Cost-effectiveness of functional cardiac testing in the diagnosis and management of coronary artery disease: a randomised controlled trial - the CECaT trial

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 health technology assessment investigated the best diagnostic approach for patients with suspected, or known, coronary artery disease, using angiography, single photon emission computed tomography (SPECT), magnetic resonance imaging, or stress echocardiography. The authors concluded that all three non-invasive strategies were slightly more expensive than angiography and produced similar quality-adjusted life-years. SPECT was the most favourable of the three non-invasive tests. The methods were sound and the study was extensively presented, in accordance with the guidelines for health technology assessments.

Type of economic evaluation
Cost-utility analysis

Study objective
This health technology assessment (HTA) investigated the best diagnostic approach for patients with suspected, or known, coronary artery disease.

Interventions
The functional cardiac diagnostic tests assessed were: angiography, single photon emission computed tomography (SPECT), magnetic resonance imaging (MRI), and stress echocardiography.

Location/setting
UK/tertiary care.

Methods
Analytical approach:
The analysis was based on a single study with an 18-month time horizon. The authors stated that it was carried out from the perspective of the UK National Health Service (NHS).

Effectiveness data:
The clinical data came from a prospective randomised controlled trial (RCT), involving 898 patients, with 222 in the angiography group (mean age 60.7 years; 67% men), 224 in the SPECT group (mean age 62.1 years; 70% men), 226 in the MRI group (mean age 62.2 years; 68% men), and 226 in the stress echocardiography group (mean age 61.9 years; 71% men). The length of follow-up was 18 months and full follow-up data were available for 187 patients with angiography, 198 with SPECT, 198 with MRI, and 190 with stress echocardiography. Exercise time was the key endpoint and this was measured using a modified Bruce protocol treadmill test.

Monetary benefit and utility valuations:
The utility values were from health-related quality of life interviews, using the European Quality of life (EQ-5D) questionnaire, with the sample of patients included in the RCT. They were assessed at baseline, six months, and 18 months.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and a 3.5% discount rate was applied to those accrued between 12 and 18 months. Life-years gained were also reported.
Cost data:
The economic analysis included the following cost categories: diagnostic imaging tests, revascularisation procedures, in-patient admissions due to cardiac-related adverse events, general practitioner and out-patient visits, repeat imaging tests, and cardiac-related medications. These costs were from the UK institution where the imaging was carried out, the latest NHS Reference Costs, the Personal Social Services Research Unit, and the British National Formulary. The resource use data were from the RCT. All costs were in UK pounds sterling (£) and referred to the fiscal year 2005 to 2006. Those costs incurred between 12 and 18 months were discounted at a rate of 3.5% per annum.

Analysis of uncertainty:
Bootstrapping was used to determine the average estimates and confidence intervals for costs, benefits, and cost-utility ratios. Cost-effectiveness acceptability curves were generated. A deterministic sensitivity analysis was undertaken, varying the following: using the Short Form (SF-6D) Health Survey instead of the EQ-5D; the test costs; the assumption of not performing confirmatory angiography after negative functional tests; excluding cost outliers; and subgroup analysis for type of referring physician (interventional or non-interventional cardiologist, according to their usual clinical practices).

Results
The mean total costs were £3,630 (95% CI 3,196 to 4,154) with angiography; £4,045 (95% CI 3,494 to 4,590) with SPECT; £4,056 (95% CI 3,575 to 4,550) with cardiac MRI; and £4,452 (95% CI 3,817 to 5,223) with stress echocardiography. The QALYs were 1.13 with angiography, 1.17 with SPECT, 1.14 with MRI, and 1.17 with echocardiography and the differences between groups did not reach statistical significance.

Compared with angiography, the incremental cost per QALY gained was £11,463 (95% CI -99,480 to 120,130) with SPECT; £44,573 (95% CI -80,543 to 282,058) with MRI; and £22,157 (95% CI -253,083 to 213,286) with echocardiography. The wide confidence intervals reflected the uncertainty due to small differences in the costs and benefits between the diagnostic tests. The authors stated that a cost-minimisation analysis would have been more appropriate and clearly would have favoured the angiography strategy.

The sensitivity analysis generally confirmed the base-case findings, but they were sensitive to the method of estimation used.

Authors’ conclusions
The authors concluded that all three non-invasive strategies were slightly more expensive than angiography and led to similar QALYs. SPECT was the most favourable of the three non-invasive tests. Future studies should consider a longer time horizon and should analyse new generation tests.

CRD commentary
Interventions:
The selection of comparators was appropriate as the available diagnostic tests were considered. They are likely to be valid in other settings, but the authors noted the limited availability of the functional tests in some areas.

Effectiveness/benefits:
The clinical evidence came from a well-conducted RCT, which is a valid source of data due to the rigour of its methods. The authors stated that the trial was designed to be pragmatic and generalisable. The inclusion and exclusion criteria were reported, as were the power calculations. The trial groups were comparable at baseline and the flow of patients from enrolment through the trial period was described. In general, the trial was satisfactorily carried out and presented. QALYs were appropriately used as the summary benefit measure as they capture the impact of the interventions on the patients’ health and allow cross-disease comparisons to be made. The utility values were estimated in accordance with the guidelines of the National Institute for Health and Clinical Excellence (NICE) and were elicited from the patients who were in the clinical analysis.

Costs:
The analysis of costs was consistent with the viewpoint. The details of unit costs, quantities of resources used, the price year, data sources, and the use of statistical tests were given, enhancing the transparency of the economic analysis.
Bootstrapping was used to assess the variability in resource use and alternative cost estimates were tested in the sensitivity analysis.

Analysis and results:
An appropriate approach was used to synthesise the costs and benefits, which were clearly presented. The issue of uncertainty was investigated in the sensitivity analysis, using valid methods. The authors acknowledged some limitations of their analysis, such as the use of data from a single institution, which might not be representative of other health care centres, especially the patient population, which was predominantly white and European, and the cohort age, which was relatively young. An extensive discussion of the implications of using these tests in the UK was presented and this was not restricted to cost-effectiveness issues.

Concluding remarks:
The methods were sound and the study was extensively presented, in accordance with the guidelines for HTA reports.

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