Second-trimester uterine artery Doppler screening in unselected populations: a review
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Authors' objectives
To review the findings of all available Doppler studies of the uterine arteries during the second trimester in unselected populations.

Searching
Two reviewers independently searched MEDLINE. The reference lists of retrieved studies were screened for additional studies.

Study selection
Study designs of evaluations included in the review
No inclusion criteria relating to the study design were specified.

Specific interventions included in the review
Studies that assessed uterine artery Doppler assessment were eligible for inclusion. Several types of Doppler imaging were used in the included studies: continuous-wave Doppler without visualising the vessel, pulse-wave Doppler after identification of the vessel using B-mode ultrasound, and colour flow imaging to identify the vessel followed by pulsed-wave Doppler. The ultrasound was carried out transvaginally in one study of colour pulsed-wave ultrasound; in all other studies it was carried out transabdominally. The threshold used to define a positive result varied between studies and included: a systolic-to-diastolic ratio greater than 2.18 or 2.7; a mean resistance index greater than 95th centile; a resistance index or mean resistance index greater than 0.55, greater than 0.57, greater than 0.58 or greater than 0.65, with or without the presence of notches; the presence of bilateral notches.

Reference standard test against which the new test was compared
Studies that assessed pre-eclampsia, foetal growth restriction (FGR) or perinatal death as reference standards were eligible for inclusion. The definitions of pre-eclampsia used by the studies were a blood-pressure of at least 140/90 mmHg and proteinuria greater than 150 or 300 mg/24 hours, or a rise in blood-pressure (systolic more than 30 mmHg and diastolic more than 25 mmHg) with proteinuria greater than 500 mg/24 hours. Definitions of FGR were below the 3rd, below the 5th or below the 10th centile.

Participants included in the review
Studies of unselected pregnant women were eligible for inclusion. The gestation periods ranged from 16 to 26 weeks.

Outcomes assessed in the review
The studies had to provide sufficient data to calculate measures of diagnostic accuracy to be eligible for inclusion. Likelihood ratios (LRs) were selected as the primary outcome. Data on screen-positive rates, prevalence, sensitivity, specificity, and positive and negative predictive values were also presented.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors did not state how the data were extracted from the primary studies, or how many reviewers performed the data extraction.
The results were extracted as 2x2 tables of the screening test results against the three reference standards. In several papers the 2x2 data were calculated from the reported prevalence, sensitivity and specificity. If any of the 2x2 table cells contained a zero value, 0.5 was added to each cell in the 2x2 table. LRs were calculated for each set of 2x2 data. Confidence intervals (CIs) for the LRs were calculated using the method of Gart and Nam (see Other Publications of Related Interest).

Methods of synthesis
How were the studies combined?
The authors did not report how the studies were combined. Pooled LRs, which appear to be have been calculated using a simple fixed-effect meta-analysis, were presented.

How were differences between studies investigated?
Differences between the studies were discussed in terms of technical details of the ultrasound scan, but no formal tests for heterogeneity appear to have been carried out.

Results of the review
Fifteen studies (n=22,126) were included.

Prediction of pre-eclampsia (n=12).

Prevalence ranged from 1.4 to 5.5%. The sensitivity ranged from 24 to 89% and the specificity from 89 to 96%. The pooled positive LR was 5.90 (95% CI: 5.30, 6.52) and the pooled negative LR was 0.55 (95% CI: 0.50, 0.60). Studies that examined different degrees of pre-eclampsia found that Doppler was better at predicting more severe disease.

Prediction of FGR (n=13).

Prevalence ranged from 4.6 to 16.5%. The sensitivity ranged from 6 to 67% and the specificity from 82 to 96%. The pooled positive LR was 3.67 (95% CI: 3.34, 4.03) when FGR was defined as below the 10th centile; the corresponding negative LR was 0.80 (95% CI: 0.78, 0.82). When FGR was defined as below the 5th centile, the pooled positive LR was 3.38 (95% CI: 2.82, 4.00) and the corresponding negative LR was 0.71 (95% CI: 0.65, 0.77). When FGR was defined as below the 3rd centile, the pooled positive LR was 3.85 (95% CI: 3.08, 4.72) and the corresponding negative LR was 0.69 (95% CI: 0.61, 0.77).

Prediction of perinatal or foetal death (n=4).

Prevalence ranged from 0.3 to 1.5%. The sensitivity ranged from 8 to 83% and the specificity from 84 to 93%. The pooled positive LR was 2.37 (95% CI: 1.54, 3.44) and the pooled negative LR was 0.82 (95% CI: 0.68, 0.93).

Authors’ conclusions
Increased impedance to flow in the uterine arteries in pregnant women attending for routine antenatal care identifies about 40% of those who subsequently develop pre-eclampsia and about 20% of those who develop FGR. Following a positive test, the likelihoods of these complications are increased by about 6 and 3.5 times, respectively.

CRD commentary
This review addressed a well-defined question that was supported by clear inclusion criteria. However, it suffered from several limitations. Since only a single electronic database was searched for relevant studies and there were no attempts to find unpublished studies, potentially relevant studies might have been missed. No formal quality assessment of the included studies was carried out, so it is unclear how reliable the results are. Very few details of the review process, including the methods used to pool the studies, were reported. It is therefore not possible to determine whether appropriate measures to reduce bias in the review process were carried out.

Heterogeneity was not formally assessed, although differences between the studies, especially in estimates of sensitivity,
appeared large. It would have been helpful had the results been plotted in receiver operating characteristic space to give a visual indication of heterogeneity and the trade-off between sensitivity and specificity. The authors’ conclusions appear to be supported by the results presented, but should be interpreted with caution given the limitations highlighted.

**Implications of the review for practice and research**
The authors did not state any implications for practice or further research.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.