Does this dyspneic patient in the emergency department have congestive heart failure?

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CRD summary
This review assessed the usefulness of components of medical history, clinical examination and routine diagnostic studies in the diagnosis of heart failure as the cause of dyspnea in the emergency department. The authors concluded that a directed history, physical examination, chest radiograph and electrocardiography are useful. The authors’ conclusions are likely to be reliable.

Authors’ objectives
To assess the accuracy of components of medical history, clinical examination and routine diagnostic studies in diagnosing heart failure as the cause of dyspnea in the emergency department.

Searching
MEDLINE was searched from 1966 to July 2005; the search terms were reported. Reference lists of retrieved studies, review articles and standard physical examination textbooks were searched manually. Only studies published in English were eligible for inclusion in the review.

Study selection
Study designs of evaluations included in the review
Diagnostic accuracy studies were included in the review. Review articles with no original data were excluded from the review.

Specific interventions included in the review
Studies that assessed some element of medical history, physical examination or readily available diagnostic tests (chest radiograph, electrocardiogram (ECG) and serum B-type natriuretic peptide (BNP)) were eligible for inclusion. Studies that investigated other cardiac neurohormones, such as A-type natriuretic peptide or other forms of BNP (e.g. NT-proBNP), or did not report that clinical examination had been performed, were excluded from the review. The included studies used various cut-off levels of BNP (from 50 pg/mL and above to 250 pg/mL and above).

Reference standard test against which the new test was compared
Studies in which the reference standard was a diagnosis agreed upon by a panel of physicians, after evaluating for appropriate symptoms and signs of heart failure and an appropriate measure of cardiac dysfunction, were eligible for inclusion. Studies that used only echocardiography, computed tomography (CT) scans or invasive haemodynamic monitoring, without clinical correlation, were excluded from the review. The reference standard in the included studies was retrospective review by at least one physician along with echocardiography; some studies also used other investigations such as radionuclide ventriculography, cardiac catheterisation, pulmonary function test and high-resolution CT scan.

Participants included in the review
Studies of adult patients with undifferentiated dyspnea presenting to the emergency department were eligible for inclusion, regardless of whether the patients had known cardiac or pulmonary diseases. The studies included both men and women who presented to the emergency department with dyspnea, acute severe dyspnea, dyspnea requiring admission, or dyspnea for less than 2 weeks. The average age of the participants in the studies ranged from 63 to 80.3 years, where stated, and between 32 and 83% had heart failure. The majority of studies excluded patients with acute coronary syndromes or who had an obvious cause of dyspnea.

Outcomes assessed in the review
Studies that evaluated diagnostic accuracy and presented sufficient data to construct 2x2 contingency tables were eligible for inclusion in the review.
How were decisions on the relevance of primary studies made?
One author identified relevant titles and abstracts. Two reviewers independently assessed all retrieved articles for relevance, and any disagreements were resolved by consensus.

Assessment of study quality
The quality of the included studies was assessed using the grading scheme developed by Sackett et al. Potential grades ranged from level 5 to level 1. Level 5 studies were comparisons of clinical findings with a reference standard of unknown or uncertain validity among convenience samples of patients and, perhaps, healthy patients. Level 1 studies were primary prospective studies of the accuracy or precision of the clinical examination that involved comparisons of clinical findings with a reference standard of diagnosis among a large number of consecutive or random patients with dyspnoea; for precision studies this required two or more independent blinded raters of symptoms or signs in a large number of patients. Two reviewers independently assessed the validity of the included studies, and any disagreements were resolved by consensus.

Data extraction
Two reviewers independently extracted the data from the included studies, and any disagreements were resolved by consensus. Data were extracted from studies and used to construct 2x2 contingency tables for each clinical variable.

Methods of synthesis
How were the studies combined?
When two or more studies reported data on the same variable, summary positive and negative likelihood ratios (LRs) and 95% confidence intervals (CIs) were calculated using random-effects models, based on the delta method. Lower quality studies (levels 4 and 5) were not included in the meta-analysis.

How were differences between studies investigated?
The authors did not appear to have assessed statistical heterogeneity.

Results of the review
Twenty-two studies were included in the review. The number of included patients was not stated.

Accuracy of the clinical examination (13 studies).

The overall clinical examination by the emergency department physician had a high positive LR (4.4, 95% CI: 1.8, 10.0) for a final diagnosis of heart failure. The odds of having heart failure when the clinical examination suggested that the patient was unlikely to have heart failure were decreased by about half (negative LR 0.45, 95% CI: 0.28, 0.73).

Medical history.
The most useful features in confirming the presence of heart failure were a medical history of congestive heart failure (positive LR 5.8, 95% CI: 4.1, 8.0), myocardial infarction (positive LR 3.1, 95% CI: 2.0, 5.9) or coronary artery disease (positive LR 1.8, 95% CI: 1.1, 2.8). Patients without a history of heart failure (negative LR 0.45, 95% CI: 0.38, 0.53), coronary artery disease (negative LR 0.68, 95% CI: 0.48, 0.96) or myocardial infarction (negative LR 0.69, 95% CI: 0.58, 0.82) were less likely to have heart failure. None of the other historical findings had statistically significant results.

