Informative value of clinical research on multislice computed tomography in the diagnosis of coronary artery disease: a systematic review

Di Tanna G L, Berti E, Sitvanello E, Cademartiri F, Achenbach S, Camerlingo M D, Grilli R

CRD summary
This review concluded that multislice spiral computed tomography is a promising technology for the assessment of coronary artery stenosis. Despite some limitations with the review, there were a large number of included studies and the cautious conclusion seems reliable.

Authors’ objectives
To evaluate the diagnostic accuracy and safety of multislice spiral computed tomography for coronary artery disease.

Searching
MEDLINE and EMBASE were searched for studies published in English between 2002 and March 2007. The search strategy was reported. In addition, reference lists, public websites of manufacturers, professional associations, guidelines and abstracts from conference proceedings were searched.

Study selection
Diagnostic accuracy studies of multislice spiral computed tomography with at least 16-slice technology compared to invasive coronary angiography, that reported diagnostic outcomes on a per patient basis, were eligible for inclusion. Included studies had to report applicability and adverse events of multislice spiral computed tomography. Controlled trials that reported the impact of multislice spiral computed tomography on patient management and outcomes were also eligible for inclusion.

Most studies were conducted in patients with suspected or known coronary artery disease, with some conducted in patients being followed-up after coronary bypass grafts or percutaneous transluminal coronaryangioplasty. Assessment was on a per patient, graft, segment or vessel basis. The multislice spiral computed tomography technology used was primarily 16-slice; 32, 40 and 64-slice were also assessed.

Two independent reviewers selected studies for the review; disagreements were resolved by consensus.

Assessment of study quality
The quality of diagnostic accuracy studies was evaluated using QUADAS (Quality Assessment of Diagnostic Accuracy Studies Assessment).

The number of reviewers performing the quality assessment was not reported.

Data extraction
Data to construct a 2x2 table were extracted from each study, from which sensitivity, specificity, positive and negative predictive values, positive and negative likelihood ratios and the diagnostic odds ratio and their corresponding 95% confidence intervals (CI) were calculated. Mean radiation exposure and the number of patients experiencing an adverse event were extracted to assess safety, and the proportion of patients with multislice spiral computed tomography failures to assess applicability.

The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
Pooled estimates of sensitivity, specificity and likelihood ratios were calculated using both fixed-effect and random-effects meta-analyses. The pooled likelihood ratios were then used to estimate the post-test probability of having
coronary artery disease. The prevalence of coronary artery disease in each study was used as the pre-test probability. Heterogeneity was assessed using the $\chi^2$ and $I^2$. Publication bias was assessed using funnel plots for positive likelihood ratios, negative likelihood ratios and diagnostic odds ratio and Begg’s test for asymmetry. A random-effects meta-regression was used to investigate potential sources of heterogeneity, using the log diagnostic odds ratio. Where zero values were present, 0.5 was added to each cell of the 2x2 table.

Results of the review
One hundred and fifty articles met the inclusion criteria; 120 assessed diagnostic accuracy (57 on a per patient basis that were used in the analysis), one assessed clinical impact, 130 assessed applicability of the technique and 103 assessed safety.

Diagnostic accuracy (57 studies, n=3,772, range eight to 197): Forty three studies (77%) avoided spectrum bias, 50 (89%) avoided disease progression bias, 54 (96%) blinded interpreters of multislice spiral computed tomography, 17 (30%) blinded interpreters to clinical data, and reasons for withdrawals were reported in 23 (41%). Positive predictive values ranged from 27.1 to 100%, negative predictive values from 36.8 to 100%, sensitivities from 62.5 to 100% and specificities from 50.0% to 100%. The pooled estimate of sensitivity was 93% (95% CI: 91, 95), specificity 83% (95% CI: 79, 87), positive likelihood ratio 5.4 (95% CI: 4.4, 6.7) and negative likelihood ratio 0.09 (95% CI: 0.07, 0.12). These estimates were improved when studies using >16 slice technology were analysed separately. Estimates calculated from pooling all studies were subject to significant heterogeneity.

Clinical impact (1 study, n=99): At six months follow-up, the proportion of patients with low-risk acute chest pain with a correct diagnosis was 95% for multislice spiral computed tomography and 91% for assessment without multislice spiral computed tomography; the difference was not statistically significant.

Safety (103 studies, n=3,131): Only 12 studies reported at least one adverse event. The overall rate of adverse events was 0.67%.

Applicability (130 studies, n=9,180, range 10 to 999): The proportion of clinically eligible patients ranged from 45.5% to 100% (84% overall, 45 studies). When stratified by technology used, the proportion was 88.7% (95% CI: 87.5, 89.7) for 16-slice and 73.6% (95% CI: 71.0, 76.0) for 64-slice machines.

Authors' conclusions
Multislice spiral computed tomography is a promising technology for the assessment of coronary artery stenosis.

CRD commentary
The authors addressed a clear review question with appropriate inclusion criteria. A range of relevant sources were searched, for both published and unpublished studies. Methods were used to reduce the potential for error and bias during study selection, but it is unclear whether data extraction and the assessment of study quality were also conducted in duplicate. Appropriate criteria were used to assess study quality and the results discussed. The majority of the overall pooled estimates, and those presented for the different technology subgroups, were subject to significant heterogeneity. Clinical heterogeneity was evident from the study details provided. Therefore the reliability of these pooled estimates is uncertain. Although there are some limitations with the review, there were a large number of included studies and the cautious conclusion seems reliable.

Implications of the review for practice and research
Practice: The authors stated that the use of multislice spiral computed tomography should be limited to patients with intermediate risk of coronary artery disease in whom unnecessary invasive coronary angiography could be avoided, and within formal empirical studies suitable to confirm or challenge this assumption.

Funding
Not stated.

Bibliographic details
Di Tanna G L, Berti E, Stivanello E, Cademartiri F, Achenbach S, Camerlingo M D, Grilli R. Informative value of
clinical research on multislice computed tomography in the diagnosis of coronary artery disease: a systematic review.
International Journal of Cardiology 2008; 130(3): 386-404

**PubMedID**
18760849

**DOI**
10.1016/j.ijcard.2008.06.032

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Coronary Angiography; Coronary Artery Disease /radiography; Humans; Tomography, X-Ray Computed /methods

**AccessionNumber**
12009101660

**Date bibliographic record published**
31/03/2009

**Date abstract record published**
17/06/2009

**Record Status**
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.