

CLINICAL VIGNETTE

Use of Coronary Artery Calcium Scoring to Estimate Risk of Coronary Events in Asymptomatic Patients

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Introduction

Despite improvements in recent decades, atherosclerotic cardiovascular disease (ASCVD) remains the most common cause of death in the developed world.¹ Strategies for primary prevention, such as lifestyle modification and prescription medication to treat hypertension and dyslipidemia, can reduce the risk of coronary artery syndromes such as angina, acute myocardial infarction and ischemic cardiomyopathy.

Inadequate assessment of cardiac risk can lead to inappropriate treatment recommendations or lack of patient acceptance of appropriate medical advice.

Because the risk of coronary events varies significantly from patient to patient with any lipid level, patients are often misinformed that a normal cholesterol level does not require treatment or that an elevated cholesterol level does.

This has been addressed by a number of cardiac risk formulae, such as the Framingham Risk Score and the Pooled Cohort Equations promoted by the ACC and AHA. These are helpful in identifying many patients with a higher risk of ASCVD, but are inaccurate for many others, including patients with intermediate risk scores or with other known risk factors such as family history, elevated C-reactive protein or low ankle-brachial index.²

Cardiac stress testing modalities are helpful to diagnose obstructive coronary artery disease and are, therefore, used to evaluate patients with chest discomfort. However, they are not capable of detecting coronary plaques that are not flow-limiting and often lead to a false sense of security and poor acceptance of therapy.

Coronary artery calcium (CAC) scoring is an inexpensive screening tool, that has been validated by the MESA study.³ The density and volume of CAC is reported as the Agatston score, which has been shown to correlate with coronary events, cardiac mortality and all-cause mortality. Advantages of CAC scoring include low cost (about \$150), low radiation dose, lack of contrast and short exam time of about 10 minutes. A score of 300 or greater is associated with an increased risk of a hemodynamically significant occlusion and should be followed with a functional cardiac stress test. An Agatston score of zero has a good negative predictive value in adults over 60 years old.⁴

There are limitations to the CAC score. Calcified plaques occur late the ASCVD process and are preceded by years or decades of soft, noncalcified plaques. These plaques impart a significant risk of coronary events and are not detected on CAC scores. This has led to a large number of false negative results in patients under 60 years of age.⁵ Because of this, CT coronary angiography, which is able to detect soft plaques, has an emerging role in ASCVD risk assessment. However, this test is more expensive (about \$500-1500), may be inconclusive in patients with significant CAC or stents and lacks sufficient validation to determine specific ASCVD risk. Another limitation of CAC scoring is that it may be increased during healthy interventions, even as overall plaque burden decreases. This has been shown with both statin therapy⁶ and physical activity⁷ and may lead to a false sense of alarm if CAC scoring is not used appropriately. The most validated use of CAC score is as a one-time test for adults age 60 or older who have intermediate or unclear ASCVD risk. It should not be used to reassure patients who are otherwise thought to be high risk.

Case Report

The following two cases illustrate the utility of CT coronary artery imaging to stratify the risk of coronary artery events.

A 60-year-old male presented as a new patient, concerned about his risk of coronary events. His family history was remarkable for a myocardial infarction in his father at the age of 60. The patient had no history of hypertension, diabetes, tobacco use, obstructive sleep apnea, or sedentary lifestyle. A recent LDL cholesterol level was 107, and he had reported multiple physicians had reassured him he was at low risk, and was not recommended to initiate lipid lowering therapy. A coronary artery calcium scan was performed, and the total Agatston score was 3000. He underwent exercise stress echocardiogram, which was normal. He was started on statin therapy and enteric coated aspirin 81 mg daily.

The second patient is a 60-year-old woman with dyslipidemia. She had no history of hypertension, diabetes, insulin resistance, smoking, obstructive sleep apnea, or sedentary lifestyle. She was trim and exercised vigorously and regularly in the gym. She had an LDL cholesterol of 170 and traditional scoring tools showed that she had intermediate cardiovascular risk. A coronary artery calcium score was performed, with an Agatston

score of 0, which was surprising. Lipid lowering therapy was not initiated at that time. She agreed to have ongoing ASCVD risk assessment to assess for any progression.

Discussion

These cases illustrate that ASCVD risk may vary considerable at any given LDL cholesterol level. The main points include (1) there is no “safe or normal” level of LDL cholesterol and (2) not all patients with hypercholesterolemia are at high risk for coronary events.

CAC scoring is a useful tool to screen asymptomatic patients at intermediate or unclear risk for coronary artery disease and to guide whether or not to initiate lipid lowering therapy. It is important to understand the uses and limitations of this test to prevent ASCVD.

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