Coronary Artery Calcium Scoring vs. Exercise Tolerance Testing: Diagnoses and Risk Stratification of ASCVD

Brittany Anundson
University of North Dakota

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Atherosclerotic cardiovascular disease (ASCVD) is highly prevalent in today’s society and contributes to high rates of mortality involved with heart disease. The initial assessment of ASCVD and risk stratification concerning the development of an acute coronary event can be performed in a number of ways. Current American Heart Association (AHA) guidelines recommend exercise stress testing (ETT) as the initial, noninvasive evaluation of choice. However, the accuracy of this test is highly dependent on the patient’s endurance, body mass index, and artifact, making analyzation difficult.

Non-contrast cardiac computed tomography (CT) with coronary artery calcium (CAC) scoring has been shown to be specific and sensitive, however only recommended for further evaluation post ETT, those with insignificant stress test findings, and those unable to exercise.

The purpose of this study is to determine if CAC scoring is a more useful predictor of ASCVD and acute coronary events compared to exercise stress testing.

The review of literature compares accuracy, predictability, and cost of ETT versus CAC scoring.

The results display high sensitivity using CAC as the initial diagnostic test in patients determined as low to intermediate risk for an acute coronary event without significant increase in cost.

The findings may be used to justify current guidelines or propose alterations to certain patient populations as to which test would be more accurate and cost-effective in the risk stratification of ASCVD.

The literature review focused on the assessment of adult patients with the indication for ETT or CAC scoring for risk stratification and diagnosis of ASCVD. Full articles were acquired from the following electronic medical databases: PubMed, The Cochrane Library, Cinahl, and Clinical Key with preference given to meta-analysis, systematic reviews, and cross-sectional studies.

Current NICE guidelines recommend CAC scoring to assess some low-risk chest pain patients, stress imaging for medium-risk, and immediate cardiac catheterization for high-risk. AHA/ACC guidelines suggest ETT for patients considered low to intermediate risk. High-risk, specific populations should automatically undergo imaging studies.

The review of literature revealed the following main points:

- Amsterdam et al (2010) demonstrated a sensitivity and specificity of ETT at 70% and 75% respectively and found high sensitivity (100% negative predictive value) with a CAC score of 0.
- Greenland et al (2007) found that a CAC < 0 increases a patient’s risk of a coronary event by 4-fold (p<0.0001) and higher levels of CAC correlated with higher rates of coronary events.
- McClelland et al (2015) concluded the addition of CAC score to the MESA risk score provided significant improvements in risk prediction of ASCVD (OR: 0.80 vs. 0.75; p<0.0001) and found the combination of CAC and MESA risk score in predicting 10-year risk within one-half of percent of the actual observed rate.
- Bengtsson et al (2013) determined the sensitivity of ETT was lower than CAC (p<0.001) at all stenosis levels, but higher at CAC 10-400.
- A study by Purvis et al (2011) concluded the strategy implemented by 2010 NICE guidelines with a sensitivity of 88% and a NPV of 98% for excluding obstructive coronary disease.
- Rozanski et al (2011) determined a decrease in downstream testing and medication cost by 37% and 25% with CAC=0.
- Demir et al (2015) found patients evaluated using ETT compared to those evaluated with cardiac imaging following NICE guidelines to have significantly higher cost (p<0.001) due to overall higher cost, lesser efficacy, and higher rate of invasive coronary angiography.
- Kelly et al (2011) found opposing results displaying an average increase of $8300 per 100 patients using NICE guidelines.
- Rame et al (2012) concluded CAC to be a cost-effective strategy for initial investigation if the prior probability of ASCVD is <30%.

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