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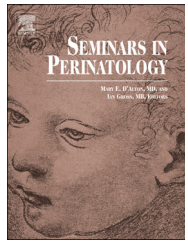

Should second trimester ultrasound be routine for all pregnancies?

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ABSTRACT

Ultrasound use has become ubiquitous in pregnancy. We review the evidence regarding the benefits of routine ultrasound use during pregnancy. Routine ultrasound use before 24 weeks improves detection of undiagnosed twins, reduces postdates inductions, and allows detection of fetal anomalies before birth. Wide variations exist in the sensitivity of ultrasound in detecting fetal anomalies. These may be related to equipment, training, and maternal characteristics, such as obesity. Standards have been developed for the performance of routine fetal ultrasonography in the second trimester. The benefits of routine first trimester ultrasound in the diagnosis of structural fetal anomalies or of routine ultrasonography after 24 weeks are not proven. As ultrasound technology improves and obstetrical care changes, new uses of routine ultrasonography may emerge.

1. Benefits of second trimester ultrasound

Ultrasound use has become more frequent during pregnancy. In the developed world, an ultrasound evaluation is performed at some point during gestation for the vast majority of pregnancies. In many countries, ultrasonography has become routine. The most studied benefit of routine ultrasonography is that of exams conducted in the second trimester. Whitworth et al.[1] conducted a review of 11 randomized and quasi-randomized trials evaluating pregnant women undergoing selective ultrasound versus routine ultrasound at less than 24 weeks. The primary outcomes for the review were the early detection of fetal anomalies, detection of multiple gestation by 24 weeks, rate of postdate induction, and rate of perinatal death. The trials included in the overall systematic review enrolled a total of 37,505 women, with the earliest trial recruiting patients in the 1970s. Early routine ultrasound was associated with increased detection of fetal abnormalities before 24 weeks (two trials, 17,158 pregnancies, 387 fetal abnormalities, 16% detected in the early ultrasound versus 4% in the unscreened group; risk ratio (RR) of 3.46, 95% confidence interval (CI) 1.67–7.14) although the majority of the anomalies were not detected. Similarly, ultrasound was associated with earlier detection of twins or multiple gestation: in the screened group, two of 153 multiple gestations were undetected at 24 weeks compared to 56 of 142 in the control groups (seven trials, 295 multiple gestations; RR 0.07, 95% CI 0.03–0.17). The screened groups also had lower rates of induction for postdates (eight trials, 25,516 women; RR 0.59, 95% CI 0.42–0.83) as well as induction for any reason (seven trials, 24,790 women; RR 0.78, 95% CI 0.63–0.97). The effect on induction for postdates was not substantially different when only studies in which ultrasound was performed after 14 weeks were analyzed (five trials, 23,434 women; RR 0.49, 95% CI 0.31–0.77). There was no difference in the perinatal mortality between the two groups overall (10 trials, 35,735 participants; RR 0.89, 95% CI 0.70–1.12) nor for those pregnancies without known lethal anomalies (eight trials, 34,331 participants; RR 0.96, 95% CI 0.72–1.27).

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The authors also compared detection of fetal anomalies and multiple gestations all the way up to delivery. The screened group had higher rates of fetal anomaly detection before birth (two trials, 387 fetal abnormalities; RR 3.19, 95% CI 1.99–5.11). In the screened group, all multiple gestations were detected before labor, whereas 12/133 multiple gestations remained undetected in the control group (five trials, 273 multiple gestations; RR 0.12, 95% CI 0.03–0.54). Neonatal outcomes were similar between the two groups: there was no difference in mean birth weight, rate of low birth weight (<1500 g) or very low birth weight (<2500 g), Apgar scores, or admission to neonatal intensive care. Similarly, in the studies in which the offspring were evaluated in childhood and adolescence, there was no significant difference in school performance. Finally, with regard to maternal outcomes, there was no difference in the rate of cesarean delivery. Additionally, the number of prenatal visits and hospital admissions was similar between the two groups.

