

Routine Third Trimester Ultrasound: What Is the Evidence?

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Abstract

Policies for routine third trimester obstetrical ultrasound examinations differ among countries. In Canada, a routine third trimester ultrasound scan is not offered in the low-risk pregnancy population. This practice is based mainly on results of a meta-analysis published in 2001 that concluded "routine late pregnancy ultrasound in low-risk or unselected populations does not confer benefit on mother or baby." We reviewed in detail each study included in this meta-analysis in order to re-evaluate the Canadian practice regarding routine third trimester ultrasound in the low-risk pregnant population. The meta-analysis included outdated techniques and ultrasound examinations performed in the late 1970s and early 1980s. To assess the effect of routine third trimester ultrasound on perinatal outcome, the interventions prompted by an abnormal diagnostic test result must be considered. None of the trials included in the meta-analysis evaluated the effect of routine third trimester ultrasound on perinatal outcomes in a low-risk population when ultrasound assessment was followed by an altered perinatal management plan. Our assessment of the published evidence regarding routine third trimester ultrasound puts in question the contemporary validity of the conclusion of the 2001 meta-analysis. In fact, the 2001 meta-analysis has recently been withdrawn by the authors.

Résumé

Les politiques en ce qui concerne la tenue systématique d'un examen échographique obstétrical au cours du troisième trimestre varient d'un pays à l'autre. Au Canada, l'examen échographique systématique au cours du troisième trimestre n'est pas offert aux femmes enceintes ne courant que de faibles risques. Cette pratique est principalement fondée sur les résultats d'une méta-analyse publiée en 2001, laquelle en était arrivée à la conclusion que « la tenue systématique d'un examen échographique à la fin de la grossesse, chez les femmes ne courant que de faibles risques ou n'ayant pas fait l'objet d'une sélection, ne confère aucun avantage à la mère ou à l'enfant ». Nous avons analysé en détail chacune des études couvertes par cette méta-analyse, afin de réévaluer les pratiques canadiennes en matière de tenue systématique d'un examen échographique au cours du troisième trimestre chez les femmes enceintes ne courant que de faibles risques. La méta-analyse couvrait des

techniques et des examens échographiques désuets mis en œuvre à la fin des années 1970 et au début des années 1980. Pour évaluer l'effet de la tenue systématique d'un examen échographique au cours du troisième trimestre sur les issues périnatales, les interventions suscitées par des résultats de test diagnostique anormaux doivent être prises en considération. Aucun des essais couverts par cette méta-analyse n'a évalué l'effet de la tenue systématique d'un examen échographique au cours du troisième trimestre sur les issues périnatales au sein d'une population ne courant que de faibles risques, lorsque l'examen échographique en question était suivi d'un plan de prise en charge périnatale modifié. Notre évaluation des résultats publiés au sujet de la tenue systématique d'un examen échographique au cours du troisième trimestre remet en question la validité contemporaine des conclusions de la méta-analyse de 2001. En fait, les auteurs de celle-ci se sont récemment rétractés.

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INTRODUCTION

Policies regarding routine third trimester obstetrical ultrasound differ among countries. In some European countries (France, Switzerland, Belgium, and Germany), it is common practice to include routine third trimester ultrasound as part of normal prenatal care.¹ This practice is justified by several observations; for example, although a routine second trimester scan can reveal several congenital anomalies, a third trimester ultrasound examination is more sensitive.² Anomalies such as congenital heart defects can be missed at an earlier stage of pregnancy, while others such as duodenal atresia or microcephaly may not be detectable before the third trimester. The ethical and legislative issues related to TOP are critical when fetal malformations are discovered late in pregnancy. In countries that permit late TOP, such as France, a policy of routine third trimester ultrasound is easier to justify. If TOP is not permitted, when a fetal malformation is diagnosed during the third trimester, the location, timing, and route of delivery may be modified in order to improve the neonatal outcome.

Ultrasound assessment remains the gold standard for diagnosing IUGR.³ Once IUGR is suspected, fetal surveillance

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can improve perinatal outcome.⁴ Other indicators of high-risk pregnancy such as oligohydramnios can be ascertained only by ultrasound. This finding may also be an indication for increased fetal surveillance. The Leopold manoeuvre has a lower sensitivity than ultrasound in the diagnosis of breech presentation and other malpresentations.⁵ Although these arguments favour a policy of routine third trimester ultrasound assessment, there is no published evidence to support applying this policy to the general obstetric population.

