Editorial

Perspectives on Coronary Artery Calcium Testing in 2025

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Abstract
In regard to "Self- vs provider-referral differences for coronary artery calcium testing" by Lantz et al [1] we wish to provide updates on the use of coronary artery calcium (CAC) computed tomography (CT) testing in 2023. The test continues to be useful for noninvasive determination of future coronary risk. While it has some limitations, the benefits far outweigh the potential risks as we describe further.

Editorial:
As reported in "Self- vs provider-referral differences for coronary artery calcium testing" by Lantz et al,[1] coronary artery calcium (CAC) computerized tomography (CT) is a cost-effective noninvasive screening test that objectively quantifies burden and shows vessel distribution of coronary artery calcification.[2] Any CAC has significant implications for major adverse cardiac event (MACE) and myocardial infarction (MI).[3-4] This is due to calcification as a specific marker of subclinical atherosclerosis and surrogacy of total coronary plaque volume including less stable plaque types which may detect risk for future MI.[5] This information can be used to positively influence current and future clinical decisions. The out-of-pocket patient cost of CAC CT in most networks is approximately $100 and can be scheduled by a patient-initiated phone call or provider order. Primary care providers (PCP) can arrange the order without a cardiology referral. Detailed results within 24-48 hours provide a coronary artery Agatston score with a report of distribution. Given that coronary artery disease (CAD) is a leader in both morbidity and mortality, use of a low-cost noninvasive test that can give prognostic information and augment risk factor-based scoring should be routinely used.[6] Increased use of CAC CT identifies patients with asymptomatic CAD or a high burden of calcification, which gives opportunity for prevention and early intervention with medical therapy or invasive workup if indicated. It also identifies patients who are low risk for MACE and therefore may not need lipid lowering agents and likely have non-cardiac causes of chest pain.[7-8]

Guidelines
The 2018 American College of Cardiology (ACC) and American Heart Association (AHA) guidelines included recommendations for use of CAC CT for determining whether to initiate statin therapy in patients ages 40-75 years with intermediate (7.5-20%) atherosclerotic cardiovascular disease (ASCVD) risk without diabetes mellitus and low-density lipoprotein (LDL) cholesterol 70-189 mg/dL.[7] If the patient has a CAC score of 0, delaying statin therapy is reasonable. In a patient over 55 years old, a score of 1-99 indicates a potential benefit to initiate statin. In patients with a score ≥ 100 or ≥75th percentile for age, statin therapy should be prescribed, as the atherosclerosis process is well underway and risk for obstructive coronary disease increases. Statin therapy should always be initiated for baseline LDL ≥190 mg/dL and diabetes where LDL ≥70 mg/dL.[7] Guidelines have been further updated since that time and suggest utility of CAC CT beyond initiation of statin therapy for intermediate-risk patients, subgroups of patients, as well as further utility of aspirin.[9] There is additional benefit for risk stratification in patients at-risk for CAD when they present with stable or atypical symptoms.[10]

Decision-making
Clinical decision making from the CAC score has been effective in escalating invasive evaluation of stable anginal symptoms to cardiac catheterization. It was shown in the Multi-Ethnic Study of Atherosclerosis (MESA) study that there is a gradient association between score and MACE.[11] A patient with a known CAC score >400 is more likely to need cardiac catheterization and percutaneous intervention (PCI) for anginal symptoms than a patient with a CAC score of 0. This knowledge can assist the clinician in deciding who to send for invasive evaluation or provide insight on why optimization of medical therapy is not successfully reducing symptoms. Studies have reported the clinical relevance and patient benefit in having a prior documented CAC CT, even if performed years prior, in both diagnosis and treatment of a patient with accelerated or unstable angina.[10] The provider is likely to escalate therapy at a faster pace resulting in earlier intervention, which has the potential to result in PCI prior to MACE.

