The effectiveness and cost-effectiveness of computed tomography screening for coronary artery disease: systematic review

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CRD summary
This review concluded that CT can detect calcification of the coronary arteries in asymptomatic patients, and the higher the coronary artery calcification score the higher the risk. Given the limitations of the available evidence and the lack of reporting of the details of the review methodology, the results should be viewed with caution.

Authors' objectives
To evaluate the clinical and cost-effectiveness of screening for heart disease using computed tomography (CT).

Searching
MEDLINE, EMBASE, BIOSIS Previews, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials (CENTRAL), NHS EED, HTA database, DARE, Bandolier, Health Management Information Consortium, Research Findings Register, National Horizon Scanning Centre, Science Citation Index, Web of Science Proceedings, National Research Register and HTA databases were searched for systematic reviews between 1994 and 2003 and primary research from 2004 to 2006; the systematic reviews were used as a source of primary studies. There were no language restrictions applied to the search, but foreign language papers were not included in the review. The search strategy was reported. Bibliographies of included studies were searched.

Study selection
Primary studies of any design with screening for coronary heart disease (CHD) as the primary focus of the paper were eligible for inclusion if they compared CT to current practice (risk factor scoring) and included an intervention to modify risk in patients found to have coronary heart disease. When no such studies were located, studies that assessed the association between coronary artery calcification (CAC) scores on CT and outcomes in asymptomatic people were sought. Most of these studies used electron beam CT. The mean age of participants ranged from 50 to 65.7 years. Where reported, the proportion of patients with hypertension varied from 20% to 44%, hypercholesterolaemia 18% to 62%, smokers 10% to 48%, diabetes 3.4% to 6% and a family history of coronary heart disease from 21% to 69%. The cutoffs for coronary artery calcification scores and the events measured varied across the studies. It appeared that one reviewer reviewed titles and abstracts to assess initial relevance to the review and two reviewers independently reviewed titles and abstracts of the potentially relevant studies and full papers that were retrieved.

Assessment of study quality
The authors stated that study quality was assessed using a checklist from CRD Report 4. The authors did not state how many reviewers performed the validity assessment.

Data extraction
The number of deaths, cardiac events and invasive cardiac interventions were extracted from each study and the relative risk (RR) and 95% confidence intervals (CI) calculated. The authors stated neither how data were extracted for the review nor how many reviewers performed the data extraction.

Methods of synthesis
Pooled relative risks and 95% CIs for cardiac death or myocardial infarction were calculated (the meta-analytical method used was not reported). Statistical heterogeneity was assessed (the method used was not reported). The predicted rates of coronary death or non-fatal myocardial infarction for ranges of CT-determined coronary artery calcification scores were presented based on the Framingham risk score within each category.

Results of the review
No studies met the initial inclusion criteria. Seven studies assessed the association between coronary artery calcification scores on CT and outcomes in asymptomatic people (n=30,599; range 926 to 10,377). The results of the quality assessment were not presented. There was a significant increase in the overall risk of a cardiac event in patients with
coronary artery calcification identified by CT (relative risk 3.5, 95% CI: 2.5 to 5.0); statistically significant heterogeneity was observed. Results for each outcome from each individual study were presented. Patients with a coronary artery calcification score of over 300 were at greater risk of coronary death or non-fatal myocardial infarction. The risk increased with increasing Framingham risk score, however, the number of patients with a coronary artery calcification score over 300 was small.

**Cost information**
For CT screening to be cost-effective it had to add value over risk-factor scoring by providing additional information to modify treatment and cardiac outcomes at an acceptable cost per quality-adjusted life year; there was no evidence to support this.

**Authors’ conclusions**
CT can detect calcification of the coronary arteries in asymptomatic people. The higher the coronary artery calcification score, the higher the risk.

**CRD commentary**
The authors addressed a clear review question and undertook a comprehensive search. Although non-English language papers were identified, they were not used to inform the review, therefore, language bias cannot be ruled out. The method used to select studies for the review was unclear. It appeared that one reviewer performed an initial screen of titles and abstracts, with those deemed potentially relevant then screened by two reviewers. Some studies could have been missed. No studies were located to answer the original review question, and it was unclear whether the methods described (such as quality assessment) were applied to the subsequent review, as results were not reported. The overall pooled result was derived from studies exhibiting clinical heterogeneity. Statistically significant heterogeneity was observed. Results for the other outcomes were presented by study, with no attempt to synthesise them. There seemed to be some discrepancies between the text and the figures. Although the numbers included in the studies was generally large, there were only seven included in the review and the number of events was low. Given the limitations of the available evidence and the lack of reporting of the details of the review methodology, the results should be viewed with caution.

**Implications of the review for practice and research**

**Practice:** The authors did not state implications for practice.

**Research:** The authors stated that more data were needed on the distribution of risk scores and coronary artery calcification scores in asymptomatic people. The risk of cardiac events relating to coronary artery calcification score and the acceptability of CT should be assessed. The authors stated that an RCT adding CT screening to current risk factor-based practice was required.

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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.