Computed tomography for detecting coronary artery plaques: a meta-analysis
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CRD summary
This well conducted review concluded that computed tomography should be considered the leading non-invasive imaging alternative to intravascular ultrasound for detecting coronary artery plaques. The results reported in the review are likely to be reliable, but the conclusion is not justified as no other non-invasive imaging modalities were assessed in the review.

Authors' objectives
To assess the diagnostic performance of computed tomography (CT) in detecting coronary artery plaques.

Searching
PubMed and EMBASE were searched from inception to January 2011; search terms were reported. The bibliographies of identified articles and the proceedings of the American College of Cardiology, the American Heart Association and the European Society of Cardiology (2005 to 2010) were searched for additional studies. No language restrictions were applied.

Study selection
Prospective studies of patients with known or suspected coronary artery disease, that compared non-invasive imaging using multi-slice CT scanners (four slice or greater) with the reference standard of invasive intravascular ultrasound, were eligible for inclusion. Studies were required to report absolute numbers of true positive, false negative, false positive and true negative test results, for the diagnosis of any plaque.

All included studies were single-centre prospective cohorts. The mean age of study participants ranged from 53 to 68 years, where reported. Where reported, all studies included at least 50% male participants. All included studies used contrast-enhanced CT and most used 16-slice or 64-slice scanners. Most studies defined CT evidence of a plaque as structures greater than 1mm² within and/or adjacent to the coronary artery lumen. All studies defined invasive intravascular ultrasound evidence of a plaque as lesions 0.5mm or larger located between the media and the intima.

Two reviewers assessed studies for inclusion and any disagreements were resolved by discussion, or referred to a third reviewer where necessary.

Assessment of study quality
The methodological quality of included studies was assessed using 12 items of the QUADAS tool; the items on differential verification bias and incorporation bias were omitted because invasive intravascular ultrasound was defined as the only acceptable reference standard. An additional item on the reporting of inter-observer variability was added.

At least two reviewers appeared to have assessed study quality.

Data extraction
Data were extracted from each study on the absolute numbers of true positive, false negative, false positive and true negative CT results, for the detection of any plaques. Data were also extracted for the detection of calcified plaques and non-calcified plaques, where available. All data were extracted at segment level. These data were used to calculate sensitivity and specificity, with 95% confidence intervals (CIs). Study authors were contacted for missing data where necessary.

Two reviewers extracted data using standard forms and the accuracy of data extraction was checked by a third reviewer.

Methods of synthesis
Pooled estimates of sensitivity and specificity, with 95% confidence intervals, were calculated using a bivariate model, and hierarchical summary receiver operating characteristic (HSROC) curves were presented.
Between-study heterogeneity was assessed using $\chi^2$ and $I^2$. Possible sources of heterogeneity were assessed using meta-regression analysis; covariates added to the bivariate model included calcified versus non-calcified plaque, CT scanner type, and overall QUADAS score.

Publication bias was assessed by constructing effective sample size funnel plots versus the log diagnostic odds ratio and performing a regression test of asymmetry.

**Results of the review**

Seventeen studies, with a total of 633 (range 11 to 106) participants, were included in the review. Studies were described as moderate quality; six QUADAS items were met by at least 75% of studies, all studies met at least four items but no studies met all items.

The pooled estimate of sensitivity for detecting any coronary plaque was 92% (95% CI 88 to 95%) and the pooled estimate of specificity was 93% (95% CI 90 to 96%) based on 17 studies; between-study heterogeneity was high for both estimates.

The pooled estimate of sensitivity for detecting a calcified coronary plaque was 93% (95% CI 84 to 97%) and the pooled estimate of specificity was 98% (95% CI 96 to 99%) based on nine studies; between-study heterogeneity was moderate-to-high for both estimates.

The pooled estimate of sensitivity for detecting a non-calcified coronary plaque was 88% (95% CI 81 to 93%) and the pooled estimate of specificity was 92% (95% CI 89 to 95%) based on seven studies; between-study heterogeneity was moderate-to-high for both estimates.

Covariate analysis indicated that CT scanners with more than 16 detector rows, studies which did not report a blinded design, studies with a lower quality score (eight or less) and studies with single rather than multiple observers, were associated with significantly higher estimates of sensitivity and specificity.

Likelihood ratios were also reported.

There was no evidence of small study publication bias.

**Authors' conclusions**

Computed tomography should be considered the leading non-invasive imaging alternative to intravascular ultrasound for detecting coronary artery plaques.

**CRD commentary**

The review stated a clear objective and defined appropriate inclusion criteria. Several sources were searched for relevant studies and attempts were made to identify and include unpublished studies. The review process incorporated measures to minimise error and bias at all stages. The methodological quality of included studies was assessed and the potential impact of study quality on the results of the review was explored in the analysis. Robust meta-analytic methods were used and these were clearly described.

Overall, the results reported in the review are likely to be reliable, but the authors conclusion that CT should be considered the leading non-invasive alternative to invasive intravascular ultrasound is not justified as no other non-invasive imaging modalities were assessed in the review.

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

**Practice**: The authors stated that CT should be considered the most important non-invasive alternative to invasive intravascular ultrasound for the detection of coronary artery plaques. The authors noted that the generalisability of their findings may be limited, as studies included high-risk patients who were already scheduled for invasive coronary angiography and so were likely to have more advanced, easier to detect disease.

**Research**: The authors stated that randomised controlled trials were needed to assess the potential use of CT in triage to alter management and outcomes in patients with high risk suspected or known coronary artery disease.
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