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POSITION STATEMENT

Cardiac Society of Australia and New Zealand Position Statement: Coronary Artery Calcium Scoring

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Coronary Artery Calcium Scoring (CAC) is a non-invasive quantitation of coronary artery calcification using computed tomography (CT). It is a marker of atherosclerotic plaque burden and an independent predictor of future myocardial infarction and mortality.

Coronary Artery Calcium Scoring provides incremental risk information beyond traditional risk calculators (eg. Framingham Risk Score). Its use for risk stratification is confined to primary prevention of cardiovascular events, and can be considered as ''individualized coronary risk scoring" for those not considered to be of high or low risk. Medical practitioners should carefully counsel patients prior to CAC. Coronary Artery Calcium Scoring should only be undertaken if an alteration in therapy including embarking on pharmacotherapy is being considered based on the test result.

Patient Groups to Consider Coronary Calcium Scoring:

1. CAC is of most value in intermediate risk patients (absolute 10-year cardiovascular risk of 10–20%) who are asymptomatic, do not have known coronary artery disease and aged 45–75 years, where it has the ability to reclassify patients into lower or higher risk groups.
2. It may also be considered for lower risk patients (absolute 10-year cardiovascular risk 6–10%) particularly in those where traditionally risk scores under estimate risk e.g. especially in the context of family history of premature cardiovascular disease (CVD) and possibly in patients with diabetes aged 40 to 60 years old.

Patient Groups in Whom Coronary Calcium Scoring Should Not be Considered:

Coronary Artery Calcium Scoring is not recommended for patients who are:

1. At very low risk (<5% absolute 10 year risk); or,
2. High risk (>20% absolute 10 year risk) – as testing is unlikely to alter the recommended management. This includes some patients who are automatically considered to be high risk (eg. diabetics over 60 years old or diabetics with albuminuria, chronic kidney disease (eGFR <45 mL/min), BP >180/110,

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familial hypercholesterolaemia and cholesterol >7.5 mmol/L) and therefore should be managed aggressively with optimal medical therapy; or
3. Symptomatic or previously documented coronary artery disease.

Interpretation of CAC

CAC = 0 A zero score confers a very low risk of death, <1% at 10 years.
CAC = 1-100 **Low risk**, <10%
CAC = 101-400 **Intermediate** risk, 10–20%
CAC = 101-400 & >75th centile. **Moderately high** risk, 15–20%
CAC >400 **High** risk, >20%

Management Recommendations Based on CAC

Optimal diet and lifestyle measures are encouraged in all risk groups and form the basis of primary prevention strategies. Patients with moderately-high or high risk based on CAC score are *recommended* to receive preventative medical therapy such as aspirin and statins. The evidence for pharmacotherapy is less robust in patients at intermediate levels of CAC 100–400, with modest benefit for aspirin use; though statins maybe *reasonable* if they are above 75th centile. Aspirin and statins are generally not recommended in patients with CAC <100.

Repeat CAC Testing

In patients with a CAC of 0, a repeat CAC may be considered in five years but not sooner.
In patients with positive calcium score, routine re-scanning is not currently recommended. However, an annual increase in CAC of >15% or annual increase of CAC >100 units are predictive of future myocardial infarction and mortality.

Cost Effectiveness of CAC Based Primary Prevention Recommendations:

There is currently no data in Australia and New Zealand that CAC is cost-effective in informing primary prevention decisions. Given the cost of testing is currently borne entirely by the patient, discussion regarding the implications of CAC results should occur before CAC is recommended and undertaken.

Keywords Atherosclerosis • Calcium • Computed tomography • Risk assessment

Introduction

Coronary Artery Calcium Scoring (CAC) is a technique of measuring the amount of calcium in the coronary arteries using ECG-gated non-contrast computed tomography (CT) scan of the heart. Its main clinical application is to predict the risk of a future cardiac event in an asymptomatic individual in the setting of primary prevention. The scan acquisition is relatively quick (less than 10 seconds), has low radiation exposure (~1mSv) and does not require intravenous contrast or special preparation.

The development of atherosclerotic plaque has been well studied. As atheroma develops, it may form lipid pools, fibrous tissue and calcium at later stages [1]. Calcification does not occur in normal vessel wall; it often represents the 'tip of the iceberg' in atherosclerosis with a component of non-calcified plaque which is not visible on non-contrast CT scan. Coronary Artery Calcium Scoring is a surrogate measure of total atherosclerotic plaque burden but it is not specific for luminal obstruction. As CAC and plaque burden increase, there is proportionate rise in the risk of cardiovascular disease (CVD) events.

Currently in Australia, Medicare does not regulate or reimburse for CAC testing. Furthermore, there has not been guidance from national bodies on indications, patient population, scanning techniques and reporting standards. The literature continues to evolve and is not conclusive with respect to certain aspects of CAC interpretation and subsequent clinical management. This document will attempt to provide some background information, rationale and guidance on these matters so that the test is used appropriately and a high standard maintained for practice in Australia and New Zealand.

Development of CAC

The ability to image calcification within coronary arteries was recognised from the earliest days of x-ray technology in the 1920s [2]. Coronary calcification was linked to atherosclerosis before the end of the 1950s and calcium seen on fluoroscopy carried prognostic significance [3,4]. In the late 1980s it was shown that early CT scanners were more sensitive than fluoroscopy for detecting calcium (62% versus 35%) but the images were affected by motion artefact [5].

A new era in cardiac imaging arrived in 1990s with the development of ultrafast computed tomography, later known as electron beam computed tomography (EBCT). These scanners were developed primarily for cardiac applications but were never commercially available in Australia. They could generate 3 mm thick slices with a scan time (temporal resolution) of 100 milliseconds, gated to the diastolic phase of the cardiac cycle. This allowed the heart to be examined in a single breath hold with minimal movement artefact.

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