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

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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 analysis 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 findings of the literature review can offer modifications to current clinical practice guidelines in the assessment of stable angina and risk stratification of ASCVD by following the steps:

1. Identify high-risk conditions requiring emergent invasive intervention.
2. Determine high-risk factors and estimate 10-year likelihood for developing a coronary event.
3. ETT is recommended by current ACC/AHA guidelines for initial evaluation, but evidence demonstrated CAC scoring as an appropriate substitute in patients considered in the low to intermediate risk category, those with endurance unproven by exercise, and those contraindicated to ETT.
4. Consider CAC score to amplify clinical judgement in risk stratification and to initiate treatment as indicated.

• CAC>0 consider other causes of chest pain
• CAC 1-400 medication management/consider risk and further assessment with coronary angiography
• CAC>400 consider coronary angiography

The data collected demonstrated similarities among effectiveness of studies but also conflicting results. The most recent guidelines and studies based in the UK tend to favor the use of CAC scoring over ETT in patients with low to moderate risk for coronary events contributing to the evident difference in recommendations published most recently by the AHA and NICE.

This study aims to evaluate the accuracy of CAC scoring and ETT in identifying high-risk chest pain patients, stress imaging for medium-risk, and immediate cardiac catheterization for high-risk patients.

Many contraindications: acute MI within 2 days, unstable angina, hemodynamic compromise, uncontrollable arrhythmia, endocarditis, symptomatic aortic stenosis, decompensated heart failure, disability

The review of literature revealed the following main points:

- In patients with symptoms of ASCVD, is CAC scoring a more useful or accurate predictor of ASCVD and acute coronary events than exercise stress electrocardiogram?
- In diagnosing ASCVD and assessing risk stratification, is exercise stress electrocardiogram or CAC scoring more cost effective as an initial screening test?

The review of literature focuses 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. High-risk, specific populations should automatically undergo imaging studies.

Advantages of CAC scoring over ETT

- High Sensitivity (97%) with nearly 100% specificity
- Lower rate of downstream testing and medication cost
- Prognostic value with degree of CAC
- Ability to detect other causes of angina (valve calcification, effusion, thickening)
- Few contraindications (pregnancy, weight limits)
- Assess anatomical defects

Disadvantages of CAC scoring over ETT

- Lower Specificity (26%)
- Radiation exposure (1mSv)
- Higher cost
- Less accessibility
- May be unnecessary when hard evidence (elevated LDL, low HDL) history is noted and will not alter treatment or compliance

There are several limitations to this study. One of the major limitations is the inability to directly compare CAC scoring and ETT due to different end points and methodologies used in the studies.

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