Accuracy of a 12-lead electrocardiogram in screening patients with suspected heart failure for open access echocardiography: a systematic review and meta-analysis

CRD summary
This review assessed the usefulness of 12-lead electrocardiogram (ECG) in screening patients with suspected heart failure for referral to echocardiography. The conclusion that 12-lead ECG is an inadequate screening tool is unreliable given the small number of studies included, differences in their results, and problems with the methods used by the review. Further research is needed.

Authors' objectives
To determine the usefulness of a 12-lead electrocardiogram (ECG) for the identification of left ventricular systolic dysfunction (LVSD) in patients referred for open access echocardiography.

Searching
MEDLINE and EMBASE were searched from 1993 to December 2002; the search terms were reported. To identify additional studies, the Cochrane Library was searched, the reference lists of included articles were checked, and experts in the field were contacted. All searches were limited to articles reported in the English language.

Study selection
Study designs of evaluations included in the review
No inclusion criteria for the study design were specified. All included studies were retrospective.

Specific interventions included in the review
Studies assessing the usefulness of 12-lead ECG were eligible for inclusion. Where stated, cardiologists reported ECGs in the included studies.

Reference standard test against which the new test was compared
The included studies were required to use a clearly reported reference standard. The included studies used echocardiography as the reference standard.

Participants included in the review
Patients with suspected heart failure referred from primary care to open access echocardiography services were eligible for inclusion.

Outcomes assessed in the review
No inclusion criteria for the diagnostic outcome were specified. Sensitivity and specificity were calculated for each included study.

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 specify a method for assessing the quality of the included studies. However, some elements of study quality were used as inclusion criteria for the review: clear descriptions of population, setting, reference standard, index test and diagnostic criteria. The authors also stated that no included study reported whether or not echocardiographers were blinded to other information. The authors did not state how the papers were assessed for quality, or how many reviewers performed the quality assessment.
Data extraction
Two reviewers independently extracted the data from the primary studies. Any disagreements were resolved by discussion.

Methods of synthesis
How were the studies combined?
A summary receiver operating characteristic (sROC) curve was estimated, using the method of Moses and Littenberg (see Other Publications of Related Interest) to incorporate the effect of changing diagnostic threshold on test performance. The area under the curve (AUC) and its 95% confidence interval (CI) was calculated as a summary measure of test performance.

How were differences between studies investigated?
The authors did not report a method of assessing between-study heterogeneity. Potentially important, possible sources of heterogeneity were discussed in the article.

Results of the review
Four studies (1,327 participants) were included in the review. The prevalence of LSVD in the included studies ranged from 18 to 36%.

The sensitivity of 12-lead ECG ranged from 0.73 (specificity 0.53) to 0.94 (specificity 0.61), while the specificity ranged from 0.20 (sensitivity 0.78) to 0.65 (sensitivity 0.91). The estimated AUC for the sROC curve was 0.84 (95% CI: 0.33, 1.00).

Authors’ conclusions
A 12-lead ECG is an inadequate screening tool for identifying patients with suspected heart failure who require echocardiography.

CRD commentary
The review addressed a clearly stated research question using broad but appropriate inclusion criteria. The literature search was limited to English language articles and, as such, might have excluded relevant information. In addition, the authors referred to the use of ‘diagnostic and guideline search filters’; diagnostic search filters are known to have limited sensitivity and their use may lead to reduced retrieval of the available literature. The reporting of the assessment of methodological quality of the included studies, as well as the review process itself, was limited. It was therefore difficult to assess the potential for the introduction of bias or error during the review process or as a result of methodological flaws in the included studies.

The authors stated that the included studies were not well reported, and discussed the potential sources and impact of between-study heterogeneity; available details of the included studies were reported. However, there was no formal assessment of between-study heterogeneity to indicate whether or not pooling might be appropriate. The wide CI on the estimated AUC tends to suggest the presence of significant between-study heterogeneity, as does visual inspection of the ROC plot. In these circumstances, the value of AUC as a summary estimate is questionable. The authors’ conclusions, that 12-lead ECG is an inadequate screening tool, are somewhat strong given that they were based on a small heterogeneous data set.

Implications of the review for practice and research
Practice: The authors stated that 12-lead ECG is an inadequate screening tool for identifying patients with suspected heart failure who require echocardiography.

Research: The authors stated that further research to determine the usefulness of other screening strategies, including B-type natriuretic peptide, is required.
Bibliographic details

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15352303

Other publications of related interest

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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.