Clinical Practice Assessment
Coronary Artery Calcium Score (CACS) for the Screening of Asymptomatic Patients

Clinical Question:
Does the use of the coronary artery calcium score (CACS) to screen asymptomatic individuals for coronary heart disease (CHD) lead to more clinical benefit than harm?

Bottom Line:
Guidelines and expert consensus documents have stated that CACS screening may be reasonable in clinically selected patients at intermediate risk for CHD to assess whether more aggressive risk factor modification is warranted. However, there have been no large-scale prospective trials demonstrating more benefit than harm when the CACS is used to systematically screen asymptomatic individuals. CHD risk factor modification using the Framingham Risk Score (FRS) continues to be the recommended strategy for primary prevention in asymptomatic patients, and efforts should continue to focus on improving compliance with risk factor assessment and current preventive therapy recommendations.

Study Design
Prospective, Observational Study

Synopsis:
The traditional FRS predicts about 70% of cardiac events. Because of the known limitations of the FRS, there are a growing number of published studies evaluating the use of the CACS to improve risk prediction. Although use of the CACS has been suggested, in part, because of its ability to predict CHD events independent of the FRS, its false positive rate is relatively high. In numerous cohort studies mentioned above, the majority of individuals with an abnormal CACS (approximately 85%-95%) did not have an adverse clinical event during follow-up. The consequences of a significant number of false-positive results are unknown, but they could cause more harm than benefit.

The St. Francis Heart Study followed a population sample of 4,903 subjects aged 50-70 years without cardiovascular disease at baseline who underwent CAC evaluation using electron beam computed tomography (EBCT). Seventy percent were men. Risk factors were objectively measured in only 20% of patients. The remaining 80% were based on self-reported risk factors. Over 4.3 years of follow-up there were 119 cardiovascular (CV) events: nonfatal MI or coronary death in 40, coronary revascularization in 59, non-hemorrhagic stroke in 7, and peripheral vascular surgery in 13. In multivariable analyses where traditional risk factors (age, sex, LDL cholesterol, HDL cholesterol, family history, hypertension, diabetes, and smoking) were available for the participants, the CACS was statistically related to the development of coronary events. In particular, for CACS ≥ 100 versus < 100 the relative risk (RR) was 9.6 (95% CI, 6.7-13.9) for all CV events, and CV event rates increased as a function of the baseline calcium score (p < 0.0001). Their analysis demonstrated that the CACS was an independent predictor of CHD events.

Problems with the study include: a self-referred population sample (referral bias); risk factors were self-reported in 80% of all participants leading to a significant under-assessment of baseline risk.
and an over-assessment of CACS effect; outcomes included endpoints such as coronary revascularization and peripheral vascular surgery—potentially influenced by knowledge of calcium scores (verification bias); the data provided in the published study does not allow for calculations of absolute risk reduction (ARR)—a better indicator of clinical significance; the determination of a positive CACS using values ≥ 100 was derived through post hoc analysis instead of defined a priori as part of the initial study design; and an observational design that is unable to provide patient-oriented evidence demonstrating that use of the CACS in clinical practice leads to more benefit than harm.

**Update:**
Whelton and colleagues note that presently, there are few studies that have investigated how the results from a CAC scan may impact clinical outcomes and they are predominately observational. These observational cohort studies cannot definitively prove an independent impact of CAC screening on management decisions, patient behavior, and cardiovascular outcomes. No prospective studies are underway. Adding CAC as part of a risk stratification protocol remains a clinical judgment.

The most recent American College of Cardiology Foundation/American Heart Association guidelines (2010) give a Class IIa* recommendation for the use of CAC as a reasonable procedure to aid in the risk assessment of patients with an intermediate 10-year cardiovascular risk. However, there is limited evidence from randomized controlled trials.

*Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

IIa. Weight of evidence/opinion is in favor of usefulness/efficacy
IIb. Usefulness/efficacy is less well established by evidence/opinion.

**Sources:**
Arad Y, Goodman KJ, Roth M, Newstein D, Guerci A. Coronary Calcification, Coronary Disease Risk Factors, C-Reactive Protein, and Atherosclerotic Cardiovascular Disease Events: The St. Francis Heart Study. *J Am Coll Cardiol* 2005; 46; 158-165. [Level 2 Study]


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