In Canada and the United States, a routine third trimester ultrasound scan is not recommended for the low-risk pregnancy population.^{6,7} This policy relies essentially on the results of a meta-analysis published in 2001 by Bricker and Neilson.⁸ The authors concluded: “routine late pregnancy ultrasound in low risk or unselected populations does not confer benefit on mother or baby.”

We reviewed in detail the material, methods, and results of each of the studies included in the meta-analysis performed by Bricker and Neilson⁸ in order to re-evaluate our policy regarding routine third trimester ultrasound in the low-risk population. Seven randomized controlled trials were included. These studies were selected because all patients had at least one routine ultrasound after 24 weeks’ gestation, and the findings were compared with those in a control population that had third trimester ultrasound assessment only when medically indicated. All patients selected were designated as part of the population with a low-risk pregnancy. We noted in particular the time period in which these studies were conducted, the objective of the studies, the interpretation of the results, and the contemporary validity of the methods used.

THE STUDIES

Most of the studies included in this meta-analysis were carried out in the late 1970s and early 1980s. The most recent data included came from 1993. The following represents the analysis of each trial in the meta-analysis.

ABBREVIATIONS

CHD	congenital heart defect
CS	Caesarean section
ECV	external cephalic version
IUGR	intrauterine growth restriction
NICU	neonatal intensive care unit
TOGV	transposition of the great vessels
TOP	termination of pregnancy

1. The RADIUS Study (1993)⁹

The objective of the RADIUS Study was “to determine whether ultrasound screening decreased the frequency of adverse perinatal outcomes.” This was the largest study included in the meta-analysis, with 15 151 pregnant women at low risk. Multiple pregnancies were included in this low-risk population. The ultrasound examination included assessment of placental location, amniotic fluid volume, fetal biometry, and a detailed fetal anatomical survey. In the study group, the detection rate of fetal anomaly was 34.8%. This rate was higher in the study population than in the controls (11%). Although more than 50% of fetal anomalies were diagnosed during the third trimester ultrasound, the authors concluded that routine ultrasound did not improve perinatal outcomes. However, no mention was made of any management plans following abnormal ultrasound findings such as IUGR or fetal malformation.

2. The Alesund Trial (2000)¹⁰

Although this study was published in 2000, patients were recruited between 1979 and 1981. This randomized controlled trial was designed “to detect a 50% difference in the incidence of induction for apparent post-term pregnancies between women who were screened with ultrasound and unscreened women.” The objective of this study does not match the objective of the meta-analysis. Only two fetal malformations were detected in the screening group for a detection rate of 10%. As specified in the article, “the low detection rate is likely to be a consequence of the equipment.”

3. The Trondheim Study (1984)¹¹

The sample size of this study was calculated to be able to demonstrate a 50% reduction in post-term pregnancies. To discriminate between normal growth and suspected IUGR, the authors used “fetal biparietal diameter one standard deviation below the mean growth curve.” Using this criterion, only 25% of small for gestational age fetuses were identified antenatally. Moreover, the authors of this trial noted that “two of the three sonographers had only limited experience in the technique and received two months of intensive training before the study.”

4. The Glasgow Study (1984)¹²

The objective of this study was to use ultrasound screening to reduce adverse perinatal outcomes associated with IUGR. The ultrasound examination did not include assessment of placental location, amniotic fluid volume, fetal presentation, or fetal morphology. To estimate fetal size, the authors of this study measured crown—rump length and multiplied this by trunk area measured at between 34 and 36 weeks’ gestation. This method is not currently used to estimate fetal weight.

5. The Perth Study (1993)¹³

This study evaluated the impact of serial ultrasound and Doppler studies on perinatal outcomes. The main outcome measures were prematurity rate and NICU length of stay. Even though this study did not show improvement in neonatal outcomes, the diagnosis of IUGR in the study group was made twice as often as in controls (relative risk 2.07; 95% confidence intervals 1.34–3.21). Although perinatal mortality rate was not one of the outcome measures, there were 10 neonatal deaths in the control group (n = 1415) compared with three in the study group (n = 1419). In this study, no management plan had been evaluated.

6. The Peterborough Study (1987)¹⁴

The objective of this trial was to show an effect on pregnancy outcome when placental grading was revealed to the clinician after a third trimester ultrasound examination. The ultrasound examination did not include assessment of fetal biometry, amniotic fluid volume, fetal presentation, or fetal morphology. Placental grading was assessed in both the study and the control groups of women, but was revealed only to the clinicians in the study group. The study group had a 14% decrease in adverse perinatal outcome, although this difference was not significant. The perinatal mortality rate was five times lower in the study group.

