Accuracy of ultrasonography with color doppler in ovarian tumor: a systematic quantitative review
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CRD summary
This review concluded that colour Doppler ultrasonography was a useful preoperative test for predicting the diagnosis of pelvic masses. Several of the included studies were small and poor quality which, along with potential for missed studies, large variability across studies and limitations of the analyses, means the authors' conclusion should be viewed with some caution.

Authors' objectives
To estimate the accuracy of ultrasonography with colour Doppler for diagnosis of ovarian tumours.

Searching
MEDLINE, EMBASE, CANCERLIT, LILACS and The Cochrane Library were searched without language restrictions between 1990 and December 2007; search terms were reported. Reference lists of included studies were scanned.

Study selection
Diagnostic accuracy studies of transvaginal ultrasonography with a 5-MHz probe and colour Doppler compared to histology of paraffin-embedded sections for diagnosis of ovarian tumours in women who underwent surgery were eligible for inclusion. Histological diagnosis had to be classified as benign, borderline or malignant; studies that reported only borderline or malignant tumours were excluded. Studies had to report sufficient data to produce a 2x2 table of test performance. Few study details were provided in the included studies. Most of the women (77%) had normal ovarian tissue or benign tumours, 20% had malignant tumours and 3% had borderline tumours on histological examination. The resistance index used as the cut-off for a positive ultrasound test was less than 0.5.

Three independent reviewers selected studies for the review; disagreements were resolved by consensus or referral to a fourth reviewer.

Assessment of study quality
Study quality was assessed in terms of patient selection, test descriptions, verification biases and methods of data collection.

The authors did not specify how many reviewers performed the quality assessment.

Data extraction
Data to construct 2x2 tables of test performance (borderline or malignant versus benign) were extracted by three independent reviewers for English-language studies and one reviewer after translation for foreign language studies. Sensitivity, specificity and diagnostic odds ratio plus 95% confidence intervals (CI) were calculated. Disagreements were resolved by consensus.

Methods of synthesis
Summary estimates of sensitivity and specificity were calculated using a random-effects model. 95% CI were calculated using the exact method. Where 2x2 tables had a single zero cell, 0.5 was added to all cells; tables with two zero cells were excluded from the analyses. Spearman correlation was used to assess for a threshold effect. Where a correlation was observed, summary receiver operating characteristic (SROC) curves were produced using the Moses-Littenberg model. The area under the curve was calculated. Heterogeneity was assessed using the Cochran Q statistic. The impact of study quality was investigated by pooling high-quality studies. Publication bias was assessed using funnel plots.
Results of the review
Twelve studies met the inclusion criteria (n=2,398, range 41 to 826). Six studies were small, prospective and reported sufficient details of the tests, but were not blinded; these were considered high quality as they passed 55% or more of the quality criteria.

Colour Doppler ultrasonography had a sensitivity of 87% (95% CI 84% to 90%), specificity of 89% (95% CI 87% to 90%) and diagnostic odds ratio of 125 (95% CI 55 to 285) when the cutoff of borderline or malignant (positive test) versus benign (negative test) was used; significant heterogeneity was observed for all three analyses (p=0.001 and $I^2=65\%$ or over). The area under the SROC curve was 0.9573 (standard error 0.0181). No threshold effect was detected (Spearman correlation coefficient 0.042, p=0.897).

The estimates did not alter significantly when high-quality studies were pooled separately. Funnel plots showed evidence of publication bias.

Authors’ conclusions
Colour Doppler ultrasonography is a useful preoperative test for predicting the diagnosis of pelvic masses.

CRD commentary
The review addressed a clear question supported by appropriate inclusion criteria. Several relevant sources were searched without language restrictions. A diagnostic filter was used during the electronic searches, so studies may have been missed. There was no specific search for unpublished data. Study selection and data extraction was conducted in duplicate, which reduced the risk of error and bias. It was unclear whether similar methods were used during the assessment of study quality. Study quality was assessed using appropriate criteria, and the results for each study reported. Insufficient study details were provided to allow the reader to make an assessment of differences across populations, settings and execution of the tests. Although there was no threshold effect, there was substantial heterogeneity between studies; therefore, the reliability and generalisability of the pooled estimates of sensitivity and specificity were unclear. The SROC model used did not take into account between-study variability. Given the small sample sizes of most of the included studies, overall poor quality and heterogeneous nature of the available evidence, potential for missed studies and the limitations of the analyses, the authors’ conclusion should be viewed with some caution.

Implications of the review for practice and research
Practice: The authors stated that better methods to improve the diagnostic accuracy of the diagnosis of borderline ovarian tumours were required.

Research: The authors stated that blinded prospective diagnostic accuracy studies were needed of colour Doppler ultrasonography used to diagnose ovarian cancers.

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