Accuracy of mean arterial pressure and blood pressure measurements in predicting pre-eclampsia: systematic review and meta-analysis


CRD summary
This review concluded that when blood-pressure is measured in the first or second trimester, the mean arterial pressure is a better predictor for pre-eclampsia than systolic or diastolic blood-pressure, or an increased blood-pressure. The authors acknowledged the limitations of the evidence available. However, this was a generally well-conducted review and the results seem reliable.

Authors' objectives
To evaluate the accuracy of systolic and diastolic blood-pressure (BP), mean arterial pressure and increased BP to predict pre-eclampsia.

Searching
MEDLINE, EMBASE, the Cochrane Library and MEDION were searched from inception to February 2007 without any language restrictions; the search terms were reported. The reference lists of retrieved studies were screened and authors were contacted to identify additional studies.

Study selection
Accuracy studies evaluating any technique to measure BP in pregnant women with any level of risk of pre-eclampsia, in any health care setting, were eligible for inclusion. There were no inclusion criteria relating to the reference standard. Few details were provided of the included studies. It appears that there was a variety of patient populations across the studies: some were restricted to women at high risk, and some included and others excluded women with chronic hypertension. Studies also varied on whether they reported results for either the first, second, or both trimesters. Different definitions for different severities of pre-eclampsia used as the reference standard were described.

Two independent reviewers screened studies for inclusion, with any disagreements resolved by consensus or by referral to a third reviewer.

Assessment of study quality
One reviewer assessed the quality of the studies against the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) criteria, with a second reviewer making random checks.

Data extraction
The sensitivity and specificity were calculated from 2×2 tables derived from each study. Two reviewers independently extracted the data, with any disagreements resolved by consensus or by referral to a third reviewer.

Methods of synthesis
Pooled sensitivities and specificities were used to derive likelihood ratios, and summary receiver operating curves were produced and the area under the curve (AUC) calculated. Studies measuring similar BP variables and outcomes were pooled together. A bivariate regression model was used to account for the negative correlation between sensitivity and specificity. The Akaike's information criteria was used to assess the goodness of fit of the model. Subgroup analyses were planned a priori to investigate a number of variables, such as the underlying risk of pre-eclampsia, stage of pregnancy and number of measurements recorded.

Results of the review
Thirty-four studies (60,599 women; 3,341 with pre-eclampsia) were included; the sample sizes ranged from 22 to 22,582. Three studies were randomised controlled trials, three were case-control studies and the remainder were diagnostic cohorts.
Less than 30% of studies met the quality criteria relating to patient spectrum, selection criteria, index and reference standard tests, and blinding to the reference standard results. Over 70% met the criteria relating to delay between tests, partial and differential verification bias, blinding to index test results and clinical data available.

In the second trimester, mean arterial pressure (AUC 0.76, 95% confidence interval, CI: 0.70, 0.82; sensitivity at 90% specificity: 35%) was a better indicator of pre-eclampsia than systolic BP (AUC 0.68, 95% CI: 0.64, 0.72; sensitivity at 90% specificity: 24%), diastolic BP (AUC 0.66, 95% CI: 0.59, 0.72; sensitivity at 90% specificity: 35%), or increase in BP in women at low risk. Pooled sensitivity for a mean arterial pressure threshold of 85 mmHg (6 studies) or more was 52% (95% CI: 28, 75) and specificity 84% (95% CI: 75, 94), with a derived positive likelihood ratio of 3.3 (95% CI: 2.2, 4.3) and negative likelihood ratio of 0.57 (95% CI: 0.35, 0.80). The results were stated as being similar in the first trimester, but were not reported. Sensitivity was increased slightly when the threshold was raised to 85 mmHg. The results of a range of subgroup and sensitivity analyses were reported.

Authors’ conclusions
When BP is measured in the first or second trimester, the mean arterial pressure is a better predictor for pre-eclampsia than systolic or diastolic BP, or an increased BP.

CRD commentary
The review question and inclusion criteria were broad, but appropriate. Several relevant sources were searched and language restrictions were not applied, thereby reducing the risk of publication and language bias. The review process was conducted in duplicate, which reduces the potential for reviewer error or bias. Study quality was assessed using appropriate criteria. The analysis appears appropriate, although not all the relevant outcomes were reported. Details of the individual studies were very limited, but it does seem that there was substantial clinical heterogeneity across the studies. The authors acknowledged the limitations of the evidence available. This was a generally well-conducted review and the results seem reliable.

Implications of the review for practice and research
Practice: The authors stated that their results do not support the current practice of repeated BP measurements in the first and second trimester in healthy women.

Research: Future research should distinguish between mild and severe pre-eclampsia, and should concentrate on the development of algorithms that combine biochemical and biophysical markers. In addition, a cost-utility analysis is required.

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