Transthoracic sonography for the detection of pulmonary embolism: a meta-analysis

Niemann T, Egelhof T, Bongartz G

CRD summary
The authors concluded that transthoracic ultrasound was a diagnostic alternative for special clinical settings in the work-up of suspected pulmonary embolism. These conclusions should be interpreted with some caution as no details on clinical settings in which studies were conducted were provided, there was a possibility of missed studies and there were limitations in the quality assessment.

Authors' objectives
To determine the diagnostic accuracy of transthoracic ultrasound for diagnosis of pulmonary embolism.

Searching
PubMed and EMBASE were searched from 1990 to 2006 for studies published in English, German or French. Reference lists of retrieved articles were screened.

Study selection
Studies that evaluated transthoracic ultrasound in patients with suspected pulmonary embolism compared to the reference standard of computed tomography (CT), magnetic resonance imaging (MRI) or a multi-diagnostic approach were eligible for inclusion. Studies needed to report sufficient data to construct a 2x2 table of test performance. One study was excluded because of selection bias of the included patients, which the authors claimed meant it was not comparable with the other included studies. Reviews, case reports, letters and comments were excluded.

Four studies used CT and a multimodality approach when the CT was negative as the reference standard; one study used MRI angiography. Mean age, where reported, ranged from 62 to 69 years. Prevalence of pulmonary embolism ranged from 49% to 64%.

Two reviewers independently assessed studies for inclusion. Disagreements were resolved through consensus.

Assessment of study quality
Two reviewers independently assessed study quality according to the STARD guidelines and used this to assign a summary score to each study.

Data extraction
Data were extracted as 2x2 tables of test performance. To avoid calculation problems caused by 0 values, 0.5 was added to each cell of the 2x2 table. Sensitivity and specificity were calculated for each study.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Summary sensitivity and specificity, together with 95% confidence intervals (CI), were estimated using the DerSimonian and Laird random-effects model. Heterogeneity was assessed using the X^2 statistic. Summary receiver operating characteristic (SROC) curves were estimated using the Moses Littenberg method.

Results of the review
Five prospective studies (n=652) were included. Mean quality score was 17.5 out of 25.

Some results were reported differently in the abstract, text and forest plots of the paper.

Sensitivity ranged from 74% to 94% (less than 83% in all but one study). Summary sensitivity was 80% (95% CI 75% to 84%). There was strong evidence of heterogeneity in sensitivity across studies (p=0.003).
Specificity ranged from 87% to 95%. Summary specificity was 93% (95% CI 90% to 96%). There was no evidence of heterogeneity for specificity (p=0.54).

The area under the SROC curve was 94.8% (SEE 0.0096).

**Authors' conclusions**
Transthoracic ultrasound is a diagnostic alternative for special clinical settings in the work-up of suspected pulmonary embolism.

**CRD commentary**
The review addressed a focused question supported by clearly defined inclusion criteria. However, one study that fulfilled the inclusion criteria was excluded as the authors considered that selection bias was present and made it incomparable with the other included studies; the appropriateness of this approach was debatable. The literature search was adequate for published studies. The restriction to published studies in certain languages meant that there was a possibility of language and publication biases. Appropriate steps were taken to minimise bias and errors in study selection and quality assessment; it was unclear whether such steps were taken during data extraction. Criteria used to assess study quality were guidelines for reporting primary studies rather than criteria for assessing the quality of studies. The authors reported only a mean quality score across studies, which was impossible to interpret without knowing exactly which criteria were assessed and which were fulfilled by each individual study. Therefore, reliability of the included studies was unclear. Limited study details, especially in relation to participants, were reported in tables; additional details would have helped to determine generalisability of results. Methods used to pool data were acceptable. Results were clearly reported. Inclusion of a SROC plot provided a concise overview of the review findings. The authors' conclusions should be interpreted with some caution as no details on clinical settings in which studies were conducted were provided, there was a possibility of missed studies and there were limitations in the quality assessment.

**Implications of the review for practice and research**

**Practice:** The authors stated that transthoracic ultrasound for detection of pulmonary embolism should not be the first choice imaging modality in all patients as other modalities such as CT were more accurate. However, it seemed helpful in special settings when CT was not immediately available or when critically ill patients could not be moved. However, these recommendations were not directly supported by the results of the review.

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

**Funding**
EC-EURATOM 6 Framework Programme (2002 to 2006) and CT Safety and Efficacy project contract FP/002388.

**Bibliographic details**

**PubMedID**
19253205

**DOI**
10.1055/s-2008-1027856

**Original Paper URL**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
AccessionNumber
12009106468

Date bibliographic record published
05/08/2009

Date abstract record published
19/05/2010

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.