Systematic review and modelling of the investigation of acute and chronic chest pain presenting in primary care

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CRD summary
This well-conducted review concluded that, where an acute coronary syndrome was suspected, emergency referral was justified and electrocardiogram (ECG) interpretation in acute chest pain could be highly specific for diagnosis of myocardial infarction. Point of care testing with troponins was cost-effective in the triaging of these patients. Other conclusions were also presented. The authors’ conclusions are likely to be reliable.

Authors’ objectives
To assess the value of different methods, including clinical features, resting and exercise electrocardiogram (ECG) and rapid access chest pain clinics, in the diagnosis and early management of acute coronary syndrome, suspected acute myocardial infarction and exertional angina.

Searching
MEDLINE, EMBASE, CINAHL and the Cochrane Library were searched from 1966 to October 1999. Search strategies were reported in full. Electronic abstracts of recent cardiology conferences were also searched. Holders of current research grants on the National Research register were surveyed. References of included studies and relevant reviews were checked.

Study selection
Studies of patients with chest pain thought to be cardiac in origin who underwent a diagnostic test were eligible for inclusion. For patients with acute chest pain the following tests were eligible: history/clinical features as a test, resting electrocardiogram (ECG), or combinations of these. For patients with chronic chest pain studies, resting ECG and exercise ECG were eligible tests. Definitions of acute and chronic chest pain, myocardial infarction and acute coronary syndrome were given in the review. Studies that included more than 20% of patients with a previous myocardial infarction were excluded from the review. Also excluded were case-control studies and studies that assessed only the prognostic, rather than the diagnostic, value of a test.

The characteristics and focuses of included studies varied widely; full details were reported in the review.

Two reviewers independently assessed the studies for inclusion in the review. Disagreements were resolved through arbitration by the review steering group.

Assessment of study quality
Two independent reviewers assessed the studies using the following criteria: incorporation bias, verification bias, blinding, selection of study sample, study population, and the treatment of indeterminate results. The results of the assessment were checked by a third reviewer.

Data extraction
Data were extracted on true and false positives and negatives to permit the calculation of likelihood ratios (LR).

Two independent reviewers carried out the data extraction, which was then checked by a third reviewer.

Methods of synthesis
Weighted average likelihood ratios, with 95% confidence intervals (CI), were calculated using the Mantel-Haenszel method. Heterogeneity was assessed using the X² statistic.

Results of the review
One hundred and seventy studies were included in the review. The methodological quality of the included studies varied considerably.

**Acute chest pain - clinical symptoms and signs** (21 studies): No clinical feature in isolation was useful for diagnosing or excluding acute coronary syndrome. The most informative signs were pleuritic pain (positive LR 0.19, 95% CI 0.14 to 0.25) and pain on palpation (positive LR 0.23, 95% CI 0.08 to 0.30).

**Acute chest pain - resting ECG** (53 studies): The presence of ST elevation was highly specific for the diagnosis of myocardial infarction (positive LR 13.1, 95% CI 8.28 to 20.6). Completely normal ECG was useful for ruling out myocardial infarction (positive LR 0.14, 95% CI 0.11 to 0.20). Clinical interpretation of ECG (15 ‘black box studies’ of real time decision making in evaluation of acute coronary syndrome) showed high positive likelihood ratios but low sensitivity.

**Chronic chest pain - resting ECG** (13 studies): Resting ECG features had limited usefulness. The positive likelihood ratio for the presence of Q-waves was 2.56 (95% CI 0.89 to 7.30). One study showed an likelihood ratio of 9.96 (95% CI 2.58 to 38.5) for QRS notching.