The sensitivity of routine ultrasonography in the detection of fetal anomalies was also evaluated in the Eurofetus study.[2] The study was conducted from January 1990 to June 1993 in the 61 centers across Europe. In this prospective study, all malformations diagnosed by ultrasound were included. Additionally, malformations detected at birth that were not detected by ultrasound were also reported. The trial only included ultrasound examinations performed as routine. The exams were performed by qualified personnel with "level 2"-type equipment. The detection rate of fetal malformations in the study was 56%. Major anomalies were more frequently detected (73.7%) compared to minor anomalies (45.7%). Urinary system anomalies and central nervous system anomalies had the highest detection rates (88.5% and 88.3% respectively). The detection rate of major cardiac anomalies was 38.8% and that of minor ones was 20.8%. The lowest rates of detection were for minor abnormalities of the musculoskeletal system (18%) and for cleft lip and palate (18%). The study also provided valuable information regarding the false-positive rates of ultrasound examinations. Of the 3085 diagnoses of malformation made during pregnancy, 2593 (84%) were true positives and 492 (16%) were false positives. Of the false positives, 187 (6%) were realized as false positives and the diagnosis was corrected during the pregnancy. Of the 305 false-positive cases identified after birth, 49 were in fetuses with other correctly identified abnormalities and 256 were false positives in a normal fetus.

As part of its prenatal care guidelines published in 2003 and updated in 2008, The National Institute for Health and Clinical Excellence (NICE) evaluated the diagnostic value of routine ultrasound in the second trimester.[3] In a systematic review of 17 studies, the sensitivity of detection of fetal anomalies prior to 24 weeks was 24%, with a wide range between studies from 13.5% to 87.5%. Specificity was 99.92% (range 99.4–100%). The overall sensitivity and specificity irrespective of gestational age at detection were 35.4% (range 15–92.9%) and 99.86% (range 99.4–100%), respectively. In the report, however, the overall detection rate for lethal fetal anomalies was 84%. Meta-analysis showed positive likelihood ratio of 541.54 (95% CI 430.8–60.76) and negative likelihood ratio of 0.56 (95% CI 0.54–0.58) for diagnosis before 24 weeks, and positive likelihood ratio of 242.89 (95% CI 218.35–270.18) and negative likelihood ratio of 0.65 (95% CI 0.63–0.66) for overall diagnosis. Based on these findings, NICE recommended that ultrasound screening for fetal anomalies should be routinely offered and performed between 18 0/7 and 20 6/7 weeks for pregnant women who choose to have screening. This recommendation is separate from recommendations regarding earlier ultrasounds to determine gestational age or screen for aneuploidy, both of which are addressed in a separate articles in this issue.

NICE also evaluated the detection rate of routine fetal echocardiography as part of the anatomic assessment. None of the studies identified were randomized. In the identified studies, fetal echocardiography consisted of assessing the four chamber view and outflow tracts. Color Doppler flow mapping and venous return evaluation were performed in select studies. The detection rate ranged from 16.7% to 94% for major cardiac anomalies and 3.6–82.1% for minor anomalies. There were no randomized trials evaluating the usefulness of routine fetal echocardiography. In a cohort study by Bonnet et al.,[4] the outcomes of neonates in whom transposition of the great arteries (TGA) was diagnosed prenatally was compared to those of neonates with TGA diagnosed after birth. Metabolic acidosis, multi-organ failure, and preoperative mortality were worse in the group diagnosed postnatally. Postoperative mortality was also increased in the postnatal identification group. These results suggest that earlier identification of TGA is associated with improved outcomes.

2. Factors affecting usefulness of second trimester ultrasound

Maternal factors also play a role in the detection rate of fetal anomalies. In a secondary analysis of the First and Second Trimester Evaluation of Risk (FaSTER) trial, Aagaard–Tillery et al.[5] observed a lower rate of detection of cardiac anomalies in women with a BMI >30 compared to those with a BMI <25. Following logistic regression, maternal obesity was associated with a significantly decreased likelihood of detection of common fetal anomalies. Of note, the exams were genetic sonograms with more detailed imaging than the routine second trimester sonogram. In a retrospective analysis, Dashe et al.[6] noted decreased detection of fetal anomalies with increasing maternal BMI. With standard ultrasonography, the detection rate of fetal anomalies was 25% in women with class III obesity as opposed to 66% in women with normal BMI.

Gestational age is another factor affecting detection by ultrasound. There is limited information about the diagnostic value of ultrasound in the first trimester in the detection of fetal structural anomalies. In a prospective study of 6634 women enrolled at <15 weeks gestation, Whitlow et al.[7] performed an early anatomical ultrasound survey in combination with a second trimester survey. Twenty percent of the subjects also underwent trans-vaginal examination in early pregnancy. The detection rate for fetal anomalies was 59% with the early ultrasound but increased to 81% when combined with the second trimester ultrasound. In a Swedish