Coronary artery calcium score by computed tomography: What does it mean?

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There is considerable debate regarding the meaning and consequent management of a coronary artery calcium (CAC) score in a given patient in clinical practice. Recent guidelines (1,2) have indicated that although CAC scoring has a high sensitivity for obstructive coronary artery disease (CAD) in most patient groups, the specificity is much lower; that is, a given patient with a high CAC score has a significant chance of not having obstructive CAD. From a clinical perspective, current guidelines suggest that a low (or zero) CAC score is associated with a low prevalence of coronary artery ischemia and low cardiac event rates. (It should be noted that there is no clear consensus on the role of CAC scoring in symptomatic patients.) Therefore, controversy remains regarding the use of CAC scoring to determine and adjust medical management in a given patient; and whether further testing (functional ischemic testing, computed tomography [CT] angiography or invasive coronary angiography) is warranted in a patient with a given CAC score.

In this issue of *The Canadian Journal of Cardiology*, Iwasaki et al (3) sought to determine the prevalence of significant CAD by 64-slice CT in 224 asymptomatic patients with low cardiac risk, in whom 117 (52%) had no CAC detected by CT, and 107 (48%) had mild CAC (Agatston score of 1 to 100). They found a prevalence of non-obstructive CAD (less than 50% diameter stenosis) in 11.1% of subjects in the group with no CAC, and in 23.4% of patients in the mild CAC group. Obstructive CAD (50% or greater diameter stenosis) was seen in one patient (1%) in the group with no CAC and in three patients (3%) in the mild CAC group.

While these findings can be construed as a relatively low incidence of obstructive coronary plaque in these low-risk, asymptomatic subjects with no or mild CAC (1% and 3%, respectively), the presence of non-obstructive plaque in these groups (11.1% and 23.4%, respectively) is quite high. This is of particular clinical importance given that most acute coronary syndromes are caused by rupture of nonobstructive coronary plaques, given that there are simply more of these than obstructive plaques in a particular patient. Therefore, even in patients with no or mild CAC, intensive medical management for atherosclerosis (lifestyle modification, smoking cessation, cholesterol reduction therapies, anti-platelet therapies and, perhaps, angiotensin-converting enzyme inhibitors) is likely warranted. Furthermore, the findings of the study by Iwasaki et al are consistent with previous data. In 213 patients referred for angiography who had a CAC score of 0, Bielak et al (4) found an incidence of obstructive CAD (50% or greater diameter stenosis) of 0.9%, and an incidence of nonobstructive CAD of 38.6% by invasive coronary angiography.

However, these are purely anatomical correlations. What is the prognostic or clinical significance of a CAC score of 0? In a recent paper by Schenker et al (5) – who studied a relatively high-risk population – of the 213 patients with no CAC, 16% had inducible ischemia by rubidium positron emission tomography, while the yearly

cardiac event rate was 7.7%. In a low- to moderate-risk population of 1312 asymptomatic patients with at least one risk factor, Greenland et al (6) found a yearly cardiac event rate of 2.0%. Finally, in an asymptomatic, low-risk population consisting of 632 subjects, Raggi et al (7) found an annual cardiac event rate of 0.4%. Therefore, the prognostic significance for cardiac events of a CAC score of 0 is entirely predicated on the risk profile of the population, in keeping with the Bayesian theorem.

What does the totality of these data mean for the use of CAC scoring in clinical practice? It is fair to conclude that the prevalence of obstructive CAD in asymptomatic, low-risk individuals who have a mild or zero CAC score is quite low. It is also fair to conclude, however, that such patients are still quite likely to have nonobstructive, yet significant, CAD, likely warranting aggressive risk factor reduction therapy. Finally, although not specifically addressed in the study by Iwasaki et al, the prognostic significance for cardiac events of a mild or zero CAC score is entirely dependent on the risk profile of the patient population examined, and should be managed accordingly.

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