Diagnostic accuracy of 320-slice computed tomography angiography for detection of coronary artery stenosis: meta-analysis

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CRD summary
This review concluded that 320-slice computed tomography angiography could effectively identify most patients with coronary artery disease, and it was an effective noninvasive alternative to invasive coronary angiography for the exclusion of coronary artery stenosis. Despite the limitations of the review, and the potential for some over-estimation of accuracy, the review's conclusions seem appropriate.

Authors' objectives
To evaluate the diagnostic accuracy of 320-slice computed tomography angiography for detection of coronary artery stenosis, using invasive coronary angiography as the reference standard.

Searching
PubMed and EMBASE were searched from 2008 to December 2012; search terms were reported.

Study selection
Eligible for inclusion were studies that evaluated the accuracy of 320-slice computed tomography angiography in patients with suspected coronary artery disease or previous percutaneous coronary intervention (invasive coronary angiography was the reference standard). Studies had to report sensitivity, specificity and positive and negative predictive values or sufficient data to calculate these. Studies also had to define a positive computed tomography angiography and invasive coronary angiography as 50% or greater stenosis.

Mean participant age ranged from 59 to 68 years, mean heart rate from 58 to 88 beats per minute, and the prevalence of coronary artery disease from 23% to 87%; most participants were male. Where reported, most studies excluded patients with atrial fibrillation and/or previous percutaneous coronary intervention.

Study selection was not entirely conducted in duplicate; studies considered eligible were checked by a second reviewer.

Assessment of study quality
Study quality was assessed using the 14-point QUADAS tool. The authors did not state how many reviewers assessed study quality.

Data extraction
Sensitivity, specificity, positive predictive values, negative predictive values and the diagnostic odds ratio (or data to construct 2x2 tables of test performance from which these could be calculated) were by extracted two independent reviewers. Differences were resolved by discussion. Where reported, data were extracted on a per patient, vessel and segment level; patient-level assessment was the primary analysis.

Methods of synthesis
Pooled estimates of sensitivity and specificity with 95% confidence intervals were calculated using a random-effects model where heterogeneity was observed, and a fixed-effect model where there was no heterogeneity. Sample size was used to weight studies. Heterogeneity was assessed using the Cochran Q and I² statistic; I²>50% was considered significant. Median positive and negative likelihood ratios (positive/negative predictive values) were presented. Summary receiver operating characteristic were produced using the Moses-Shapiro-Littenberg model. Meta-regression was used to investigate the impact of a range of potential predictors of diagnostic performance. Publication bias was investigated using funnel plots.

Results of the review
Ten studies met the inclusion criteria (1,088 patients, range 30 to 274; 1,629 vessels; 12,406 segments). Two studies scored 14 on QUADAS. The other eight studies scored 13; two studies failed and one was unclear for the criterion
which assessed progression bias, and four studies failed and one was unclear for the criterion which assessed the reporting of uninterpretable results.

On a per patient basis (10 studies), the pooled sensitivity of 320-slice computed tomography angiography was 93% (95% CI, 91% to 95%) and specificity was 86% (95% CI, 82% to 89%). On a per vessel basis (seven studies), the pooled sensitivity was 92% (95% CI, 89% to 94%) and specificity was 95% (95% CI, 94% to 96%). On a per segment basis (nine studies), the pooled sensitivity was 78% (95% CI, 76% to 80%) and specificity was 98% (95% CI, 97% to 98%).

Heterogeneity was $I^2$ 76.3% for the per-patient analysis, 85.8% for the per-vessel analyses and 95.1% for the per-segment analyses; results for individual analyses were not reported. The prevalence of coronary artery disease was identified as a predictor of diagnostic accuracy. The areas under the curve and median positive predictive values and negative predictive values were also reported. Publication bias was not detected.

Authors’ conclusions
320-computed tomography angiography could effectively identify most patients with coronary artery disease. The high negative predictive values made it an effective noninvasive alternative to ICA for the exclusion of stenosis.

CRD commentary
The review addressed a clear question supported by reproducible inclusion criteria. The search was limited; only two sources were searched, unpublished studies were not sought, and it was unclear whether language restrictions were applied. Publication bias was investigated, but there were too few included studies to make this assessment reliable. Data extraction was conducted in duplicate, but similar methods were not used during the entire study selection process; it was also unclear whether the assessment of study quality was conducted in duplicate during data extraction. Study quality was assessed using appropriate criteria; the two criteria on which the studies failed or did not report can lead to overestimations of test accuracy. The pooled estimates of sensitivity and specificity were obtained separately using standard meta-analytical techniques, which to not maintain the within study relationship between these measures; this can overestimate accuracy especially when the studies were heterogeneous. Summary Receiver Operating Characteristic curves were produced, but more robust models are available from which pooled estimates of sensitivity and specificity could have been obtained.

Despite limitations of the review, and potential for some over-estimation of the estimates of accuracy, the review's conclusions seem appropriate.

Implications of the review for practice and research
Practice: The authors stated that it was unlikely that 320-slice computed tomography angiography would replace invasive cardiac angiography, especially for patients who had a high possibility of undergoing revascularisation operation.

Research: The authors did not make recommendations for research.

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