

Evidence Based Practice Critically Appraised Topic (CAT)

*Are coronary CT angiograms as accurate as
conventional angiograms for the diagnosis of CAD?*

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Case Scenario: A 45 year-old male is seen in the clinic for chest pain consistent with angina. He is stable and pain free at this time. He reports a strong family history of coronary disease (father and 2 brothers had MI's at age 48) and a personal history of severe (untreated) hyperlipidemia. He has had a recent borderline exercise stress echocardiogram test. Patient is requesting additional testing. He is somewhat reluctant to have an invasive coronary angiogram r/t risks associated with the procedure. His EKG today is normal.

Clinical Question: Are coronary CT angiograms as accurate as conventional angiograms for the diagnosis of coronary blockage in patients (45- 60 years of age) with strong family history of coronary disease, and current risk factors?

Articles:

Janne d'Othee, B., Siebert, U., Cury, R., Jadvar, J., Dunn, E.J., & Hoffmann, U. (2008). A systematic review on diagnostic accuracy of CT based detection of significant coronary artery disease. *European Journal of Radiology*, 65. 449-461.

Mowatt, G., Cook, J.A., Hillis, G.S., Walker, S., Fraser, C., Jia, X., & Waugh, N. (2008). 64-slice computed tomography angiography in the diagnosis and assessment of coronary artery disease: systematic review and meta- analysis. *Heart*, 94. 1386-1393.

Critical Review of Study:

Janne d'Othee & Siebert et al., (2008) provided a Grade A, Level 1a evidence systematic review of diagnostic accuracy of contrast enhanced coronary computed tomography (CE-CCT) and how it relates to the non-invasive detection of coronary artery stenosis (CAS) by CE-CCT as an alternative to catheter-based conventional coronary angiography (CCA). They included forty-one articles published between 1997 and 2006 that evaluated native coronary arteries for significant stenosis and used CE-CCT as a diagnostic test and CCA as a reference standard.

Mowatt & Cook et al., (2008) conducted a systematic review and meta-analysis using a Grade A, Level 1a evidence as well to assess whether 64-slice CT/MSCT (Multi-sliced computerized tomography) angiography might replace conventional coronary angiography (CCA) for diagnosis and assessment of coronary artery disease (CAD). They included randomized controlled trials and non randomized comparative studies involving adults age 45-60 years of age with suspected CAD. The index test was a 64-slice CT angiography compared with conventional CA as the reference standard.

Results:

In the quantitative study of Janne d' Othee & Siebert et al., (2008) forty-one studies totaled 2515 patients were evaluated for the diagnostic accuracy of CE-CCT (75% males; mean age 59 years, CAS coronary artery stenosis prevalence: 59%). Analysis of all coronary segments yielded a sensitivity of 95% for electron beam CT, for a specificity of 85%. Analysis limited to segments deemed assessable by CT showed sensitivity of 96% for a specificity of 95%. Per patient, sensitivity was 99% and specificity was 76%. Heterogeneity was quantitatively important but explainable by patient group characteristics or study methodology.

In the comparative quantitative study by Mowatt & Cook et al., (2008) forty eligible studies compared 64-slice CT/MSCT with a reference standard of CCA in adults with suspected/known CAD, reporting sensitivity and specificity. This study included totaling 1286 patients; 28 provided sufficient data for inclusion in the meta-analyses, all using a cut off point of >50% stenosis to define significant CAD. In patient-based detection, 64-slice CT pooled sensitivity was 99% , specificity 89%, median positive predictive value across studies as 93% and negative predictive value of 100%. In segment based detection (n=14 199) 64 slice CT pooled sensitivity was 90%, specificity 97%, median PPV positive predictive value across studies was 76% and NPV negative predicted value of 99%.

Clinical Bottom Line:

Mowatt & Cook et al., (2008) systemic review and meta-analysis showed that 64-slice CT/MSCT is highly sensitive for patient based detection of CAD. Having the ability to rule out significant CAD means that it may have a role in the assessment of chest pain, particularly when the diagnosis remains uncertain despite clinical evaluation and simple non-invasive testing.

While, the systemic review of Janne d'Othee & Siebert et al., (2008) findings suggested that the diagnostic accuracy of 64-slice CT is high and therefore the advances in CT technology have greatly resulted in increased diagnostic accuracy giving providers and patients a choice based on physical exam, family history, and other associated risk factors regarding which test is more appropriate.

Strength:

The strength of the studies showed that the use of 64-slice CT/MSCT can be used to rule out or detect the presence of CAD in patients and can be just as effective as conventional angiograms. The results from many studies has shown that the results of the 64-slice CT/MSCT are very promising, and may be a potential alternative to traditional conventional coronary angiograms.

Implications for practice:

Given the high sensitivity and the negative predictive value of MSCT, the relevance of these studies to our practice demonstrates the role of MSCT is ever-changing. The impact of these evidenced based studies has demonstrated that the use of MSCT is dependent upon several clinical situations. In patients with a very low probability of CAD it is unlikely that MSCT would be recommended, particularly given the radiation doses involved. Likewise, when the probability of CAD is very high than conventional angiography is more likely to remain the preferred method of investigation in most patients. However, in our daily practice we know that patients will fall into an intermediate category where the diagnosis of CAD remains uncertain after clinical assessment and simple non-invasive testing such in the scenario mentioned above. It does seem likely that MSCT will have a increasing role in this particular setting. The risk of contrast agents on renal function and risk of allergy remain important for both procedures. Nevertheless, it should be noted that estimated overall risk associated with MSCT is still consider lower than the CCA. There are other specific settings where MSCT would be beneficial. For example, patients with acute chest pain that present to the emergency department. This test has the ability to rule out significant CAD rapidly and effectively in comparison to the CCA . This has obvious potential as well. Advances in CT technology have resulted in increased diagnostic accuracy and proportion of assessable coronary segments.

Of note, during my literature review on this topic, cost and insurance coverage for MSCT vs. conventional angiogram is still currently being debated by insurance companies so this may also be a factor in the decision making process by providers. MSCT has many advantages, however, clinicians should be cautioned regarding the high radiation dose and risks associated with MSCT vs. CCA. More research needs to be completed regarding the radiation doses associated with MSCT.