Imaging Assessment of Cardiovascular Risk in the Asymptomatic Patient

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The Vulnerable Patient

Approximately two-thirds of acute cardiac events are due to occlusive thrombosis from the rupture of the fibrous cap of an atherosclerotic plaque and exposure of the necrotic lipid core to thrombotic elements in the luminal blood. This type of plaque that is susceptible to rupture has been described as “vulnerable plaque.” Approximately 40-60% of atherosclerotic disease first manifests with major cardiac events, such as myocardial infarction or sudden death. This suggests that a subset of the asymptomatic population has subclinical atherosclerosis containing vulnerable plaque. These “vulnerable patients” may benefit from efforts to further risk stratify the asymptomatic, intermediate risk (10-20% 10-year risk of coronary heart disease) population.

Identifying Vulnerable Plaque

Vulnerable plaque may not be flow-limiting prior to the index event, and therefore, may be occult by functional stress testing. The identification of markers for vulnerable plaque is under intensive investigation. Studies have demonstrated several features of vulnerable plaque, such as a large lipid core, positive remodeling, active inflammation, and intraplaque hemorrhage. Coronary CT angiography can assess for positive remodeling, in which the vessel diameter at the diseased site is larger than the diameter of the disease. Atherosclerotic disease demonstrated several features of vulnerable plaque, such as a large lipid core, intermediate risk (10-20% 10-year risk of coronary heart disease) population.

CACS and CIMT

Although imaging of vulnerable plaque by morphologic and biologic characteristics may be helpful for symptomatic patients, they are impractical for use in the asymptomatic, intermediate risk population. Screening examinations performed in the asymptomatic population must be accessible, validated with a large evidence base, and be able to risk stratify the population. Coronary artery calcium scoring (CACS) and carotid intima media thickness (CIMT) do not directly image vulnerable plaque. However, since atherosclerosis is a systemic disease, they serve as surrogates for total plaque burden and vulnerable plaque. Furthermore, both have been independently associated with increased risk of future acute coronary events. In a secondary analysis of patients with intermediate Framingham risk score, patients with CACS of ≥400 had a 2.4% annual rate of myocardial infarction or coronary heart disease death, which would reclassify these patients as high risk (>20% 10 year risk). In multiple studies, the relative risk of high versus low CIMT ranged from 1.4 - 3.2 for myocardial infarction and 2.3 - 4.5 for stroke. Therefore, both CACS and CIMT could be considered as screening examinations to assess for subclinical atherosclerosis in asymptomatic patients.

AHA Recommendations

The most recent American College of Cardiology Foundation/American Heart Association (ACCF/AHA) guidelines from 2010 state that CACS and CIMT are reasonable (class IIa recommendation) for cardiovascular risk assessment in asymptomatic patients with intermediate risk.

Other anatomic or functional imaging do not have class IIa recommendations in the asymptomatic patient. Myocardial perfusion imaging (MPI) may be reasonable (class IIb recommendation) in asymptomatic patients with high risk (diabetes, strong family history, high CACS). Coronary CTA is not recommended in asymptomatic individuals.

Controversy

The major controversy regarding screening CACS and CIMT is that there have been no studies demonstrating outcomes benefit. Therefore, it is unclear whether treating these patients more aggressively will have improved outcomes. Interestingly, outcomes data does not exist for the Framingham risk score itself.

Clinical Scenario

A 52-year-old, non-diabetic, non-smoking male with LDL of 150 mg/dL, HDL of 30 mg/dL, and blood pressure of 140/90 presents with intermittent chest pain. CACS is recommended, based on his intermediate Framingham risk score (14% 10-year risk), with MPI to follow. Is this appropriate?

No. Because the patient is symptomatic, proceeding to MPI would be more appropriate. If the patient was asymptomatic, further risk stratification with CACS or CIMT is reasonable based on the ACCF/AHA guidelines.

References