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In addition, since the vascular distribution and burden is localized and quantified with CAC CT, clinicians may even be able to correlate with early EKG changes such as T-wave inversion and R wave progression. For example, if a patient has stable angina with T-wave changes in the lateral leads, and a prior CAC CT shows high calcium burden in the left circumflex artery, this information can be used by the clinician to appropriately escalate therapy. For similar reasons, CAC CT provides additional useful data while interpreting stress tests in symptomatic patients.[12] As the clinical benefit in reducing morbidity and mortality is evident, clinicians should integrate use of CAC not only in initiating statin therapy, but also assessing patients with anginal symptoms and for risk stratification.

Limitations

Concern against regular use of CAC scoring includes a number of minor risks in testing and result outcomes. First, concern for radiation exposure has historically limited imaging to medically necessary CT scans, as radiation exposure has been associated with increased cancer risk.[13] While the risk of excessive ionizing radiation exposure is documented, the dose of radiation used to obtain a CAC CT is overall low and benefit outweighs the risk. With new CT protocols and equipment, radiation exposure has been significantly reduced without compromising imaging quality.[13] In the MESA study the mean effective dose was 1.05 milliSieverts (mSv) with a median of 0.95 mSv and a range from 0.7-10.5 mSv.[11,13] This is an equivalent exposure to a screening mammogram or 3-4 months of background radiation while living in most cities.[13] Risk of radiation induced malignancy from 1 mSv is thought to be 0.005%, suggesting the number needed to harm is 20,000. Since approximately 1 in 3 patients scanned are found to be high risk for MACE, the number needed to treat far outweighs the number needed to harm.[13]

Second, an Agatston score of 0 also does not entirely eliminate risk of MACE so there is concern regarding false reassurance with zero and low scores.[4] It should be noted that a score of 0 should not entirely alter a clinician's differential diagnosis, as coronary artery spasm and coronary artery dissection remain possible causes of myocardial infarctions and angina in patients presenting for acute evaluation.[14-15] Alternatively, a high score does not equate with obstructive disease as the calcification could be in the arterial wall rather than intraluminal. However there remains utility to obtain CAC information in appropriate patients presenting with chest pain.

Third, there are patients with high levels of health-related anxiety where knowledge of an asymptomatic disease could lead to unnecessary and unmanageable stress. While some patients may be distressed with the discovery of coronary calcification, suggesting coronary disease, the majority of patients are able to utilize information to make healthy lifestyle changes. Positive changes include healthy lean meat and vegetable diet, ACC/AHA recommended times of exercise,[16] weight loss for overweight and obese status, smoking cessation as well as incorporating medication use for risk factor modification. Such changes ultimately improve longevity and quality of life.

Finally, cost can be a barrier to screening as the patient out-of-pocket cost is typically fixed and not currently covered by most major insurance plans. Despite cost being a limiting factor for some patients, the vast majority find the out-of-pocket cost low in comparison to insurance copays and deductibles. The test is painless, noninvasive, and convenient. While there may be question of utility regarding self-referred testing, in a study of over 2000 patients in southwest Ohio, self-referred patients had statistically similar demographics and risk factors as provider-referred patients. However self-referred patients were more reliable to self-refer with underlying peripheral vascular disease, previously abnormal cholesterol levels or prescription of an antihypertensive. They had higher CAC scores with these associations.[1]

Conclusion

In conclusion, CAC CT is useful beyond determination of statin initiation. It can define further lipid lowering augmentation as well as provide an important prediction score for future cardiac events. As the benefits of CAC CT significantly outweigh risks, patients with risk factors for coronary disease or symptoms of anginal equivalents should be screened for eligibility. Reduction of risk factors and early intervention can reduce the high morbidity and mortality associated with coronary artery disease. PCPs should include evaluation for eligibility for CAC CT at annual follow up appointments and in evaluation of acute visits for stable cardiac symptoms in patients with risk factors for CAD.

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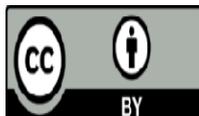
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