3.3 days. This is comparable to the improved accuracy of 1.7 days reported for first trimester and 2.8 days reported for later trimester studies from developed countries (19, 20). Recent studies from developed countries suggest not only random error but systematic error in estimating EDD from menstrual history (20–22). The EDD by menstrual history tends to over-estimate gestational age by several days, most likely due to delayed ovulation (20). In Antigua and Barbuda, this over-estimate was two days on the average. This could lead to more suspected post-term pregnancies with the potential for more intervention (22). Use of fetal ultrasound can lower suspected post-term cases by 72 to 78% (18–20).

When menstrual history is known, fetal ultrasound in Antigua and Barbuda offers slight improvement in prediction of date of birth, 3.3 days better in accuracy on average and within ten days of the date of birth 3% more of the time. This may decrease the risk of intervention in babies who are not really post-term, but may increase pre-term deliveries. In one study this increase was from 7.6% using menstrual history compared with 9.1% using fetal ultrasound EDD (21). When menstrual history is unknown, ultrasound is very useful. The prediction of the date of birth within two to three weeks of the actual date is 75 to 91%. Considering that accurate menstrual history was lacking in 50% of Antiguan women, these findings are reassuring.

Approximately 70% of women in the United States of America have ultrasound testing done in pregnancy (23). A recent randomized trial of fetal ultrasound at 30–32 weeks and 36–37 weeks of gestation compared with routine care in a low risk population resulted in more interventions (31.1% vs 16.9%), fewer small babies (6.9% vs 10.4%) but no difference in neonatal care unit admissions (2.8% vs 3.4%) (24). As obstetric intervention (*eg* Caesarean section) is increasing in the Caribbean, these considerations are more than theoretical (25). Although fetal growth curves have been

available for various ethnic groups (26), fetal growth curves have just recently been developed for a Caribbean population in Jamaica (27). Routine fetal ultrasound has not been shown to reduce perinatal morbidity or mortality or reduce unnecessary intervention, and must be applied judiciously (23). The limitation of the technology must be acknowledged. A fetus estimated to be 30 weeks gestation by ultrasound with an uncertainty of two weeks in either direction, has a range of gestational age of 28 to 32 weeks, so over reliance on a single number must be avoided (28).

Limitations of this study include a relatively small study population and a single ultrasonographer performing a single fetal ultrasound study. The retrospective nature of the study required mothers to recall last menstrual period rather than have recorded values. The data cannot be examined for inter-observer variability in fetal ultrasound or test to test variability in a single observer. These limitations, however, are those faced by obstetric practitioners every day.

This study demonstrates that fetal ultrasound can improve estimates of the date of birth over menstrual history estimates in an Afro-Caribbean population but the magnitude of improvement is small. Routine use for this purpose is probably not justified by this minor improvement. It may become more important as intervention in pregnancy becomes more common in the Caribbean. But the accuracy of ultrasound in predicting the date of birth in women whose menstrual histories are unknown is just as accurate and is very useful.

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