

Coronary Artery Calcium Scanning in Primary Prevention

A Conversation With Cardiology Fellows

AS MEDICAL EDUCATORS, question and answer sessions with our trainees often provide opportunities to share insight into the complexity of medical practice. One such opportunity occurred over an informal dinner at the Brigham and Women's Hospital in Boston, Massachusetts, earlier this year, during which I responded to thoughtful questions about cardiac imaging from a group of our fellows. The following is a summary of that conversation, with citations added for clarity.

Question: Dr Ridker, is there evidence that patients who do not already have an indication for treatment benefit from a preventive therapy if they have a high coronary artery calcium (CAC) score?

Answer: No, as far as I know, there have been no clinical trials linking a specific treatment to a high CAC score. Hopefully, we will get such evidence in the future.

Question: Well, is there any trial evidence that clinicians can safely withhold an indicated treatment from a patient because he or she has a low CAC score?

Answer: Unfortunately not. If a patient already qualifies for preventive therapy based on hard evidence, I would be nervous about withholding treatment simply because calcification is not present. This goes for behavioral advice as well. For example, smokers should be counseled to stop smoking even if they have a CAC score of 0.

Question: Isn't there evidence that CAC scanning improves compliance with preventive therapies?

Answer: Surprisingly not. In fact, meta-analyses and prospective trials addressing this very question show almost no benefit at all.¹ In the re-

cently completed EISNER trial,² knowing the CAC score had no effect on smoking cessation, weight loss, exercise level, total cholesterol levels, or adherence to any preventive therapies.

Question: Can I use CAC progression or regression as a method to evaluate my patients who are receiving statin therapy?

Answer: That's a great question. Early observational studies suggested that this might work, but randomized trials such as the St Francis Heart Study³ and BELLES⁴ showed that statin therapy does not reduce CAC scores.

Question: But CAC scores do predict events, right?

Answer: Yes, by detecting atherosclerosis, Detrano and colleagues⁵ have shown that higher CAC scores correlate to significantly increased event rates. But a low CAC score does not mean that you are free of risk. In a well-conducted study of asymptomatic adults, Greenland and colleagues⁶ reported that 41% of all future vascular events occurred among patients with a CAC score of 100 or less, and 17% occurred in those with a CAC score of 0. Moreover, because atherosclerosis is a life-long disease, we should not wait until CAC is present to initiate aggressive lifestyle approaches to prevention.

Question: So a low CAC score does not rule out atherosclerosis?

Answer: Correct. Atherosclerosis is typically present decades before it can be detected by CAC. That is why I counsel my patients on lifetime risk and tell them to start prevention early, not late.

Question: Are calcified plaques the most worrisome for my patients?

Answer: They don't seem to be. Imaging and pathology studies tell

us that less calcified plaques are more likely to rupture and cause arterial occlusion than heavily calcified plaques.⁷

Question: Does CAC scanning expose patients to radiation?

Answer: Absolutely, although the risk of cancer on this basis for an individual patient is small. Kim and colleagues⁸ estimate the excess lifetime cancer risk to be 42 cases per 100 000 men and 62 cases per 100 000 women, assuming a scan is obtained every 5 years. The radiation dose for a single scan varies widely, however, and newer machines with better protocols should reduce this exposure.

Question: Does CAC scanning lead to incidental findings that have complicated medicolegal implications and often require further scans and more radiation?

Answer: Yes, CAC scanning has this unfortunate adverse effect. In one study, Budoff and colleagues⁹ found that half of all participants undergoing cardiac computed tomographic evaluation had at least 1 noncalcified nodule in their lung fields. Finding so many benign lesions that will require follow-up testing is one of my main concerns about the indiscriminate use of CAC scanning in the community.

Question: Do I need to obtain a CAC scan to figure out who should get aggressive lifestyle interventions?

Answer: Not in my opinion. All individuals should receive counseling on dietary discretion, smoking cessation, exercise, and lifestyle improvements.

Question: Isn't it true that CAC detects patients who are at high risk and that high-risk individuals benefit from statin therapy?

Answer: We don't know that. Consider the AURORA, CORONA, 4-D, and GISSI-HF trials,¹⁰⁻¹³ in which randomized allocation to statin therapy failed to reduce events. All 4 trials enrolled very high-risk individuals who were likely to have had high CAC scores. These trials suggest that prevention needs to start early in the disease process, well before calcified plaques are widely established.

Question: But I thought statins were equally effective in all individuals?

Answer: Not so, as the 4 trials that we just discussed make clear. You may be surprised to know that trial data indicate that the greatest relative risk reductions with the use of statins occur among persons with the lowest absolute risk, not the other way around.

Question: So why did the American College of Cardiology and the American Heart Association recently promote CAC scanning for intermediate-risk individuals from a class III "do not perform" recommendation to a class IIa "the benefits exceed the risks" recommendation?¹⁴

Answer: I really don't know and was surprised by that recommendation. This guidance was not based on evidence that CAC scanning improves patient outcomes.

Question: What would it take to change your mind about the role of imaging in primary prevention?

Answer: What the cardiology community needs are randomized trial data demonstrating that patients who do not already have an indication for therapy benefit from a specific treatment based on the results of an imaging test. Alternatively, one might design a randomized trial addressing whether those already being treated do not benefit based on the results of an imaging test, although the ethics of such a trial are complicated and drop-in rates could be a real prob-

lem. The point is that the imaging community needs to conduct randomized trials and get beyond assumptions about what may or may not be correct. Over and over in cardiology, we have been humbled by the results of clinical trials. Think of all the therapies we no longer use because trial data showed that they did not work or were dangerous for our patients.

Question: As a preventive cardiologist, you seem to be saying outcome data should drive our therapeutic decisions.

Answer: You got it. Many in the preventive cardiology community share the view that we just don't have imaging data to justify a change in practice.

Question: You should write a commentary laying out our discussion. I think other trainees would benefit from it.

Answer: I may just do that.

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