Sixty-four-slice computed tomography of the coronary arteries: cost-effectiveness analysis of patients presenting to the emergency department with low-risk chest pain

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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 64-slice multi-detector computed tomography (MDCT) of the coronary arteries in the emergency department for the evaluation of patients with low-risk chest pain, in comparison with observation unit stay plus either stress electrocardiogram or stress echocardiography. The MDCT risk stratification strategy was less costly and more effective than both observation unit-based strategies. The study was based on valid methodology which, despite limited reporting of some data sources, enhances the validity of the authors’ conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of 64-slice multi-detector computed tomography (MDCT) of the coronary arteries, in the emergency department for the evaluation of patients with low-risk chest pain, in comparison with other diagnostic strategies.

Interventions
MDCT was compared with observation unit stay plus either stress electrocardiogram (ECG) or stress echocardiography. The observation unit care included enzymes and cardiac monitoring.

Location/setting
USA/emergency department.

Methods
Analytical approach:
This economic evaluation was based on a decision analytic model in three patient populations, which differed in their prevalence of symptomatic coronary artery disease. The authors stated that the perspective of the hospital was adopted.

Effectiveness data:
The clinical data came from a selection of known, relevant published studies, which appear to have been selected by the authors. No information was given on the design or other characteristics of these data sources. It was stated that good quality studies were chosen, but no further explanation was given. The key clinical endpoint was the accuracy of the MDCT.

Monetary benefit and utility valuations:
The utility values were derived from the published literature, but the details of these publications were not given.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure. Life expectancy and deaths were also reported, but were not combined with costs.

Cost data:
The economic analysis focused only on those components of costs that differed between the strategies, which included the MDCT, echocardiography, ECG, angiography, percutaneous coronary intervention, coronary artery bypass graft,
physician and hospital services in the observation unit, and missed coronary artery disease resulting in either death or myocardial infarction. The costs and quantities were derived from the authors’ institution and supplemented with national average Medicare reimbursement rates, and published estimates. All costs were in US dollars ($) and the price year was 2007.

Analysis of uncertainty:
Deterministic one-way and threshold analyses were carried out on most of the inputs to the model using confidence intervals (CIs) derived from published sources for the clinical estimates and credible ranges determined by the authors for the economic inputs. A probabilistic sensitivity analysis was also undertaken using a Monte Carlo simulation of 10,000 iterations and beta distributions for the input parameters. CIs around cost-utility ratios were calculated.

Results
In the base case, with a low prevalence of coronary artery disease (6%), the expected costs were $3,461 with ECG, $3,265 with echocardiography, and $2,684 with MDCT. The QALYs were 24.59 with ECG, 24.63 with echocardiography, and 24.69 with MDCT. MDCT dominated both comparators as it was both less expensive and more effective. The 95% CIs for MDCT ranged from dominant to $7,332 compared with ECG and from dominant to $29,738 compared with echocardiography. Echocardiography also dominated ECG.

Similar findings were achieved when considering populations with very low (2%) and moderate (10%) risks of coronary artery disease.

The sensitivity analysis confirmed that these base-case findings were robust; when unfavourable assumptions were made, the incremental cost per QALY gained with MDCT remained below the threshold of $10,000. The most influential model inputs were the cost of MDCT, cost of observation unit care, prevalence of coronary artery disease, specificity of MDCT, and indeterminate rate of MDCT.

Authors’ conclusions
The authors concluded that the MDCT risk stratification strategy was less costly and more effective than both observation unit-based strategies in patients with a low to moderate prevalence of coronary artery disease.

CRD commentary
Interventions:
The authors justified their selection of the comparators. Several emergency departments in the USA had developed observation units with either echocardiography or ECG for patients at risk of coronary artery disease. MDCT was a recent development for the evaluation of coronary artery disease and was not included in the standard of care in the emergency department setting at the time.

Effectiveness/benefits:
The authors did not provide clear information about the approach used to identify the relevant sources of data and on their characteristics (study design, patient population, type of intervention, etc). This makes it difficult to objectively assess the quality and validity of these estimates, but the extensive use of sensitivity analysis limits the uncertainty underlying them. Similarly, no details on the derivation of the utility values were provided. QALYs are a valid benefit measure given their impact on disease-related mortality and morbidity, which are both relevant dimensions of health for this patient population.

Costs:
The analysis included only hospital costs, which was appropriate for the perspective stated. The sources of the costs were reported and included both the authors’ specific institution and findings from published studies. For most costs, macro-categories were presented without information on the resource use and unit costs of individual items. This was due to the use of Medicare data, which are often presented in this way. Most of the cost data were varied in the extensive sensitivity analyses.

Analysis and results:
An appropriate incremental approach was used to synthesise the costs and benefits, and the results were clearly
The issue of uncertainty was extensively investigated using various approaches, which were appropriately described and discussed. The structure and pathways of the decision tree were described. The authors stated that no discounting was necessary because the costs and outcomes of the model were examined for a 30-day period. They acknowledged that some of the clinical data were taken from studies with a higher risk of coronary artery disease than this study population, but this should not have had an impact on the cost-effectiveness results.

**Concluding remarks:**
The study appears to have been based on valid methodology which, despite limited reporting of some data sources, enhances the validity of the authors’ conclusions.

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