7. The New Zealand Study (1993)¹⁵

The objective of this study was to evaluate the effect of routine third trimester ultrasound on the morbidity and mortality of fetuses with IUGR. The ultrasound examination did not include assessment of placental location, amniotic fluid volume, fetal presentation, or fetal morphology. The study's hypothesis was "that early diagnosis of fetal growth problems leads to more appropriate management and therefore improved outcome." The investigators found no significant difference in outcome of pregnancy between screened and unscreened women. However, "appropriate management" is not specified in the description of the study; the investigators specified only that "estimated fetal weights below the 20th percentile for gestational age were reported and additional scans were recommended but not arranged."

DISCUSSION

All of the studies included in the meta-analysis performed by Bricker and Neilson⁸ were conducted during the 1970s and 1980s. Ultrasound technology, knowledge, and expertise have improved greatly since the beginning of the 1970s.¹⁶ Detection rates for fetal anomalies have followed the same evolution. For example, 16.2% of birth defects were detected antenatally in 1983 in France, but by 2000, this detection rate had risen to 69.1%.¹⁷ Considering the evolution of ultrasound technology and expertise, the

results of ultrasound investigations conducted 20 to 30 years ago are likely to have little relevance today. Moreover, since the 1980s, the ability of ultrasound assessment to allow an accurate estimate of fetal weight has been demonstrated in many studies.¹⁸ Nowadays, estimates of fetal size are made using a composite of fetal biometry parameters that include abdominal circumference, head size, and femur length. We now know that formulas including abdominal measurements are more accurate than other measures to predict IUGR.¹⁸ In some of the studies in the meta-analysis by Bricker and Neilson, obsolete formulas were used to estimate fetal weight.^{11,12,19} We believe that the results of studies that relied on calculation methods no longer in use cannot be extrapolated to contemporary practice. In a randomized trial published in 2003, estimated fetal weight was calculated using a contemporary formula, and the findings indicated that routine third trimester ultrasound may reduce the risk of IUGR births.²⁰ In fact, Bricker and Neilson recently published a withdrawal of their meta-analysis, stating that "it is out-of-date."²¹ It is therefore inappropriate to base current obstetrical practices on the conclusion of that meta-analysis.

By definition, a meta-analysis requires the merging of datasets from several comparable studies and uses the benefit of larger datasets to reanalyse the results and provide improved statistical significance. A meta-analysis should collect all pertinent studies that were designed to answer a specific question critically and quantitatively.²² The trials included in the meta-analysis by Bricker and Nielson did not correspond exactly to this definition. The objective of the meta-analysis was "to assess the effects on pregnancy outcome of routine late pregnancy ultrasound." However, in at least three studies the objective of the study did not match the objective of the meta-analysis.^{10,11,14} In the Alesund¹⁰ and Trondheim¹¹ trials, the objective was to show a 50% reduction in post-term pregnancies. In the Peterborough Study, the objective was to determine an effect of placental grading on pregnancy outcomes.¹⁴ These objectives are quite different from the initial objective of Bricker and Nielson. The main outcome measures of the Perth Study were prematurity rate and NICU length of stay,¹³ and it is reasonable to question the rationale of using third trimester ultrasound to affect the rate of preterm birth. Because of the paucity of relevant published data, the authors of the meta-analysis were obliged to include trials with quite different objectives from their own.

Ultrasound is a screening and diagnostic tool. It is appropriate that an adequate management plan should follow the discovery by ultrasound of an abnormality (e.g., IUGR, malformation, breech presentation, or oligohydramnios). When evaluating ultrasound efficacy, it is important to

evaluate its diagnostic accuracy for discovering fetal anomalies, estimating fetal weight, and assessing fetal well-being. For an assessment of the effect on perinatal outcome, an abnormal diagnostic test result should have a specified intervention, such as surveillance or treatment. We believe that, in order to evaluate the effect of third trimester routine ultrasound, a management plan for an abnormal result is required before concluding that ultrasound carries no benefit. This did not appear to be the case in most studies in the meta-analysis.

Ultrasound performed better than clinical evaluation in the detection of IUGR.³ In fact, in the Perth Study, although third trimester ultrasound did not improve perinatal outcomes, the IUGR detection rate was twice as high in the study group as it was in controls.¹³ IUGR is an important cause of perinatal morbidity and mortality, and when IUGR is detected antenatally, intensive fetal surveillance, including Doppler studies, can improve perinatal outcome.⁴ In a study designed to show an effect on perinatal outcome, a management plan for IUGR should be evaluated. It is possible that routine third trimester ultrasound combined with a standardized management plan for IUGR could improve both the IUGR detection rate and perinatal outcomes.

