Value of Multislice Computed Tomography Coronary Angiography in Suspected Coronary Artery Disease

We read with great interest the recent study by Pundziute et al. (1) and congratulate the investigators for demonstrating the utility of multislice computed tomography (MSCT) findings in predicting coronary artery disease (CAD) events. In all patients, a coronary artery noncontrast scan was performed to determine coronary artery calcification (CAC) scores followed by contrast-enhanced computed tomography angiography (CTA). In this study, a strong trend \((p = 0.06)\) was found on univariate analysis between CAC scores and CAD events. Conversely, CAC scores were not used in multivariate analysis as they did not reach a level of significance \((p \leq 0.05)\).

In our experience, determination of CAD risk with CAC scores as a continuous variable in standard parametric analyses is extremely challenging owing to high frequency of zero scores resulting in a highly skewed distribution. The approach of assessing the hazard ratio for CAD events in a sample size of 100 patients for 1–U increase in CAC score, as in this study, would result in significant loss of information, would reduce the analytic power, and somewhat bias the findings, primarily because of the nonlinear nature of risk across the CAC range (2). Therefore, largely in standard clinical practice and in outcome studies, CAC scores are more appropriately employed as categorical variables (3–5), based on cutoffs that approximate underlying burden of coronary atherosclerosis.

In addition, a 100% event-free survival was observed in patients without any abnormalities on CTA, highlighting an excellent negative predictive value; this is reassuring and in agreement with previous studies demonstrating similar results with absence of CAC (6,7). Also of note is the finding that the 25th to 75th percentile of CAC score among patients who had an event ranged from 122 to 552. It appears that those with scores <100, let alone in the absence of CAC, did not suffer events.

These findings also raise a critical question. Can we potentially use information from the CAC scores to best identify individuals who may need further evaluation with CTA, which is definitely a more advanced and informative technique, but also associated with higher cost, is more time-consuming, and has potential risks from higher ionizing radiation and need for intravenous contrast? Based on findings from current and previous studies, we believe that performing CTA in the setting of zero CAC on a noncontrast CT may not further provide significant prognostic information for future CAD events. As a result, low CAC scores and/or absence of CAC could serve as a cost-effective, initial filter before selecting patients who would benefit from further evaluation with CTA (8).

However, performing CTA among those with intermediate to high CAC scores may potentially identify those at higher risk for events.

Furthermore, to better comprehend the independent prognostic significance of MSCT as a prognostic modality predicting CAD, we encourage the researchers to 1) identify the relationship of increasing CAC burden on the initial noncontrast scans with CAD events based on standard cutoffs (e.g., 0, 1 to 10, 11 to 100, >100) rather than using it as a continuous variable; 2) assess whether information gained from subsequent CTA provides prognostic information above and beyond CAC score categories obtained on noncontrast scan; and 3) most importantly, describe whether there is any added value of performing a CTA among those with low CAC and/or CAC = 0 in predicting CAD events.

We believe similar studies employing multimodal imaging in conjunction with outcome data will improve our understanding of the appropriate utilization of sensitive imaging markers in assessing future CAD risk in a more effective manner.

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Reply

We thank Dr. Nasir and colleagues for their interest in our study (1) on the prognostic value of multislice computed tomography (MSCT) coronary angiography. In our study, plaque characteristics on MSCT were demonstrated to provide prognostic information incremental to baseline characteristics. Although obstructive coronary artery disease (CAD), particularly located in the left main or left anterior descending coronary artery, was associated with the highest event rate, both nonobstructive CAD and the presence of mixed plaques were also associated with elevated event rates. In contrast, the absence of any atherosclerosis on MSCT was associated with excellent survival.

Accordingly, Dr. Nasir and colleagues question the relative prognostic merits of calcium scoring and MSCT coronary angiography. We agree with the authors that in asymptomatic patients, coronary calcium scoring has been demonstrated to provide reliable risk stratification, with risk of coronary events increasing from <1% for minimal calcium to 6.3% for extensive calcium (calcium scores >400) (2). Thus, Dr. Nasir and colleagues raise the question of whether in fact calcium scoring should be used as a gatekeeper for MSCT coronary angiography. As Dr. Nasir and colleagues propose, in individuals with low coronary calcium scores (<100), MSCT angiography may not be necessary, whereas in patients with intermediate to high calcium scores, MSCT angiography may provide incremental information. It is important to realize that most of the data concerning risk stratification with coronary calcium scoring are based on asymptomatic individuals without a history of cardiac disease. In contrast, our study was performed predominantly in symptomatic patients, including patients with a history of CAD. In these patient populations, the value of coronary calcium scoring may be substantially different. Particularly in the setting of acute coronary syndromes, noncalcified (even obstructive) plaques are frequently observed in patients without coronary artery calcium (3). Thus, absence of coronary calcium may not always reliably exclude CAD.

In our own study, although a strong trend was observed, coronary calcium did not reach significance as a predictor of events. In contrast, events occurred in 3 of 29 (10%) of patients without any coronary calcium. In these 3 patients, the MSCT study was normal despite the absence of coronary calcium. Moreover, 19% of patients with an event had a coronary calcium score >100. In these patients, noncalcified plaques may have been related to coronary events. Accordingly, in symptomatic patients, MSCT coronary angiography appears to provide incremental information over coronary calcium scoring. Nevertheless, we fully agree with the researchers that further investigations comparing the relative merits of these techniques are highly needed.

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