Cost-effectiveness of coronary computed tomography and cardiac stress imaging in the emergency department: a decision analytic model comparing diagnostic strategies for chest pain in patients at low risk of acute coronary syndromes

Priest VL, Scuffham PA, Hachamovitch R, Marwick TH

**Record Status**
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

**CRD summary**
This study examined the cost-effectiveness of diagnostic imaging strategies for low-risk patients with acute chest pain who presented to the emergency department. The two-stage strategy of computed tomography angiography with single-photon emission computed tomography was more cost-effective than stress-based strategies. Further research was needed for long-term costs and consequences of each strategy. The methods and results were mostly clear and comprehensive. Despite the uncertain data, the conclusions reached by the authors appear to be appropriate.

**Type of economic evaluation**
Cost-utility analysis

**Study objective**
The aim was to examine the costs and effectiveness of diagnostic imaging strategies for low-risk patients with acute chest pain and presenting to the emergency department.

**Interventions**
The study assessed the cost-effectiveness of five strategies: exercise electrocardiography (ECG), exercise and pharmacological stress echocardiography, exercise and single-photon emission computed tomography (SPECT), computed tomography angiography (CTA) only, and CTA with confirmatory SPECT.

**Location/setting**
USA/secondary care.

**Methods**

Analytical approach:
A decision-analytic model was used to synthesise evidence from published studies, trial data and meta-analyses. The authors did not state the study perspective. The analytical time frame was 12 months following diagnosis.

Effectiveness data:
Effectiveness data were derived from relevant studies that published diagnostic evidence during randomised clinical trials and meta-analyses. The main clinical effectiveness estimates were accuracy of diagnostic tests indicated by their sensitivity and specificity. Cardiovascular events and risk of mortality were measured.

Monetary benefit and utility valuations:
Utility scores were derived from two relevant published studies where utility values were available for myocardial infarction, negative test result, true-positive test result and false-positive test results.

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs).

Cost data:
Direct medical costs included the cost of the different diagnostic procedures. Current Procedural Codes were used to provide procedural, monitoring and therapeutic costs. Weighted average costs from diagnostic related groups were used.
for hospitalisation and further treatments. Costs were reported in 2010 US dollars ($).

Analysis of uncertainty:
One-way sensitivity analyses were undertaken to test variation in type of stress-based test used and incidence of event rates and costs. Results were presented in tables by prevalence of coronary artery disease: 2%, 5%, 10%, 20%, and 30%.

Results
For all coronary artery disease prevalence levels, higher QALYs were found for CTA with SPECT when compared with the other strategies. Exercise ECG had the lowest sensitivity and specificity and therefore the associated lowest QALYs of all strategies.

Costs were lowest for CTA with SPECT compared with the other strategies. Costs increased with higher prevalence of coronary artery disease. CTA strategies dominated (had lower costs and higher QALYs than) other strategies. CTA remained cost saving with use of pharmacologically induced stress in place of exercise. Results were stable to diagnostic cost and event rate variations.

Authors' conclusions
The authors concluded that the two-stage diagnostic strategy of CTA with SPECT for intermediate scans was more effective and less costly than primarily stress-based regimens such as ECG, SPECT and echocardiography. They suggested that further research was needed for longer-term costs and consequences of each testing strategy.

CRD commentary
Interventions:
The five strategies and the target population of patients were described well. Readers should decide whether the diagnostic test options are available in their own ambulatory settings.

Effectiveness/benefits:
Effectiveness data were based on randomised clinical trials and meta-analyses, which should be good quality. Readers should refer to the original studies to assess the quality of evidence. It was unclear whether or not a systematic review was undertaken to search for the included data and hence unclear whether all the best available evidence was included within the study. The measure of benefit appeared appropriate. Authors should refer to the relevant studies to assess whether the utility variables were appropriate.

Costs:
The perspective of the study was not stated, but appeared to be a health provider perspective that involved direct health care resources. The resource types appeared to include all major relevant types. Discounting costs and health outcomes were not applied; this was appropriate for a 12-month time period.

Analysis and results:
Health outcomes and costs were combined into incremental cost-effectiveness ratios; in most cases the CTA with SPECT strategy dominated, so these ratios were unnecessary. Some sensitivity analyses were undertaken. A probabilistic sensitivity analysis would have enhanced the study by providing an insight into the overall uncertainty of the model. Study limitations were discussed by the authors and related to the small evidence-base for diagnostic accuracy in low-risk patients and limited prognostic data to predict longer term outcomes.

Concluding remarks:
The methods and results were mostly clear and comprehensive. Despite the uncertain quality of the data, the analyses performed for the cost-effectiveness analysis were clear and thorough and the conclusions reached by the authors appear appropriate.

Funding
Not stated.
Bibliographic details

PubMedID
21565744

DOI
10.1016/j.jcmg.2011.03.008

Original Paper URL
http://imaging.onlinejacc.org/cgi/content/abstract/4/5/549

Indexing Status
Subject indexing assigned by NLM

MeSH
Acute Coronary Syndrome /complications /economics /radiography; Algorithms; Angina Pectoris /economics /etiology /radiography; Chest Pain /economics /etiology /radiography; Coronary Angiography /economics; Cost-Benefit Analysis; Decision Support Techniques; Echocardiography, Stress /economics; Emergency Service, Hospital /economics; Hospital Costs; Hospitalization /economics; Humans; Models, Economic; Myocardial Perfusion Imaging /economics; Patient Selection; Predictive Value of Tests; Quality-Adjusted Life Years; Risk Assessment; Risk Factors; Tomography, Emission-Computed, Single-Photon /economics; Tomography, X-Ray Computed /economics

AccessionNumber
22011000932

Date bibliographic record published
13/07/2011

Date abstract record published
10/08/2011