Color duplex ultrasonography is insensitive for the detection of endoleak after aortic endografting: a systematic review

CRD summary
This review evaluated the diagnostic accuracy of colour duplex ultrasonography (CDU) for the detection and classification of endoleaks after aortic endografting. It concluded that CDU did not have sufficient diagnostic accuracy for the detection of all endoleaks in routine clinical practice. Although this review does have limitations, the cautious conclusions seem appropriate.

Authors' objectives
To evaluate the diagnostic accuracy of colour duplex ultrasonography (CDU) compared with contrast-enhanced computed tomography (CECT) for the detection and classification of endoleaks after aortic endografting.

Searching
MEDLINE, EMBASE, PubMed, BioMed Central, BIDS and the Institute of Scientific Information (Ingenta) were searched from 1991 to 2004. The search strategies were optimised for each database, but details of the search terms were not reported. An Internet search was conducted to identify reviews, and the bibliographies of retrieved reviews were screened.

Study selection
Study designs of evaluations included in the review
Studies with follow-up at defined time points and results reported for each time point or summated over the entire follow-up period were eligible for inclusion. Studies where the delay between the index test and reference standard exceeded 7 days for the 1-month follow-up, 1 month for the 3-month follow-up and 6 weeks for follow-up at 6 months or beyond were excluded. Case reports and studies with less than 10 patients were excluded. No further study details were provided.

Specific interventions included in the review
Studies of CDU, where the CDU procedure was reported in full, were eligible for inclusion. The interpreter had to be blinded to the CECT results.

Reference standard test against which the new test was compared
Studies using CECT as the 'gold' standard, where the CECT procedure was reported in full, were eligible for inclusion. The interpreter had to be blinded to the CDU results.

Participants included in the review
Studies of patients undergoing investigation for the detection and classification of endoleaks from 1 month following abdominal aortic aneurysm (AAA) endografting were eligible for inclusion. The patients had to be a consecutive series representative of clinical practice. Studies of aortic endografts implanted suprarenally or in the thoracic aorta were excluded. No details of the participants in the included studies were reported.

Outcomes assessed in the review
The studies had to provide sufficient data to construct a 2x2 contingency table. Endoleaks were classified according to published definitions (White et al., see Other Publications of Related Interest).

How were decisions on the relevance of primary studies made?
Two reviewers independently screened full papers for relevance.
Assessment of study quality
The authors applied several selection criteria relating to quality, therefore restricting the inclusion of studies to those of higher quality. The criteria were broadly based on QUADAS (Quality Assessment of Diagnostic Accuracy Studies) guidelines and related to the patient spectrum, blinding of interpreters, and the avoidance of disease progression bias. Two reviewers independently applied the quality inclusion criteria.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Two by three contingency tables, which included indeterminate CDU scans, were constructed. Indeterminate scans were classified as indicating an endoleak on CDU. One study reporting an indeterminate CECT scan was excluded from the analysis. Sensitivity and specificity with 95% confidence intervals (CIs) were calculated for each study. Authors were contacted for additional information where required; studies with insufficient information were excluded if there was no response within 1 month of the request. Where available, data were extracted for 3-, 12- and 24-month time points.

Methods of synthesis
How were the studies combined?
The results were combined using a random-effects meta-analysis because of significant heterogeneity between the studies. Owing to the paucity of data, results from all time points were pooled together.

How were differences between studies investigated?
Heterogeneity was assessed using the Q test. Forest plots and receiver operator characteristics plots were provided for visual inspection of heterogeneity. Age, gender, graft type, and AAA diameter, were investigated as potential sources of heterogeneity.

Results of the review
Ten studies (n=711) were included, of which eight were published and two were unpublished.

The rate of endoleak ranged from 6 to 38%. The pooled sensitivity for CDU was 69.1% (95% CI: 51.7, 86.6) and the specificity was 90.6% (95% CI: 86.7, 94.6); specificity was superior to sensitivity in most studies.

There was significant heterogeneity for both sensitivity and specificity (p<0.0001); none of the factors investigated were considered to explain this heterogeneity. The exclusion of indeterminate CDU results or data from the unpublished studies did not alter the results.

Five studies reported the classification of endoleaks; CDU detected 8 of 9 type I, 8 of 33 type II and 2 of 3 type III endoleaks.

Authors’ conclusions
At the current time, CDU does not have sufficient diagnostic accuracy for the detection of all endoleaks in routine clinical practice. The diagnostic accuracy of CDU may improve if type II endoleaks are ignored.

CRD commentary
The authors addressed a clear research question. Several appropriate databases were searched and unpublished data were sought. It was unclear whether any language restrictions were applied. Appropriate quality criteria were applied as inclusion criteria. The full paper stage of study selection and the quality assessment were conducted in duplicate; it was unclear whether similar methods to reduce error and bias were employed during the title and abstract stage of study selection and the data extraction. Data were pooled across different time points and imaging protocols; although the pooling of such heterogeneous data may be questionable, the authors did attempt to investigate the sources of
heterogeneity, but without success. Insufficient study details were provided. Despite some limitations of this review, the cautious conclusions seem appropriate.

Implications of the review for practice and research
Practice: The authors stated that if centres continued to use only CDU for surveillance, there should be a systematic internal validation process to regularly monitor diagnostic accuracy by comparison with CECT scans. CDU should not displace CECT for aortic endograft surveillance as the routine clinical practice in public-funded health care systems.

Research: The authors did not state any implications for further research.

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Other publications of related interest

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MeSH
Angioscopy; Aortic Aneurysm, Abdominal /surgery; Blood Vessel Prosthesis Implantation /adverse effects /instrumentation; Follow-Up Studies; Humans; Postoperative Care /methods; Postoperative Hemorrhage /classification /etiology /ultrasonography; Prosthesis Failure; Reproducibility of Results; Retrospective Studies; Sensitivity and Specificity; Severity of Illness Index; Ultrasonography, Doppler, Color

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Record Status
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.