Symptoms.
The most useful symptoms in confirming the presence of heart failure were paroxysmal nocturnal dyspnoea (positive LR 2.6, 95% CI: 1.5, 4.5), orthopnoea (positive LR 2.2, 95% CI: 1.2, 3.9) or dyspnoea on exertion (positive LR 1.3, 95% CI: 1.2, 1.4). Patients without symptoms of dyspnoea on exertion (negative LR 0.48, 95% CI: 0.35, 0.67),
orthopnoea (negative LR 0.65, 95% CI: 0.45, 0.92) or paroxysmal nocturnal dyspnoea (negative LR 0.70, 95% CI: 0.54, 0.91) were less likely to have heart failure. None of the other symptoms had statistically significant results.

Physical examination.

The most useful physical examination features in confirming the presence of heart failure were the presence of a third heart sound (positive LR 11, 95% CI: 4.9, 25.0), jugular venous distension (positive LR 5.1, 95% CI: 3.2, 7.9), pulmonary rales (positive LR 2.8, 95% CI: 1.9, 4.1), any cardiac murmur (positive LR 2.6, 95% CI: 1.7, 4.1) or leg oedema (positive LR 2.3, 95% CI: 1.5, 3.7). Patients without pulmonary rales (negative LR 0.51, 95% CI: 0.37, 0.70), leg oedema (negative LR 0.64, 95% CI: 0.47, 0.87), jugular venous distension (negative LR 0.66, 95% CI: 0.57, 0.77) or wheezing (negative LR 0.52, 95% CI: 0.38, 0.71) were less likely to have heart failure. None of the other symptoms had statistically significant results.

Accuracy of chest radiographs (7 studies).

The most useful chest radiographic features in confirming the presence of heart failure were pulmonary venous congestion (positive LR 12, 95% CI: 6.8, 21.0), cardiomegaly (positive LR 3.3, 95% CI: 2.4, 4.7) or interstitial oedema (positive LR 12.0, 95% CI: 5.2, 27.0). Patients without cardiomegaly (negative LR 0.33, 95% CI: 0.23, 0.48) or pulmonary venous congestion (negative LR 0.48, 95% CI: 0.28, 0.83) were less likely to have heart failure.

Accuracy of ECG (7 studies).

The most useful ECG features in confirming the presence of heart failure were atrial fibrillation (positive LR 3.8, 95% CI: 1.7, 8.8), new T-wave changes (positive LR 3.0, 95% CI: 1.7, 5.3) or abnormal ECG findings (positive LR 2.2, 95% CI: 1.6, 3.1). Patients with a completely normal ECG (negative LR 0.64, 95% CI: 0.47, 0.88) were less likely to have heart failure.

Accuracy of serum BNP (11 studies).

A low serum BNP (less than 100 pg/mL) was the most useful test for excluding the presence of heart failure (negative LR 0.11, 95% CI: 0.07, 0.16). However, BNP levels should be interpreted differently for patients with renal insufficiency.

Results were also reported for a subgroup of patients in one of the included studies with a history of pulmonary disease.

Authors' conclusions

For dyspnoeic adults presenting at the emergency department, a directed history, physical examination, chest radiograph and ECG should be performed. If the suspicion of heart failure remains, obtaining a serum BNP level may be helpful, especially for excluding heart failure.

CRD commentary

The review question was clear in terms of the interventions, participants and outcomes of interest. The inclusion criteria relating to the reference standard test were not apparently adhered to. Criteria required the diagnosis to be agreed upon by a panel of physicians. However, in four of the studies the reference standard was a retrospective review by only one physician along with echocardiography.

Limiting the search to English language reports listed in one electronic database or identified from reference lists might have resulted in the omission of other relevant studies and raised the possibility of both publication and language bias; the presence of publication bias was not assessed. Two reviewers independently assessed studies for inclusion and performed the quality assessment and data extraction processes, thus reducing the potential for reviewer bias and errors. The validity of the included studies was assessed using an appropriate validated scale. Some details of the included studies were tabulated. However, three of the studies that met the quality level required for inclusion in the meta-analyses, as well as the four lower quality studies, were not included in the table summarising study characteristics. The methods used to synthesise the data appeared appropriate, but since heterogeneity was not assessed it was unclear if the
results were consistent among studies. The authors’ conclusions follow from the evidence presented and are likely to be reliable. Other relevant studies might, however, have been missed.

**Implications of the review for practice and research**
Practice: The authors stated that for dyspneic adults presenting at the emergency department, a directed history, physical examination, chest radiograph and ECG should be performed. They also stated that if the suspicion of heart failure remains, obtaining a serum BNP level may be helpful, especially for excluding heart failure. If the overall clinical impression based upon findings of tests with high LRs for heart failure are present, they may be sufficient to warrant empirical treatment without further urgent investigation. If the clinical suspicion of heart failure is very low, the physician should investigate and treat other causes of dyspnoea.

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

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**Other publications of related interest**
These additional published commentaries may also be of interest. Wyer PC. Review: medical history, physical examination, and routine tests are useful for diagnosing heart failure in dyspnoea. Evid Based Med 2006;11:58. Wyer PC. Review: medical history, physical examination, and routine tests are useful for diagnosing heart failure in dyspnoea. ACP J Club 2006;144:49.

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the reliability of the review and the conclusions drawn.