**Chronic chest pain - exercise ECG** (111 studies): With a 1mm cut-off the presence of ST depression had a positive likelihood ratio of 2.79 (95% CI 2.53 to 3.07) and a negative likelihood ratio of 0.44 (95% CI 0.40 to 0.47). The test performed better in men (LR 2.92, 95% CI 2.17 to 3.93) than in women (LR 1.92, 95% CI 1.72 to 2.24). With a 2mm cut-off, the positive likelihood ratio was 3.85 (95% CI 2.49 to 5.98) and the negative LR was 0.72 (95% CI 0.65 to 0.81).

**Rapid assessment chest pain clinic** (nine studies): There were no true evaluation studies. There was weak evidence that suggested that rapid assessment clinics were associated with reduced hospital admissions in patients with non-cardiac pain, better recognition of acute coronary syndrome, earlier assessment by specialists of exertional angina and earlier diagnosis of non-cardiac chest pain.

**Cost information**
A full economic evaluation was performed using a Monte Carlo simulation for the evaluation of assessment of suspected acute coronary syndrome and a discrete event simulation for the assessment of suspected exertional angina. Point of care testing with troponins was cost-effective. Pre-hospital thrombolysis on the basis of ambulance telemetry was more effective and more costly than thrombolysis in hospital. Rapid assessment chest pain clinics were predicted to result in earlier diagnosis of confirmed coronary heart disease and non-cardiac chest pain than other methods, but were also more expensive. The benefits of the clinics ceased if waiting times for further investigations exceeded six months.

**Authors’ conclusions**
Where an acute coronary syndrome was suspected emergency referral was justified. Electrocardiogram (ECG) interpretation in acute chest pain could be highly specific for the diagnosis of myocardial infarction. Point of care testing with troponins was cost-effective in the triaging of patients with suspected acute coronary syndrome. Resting ECG and exercise ECG were of limited value in the diagnosis of coronary heart disease. The potential advantages of rapid access chest pain clinics were lost if there were long waits for further investigations.

**CRD commentary**
The review question and inclusion criteria were clear. The authors searched several relevant databases and other sources, which reduced the chances of relevant studies being omitted. Methods designed to reduce reviewer bias and error were used at all stages of the review process.

A validity assessment using appropriate criteria was conducted and was used to inform the synthesis. The synthesis was conducted using suitable methodology.

The authors’ conclusions reflected the results of the review and appear likely to be reliable.
**Practice:** The authors stated the following implications for practice: in patients where an acute coronary syndrome is suspected, emergency referral for further assessment in a specialist setting is justified; ECG interpretation in acute chest pain can be highly specific for the diagnosis of myocardial infarction; point of care testing with troponins is cost-effective in the triaging of patients with suspected acute coronary syndrome; resting ECG and exercise ECG are of limited value in the diagnosis of coronary heart disease; and the potential advantages of rapid access chest pain clinics are lost if there are long waits for further investigations.

**Research:** The authors stated the following recommendations for further research: the determination of the most appropriate model of care to enable accurate triaging of patients with suspected acute coronary syndrome; establishment of the cost-effectiveness of pre-hospital thrombolysis in rural areas; determination of the relative cost-effectiveness of rapid access chest pain clinics compared with other innovative models of care; investigation of how these clinics should be managed; and assessment of the long-term outcomes of patients discharged from the clinics.

**Funding**
Health Technology Assessment Programme on behalf of the National Institute for Clinical Excellence, project number 97/12/01

**Bibliographic details**

**PubMedID**
14754562

**Original Paper URL**
http://www.HTA.ac.uk/execsumm/summ802.shtml

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Acute Disease; Adult; Aged; Biomedical Technology; Chest Pain /diagnosis /therapy; Coronary Disease /diagnosis; Diagnosis, Differential; Electrocardiography; Exercise Test; Female; Fibrinolytic Agents /therapeutic use; Humans; Male; Middle Aged; Monte Carlo Method; Myocardial Infarction /diagnosis; Primary Health Care /methods; Reference Standards

**AccessionNumber**
12004008173

**Date bibliographic record published**
23/03/2004

**Date abstract record published**
15/12/2010

**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.