Third trimester ultrasound also allows determination of fetal presentation. It has been demonstrated that ultrasound is better than clinical evaluation in determining fetal presentation.⁵ Approximately 20% of breech presentations are initially identified during active labour.²³ Although vaginal breech delivery is still an option,^{24,25} most centres opt for an elective CS or offer ECV.^{26,27} However, when breech presentation is diagnosed in labour, ECV may not be an option, and evaluation for vaginal delivery may not be possible; thus, CS may be the safest option. Caesarean sections performed during labour are associated with an increased risk of maternal morbidity.²⁸ In this context, it is not clear if third trimester ultrasound would contribute to a reduction in the rate of emergency CS for malpresentation identified in active labour if identification of a breech presentation is followed by a standardized management plan (ECV or elective CS).

A routine third trimester ultrasound is intended to evaluate fetal size, amniotic fluid volume, placental site, fetal structural anatomy, and fetal presentation. It is inappropriate to assess these items independently and to conclude that routine third trimester ultrasound provides no benefit. Among the seven studies included in the meta-analysis by Bricker and Nielson, only the RADIUS Trial⁹ included detection of fetal anomaly as an outcome of interest. Identification of fetal malformations in the third trimester raises the critical issue of late termination of pregnancy. However, appropriate perinatal management for specific malformations, such

as CHD, can improve neonatal outcomes.²⁹ For example, TOGV is the second most frequent CHD after endocardial cushion defects and is the most frequent CHD not associated with chromosomal anomalies.³⁰ Bonnet et al. demonstrated that perinatal morbidity and mortality improved significantly when TOGV was diagnosed prenatally, because adequate perinatal management could be instituted in tertiary care units.³¹ In a recent retrospective study, the mean gestational age at diagnosis of TOGV was 25.5 weeks, well after the routine second trimester anomaly scans.³² It is possible that routine third trimester ultrasound could improve both the detection rate of fetal anomalies and perinatal outcomes when associated with an adequate perinatal management plan. The RADIUS Study did not show improved perinatal outcomes, although it demonstrated an increased rate of diagnosis of fetal anomalies.⁹ In another study of 7812 women who had a third trimester ultrasound, 187 (2.4%) had a fetus with at least one major anomaly, 65 (34.8%) of which were detected prenatally, with more than one half detected at the third trimester ultrasound.¹⁷ In contrast to the RADIUS Study, this study demonstrated that third trimester ultrasound doubled the detection rate of fetal anomalies.

It can be argued that routine ultrasound may cause undue psychological stress because pregnant women may be distressed by false positive ultrasound results. However, Bricker and Nielson stated that “there is a lack of data about the potential psychological effects of routine ultrasound in late pregnancy.”²⁸ In fact, it cannot be said that routine third trimester ultrasound causes anxiety in a low-risk population. Further studies are needed to estimate its psychological impact. On the other hand, some have proposed that ultrasound could promote maternal-fetal bonding.³³

Third trimester obstetric ultrasound is used to screen for fetal anomaly, IUGR or macrosomia, and oligohydramnios or polyhydramnios, and to assess fetal presentation, placental position, and fetal well-being. The prevalence of abnormal findings may be low in a low-risk population. The resources required to provide third trimester ultrasound for the entire population are significant. It is likely that a policy of routine third trimester ultrasound would be unacceptable on the basis of cost-effectiveness. Moreover, it may increase antenatal interventions or the rate of CS. In the randomized trial of McKenna et al., the rate of antenatal interventions, especially the induction of labour, was higher in women who underwent routine ultrasound than in women who did not.²⁰ However, it is not known if a policy of routine third trimester ultrasound followed by adapted perinatal care would improve perinatal and maternal outcomes and thereby reduce the cost associated with neonatal and

maternal complications. To our knowledge, such an evaluation has not yet been carried out.

CONCLUSION

The meta-analysis conducted by Bricker and Nielson on the value of routine third trimester ultrasound is not relevant to contemporary practice. The meta-analysis included outdated techniques, and none of the studies included were designed to answer the specific question: Does routine third trimester ultrasound in a low-risk population, followed by an adapted perinatal management plan, improve perinatal outcomes? At present, because no adequately designed study can provide an answer, it cannot be concluded that routine third trimester ultrasound does not improve perinatal outcomes. A randomized controlled trial using current ultrasound technologies and evaluating routine third trimester ultrasound followed by appropriate management is needed for clarification.

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