

Use of coronary artery calcium scanning as a triage for invasive coronary angiography

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The presence of coronary artery calcium (CAC) is an important marker of atherosclerosis burden and the evaluation of the extent of CAC may be used in clinical management of asymptomatic patients at intermediate risk of coronary artery disease (CAD).¹ The presence of high CAC score is associated with higher probability of significant obstructive CAD and is also a strong predictor for risk assessment of hard cardiovascular events, such as myocardial infarction and sudden cardiac death.² Patients with values of CAC score > 400 are at higher risk of adverse cardiac events and need more advanced testing.³ On the other hand, myocardial perfusion imaging (MPI) is a useful noninvasive method for diagnostic and prognostic evaluation of patients with suspected CAD.⁴ The introduction of hybrid imaging as single photon emission computed tomography (SPECT)/computed tomography (CT) and positron emission tomography/CT allows to perform morphological and functional imaging in a same study session with a comfortable accuracy.⁵ A combined evaluation of functional and structural abnormalities allows to improve the detection of obstructive CAD and to better stratify patients at low-intermediate risk of CAD.⁶ Previous studies demonstrated that the major predictors of events in patients with suspected CAD are the extent of atherosclerotic burden, assessed by CAC, and the extent and severity of stress-induced myocardial ischemia, as

assessed by MPI.⁷ The evaluation of CAC content in association with myocardial perfusion may improve specificity and positive predictive value for the detection of CAD, in particular in patients with a CAC score value more than zero.⁸ However, subclinical atherosclerosis may be also frequently present in patients with normal myocardial perfusion and a normal MPI does not necessarily exclude significant coronary stenosis.^{9,10}

In the current issue of the Journal, Yokota et al.¹¹ assessed the association between high values of CAC score and increased rates of referral for invasive coronary angiography (ICA) in patients with suspected CAD and normal myocardial perfusion at SPECT imaging. In a study population of 2286 patients with suspected CAD undergoing stress MPI for evaluation of both perfusion data and CAC content by SPECT/CT, the authors found a relationship between CAC score and rates of referral for ICA. Only patients with normal myocardial perfusion were included in the analysis and decision for post-imaging treatment strategy was left to the discretion of the referring physician. In 100 patients undergoing ICA within 60 days after SPECT/CT, rates of referral increased significantly with increasing of CAC score. Only 1% of patients with CAC score 0 underwent ICA, while 11, 7% of patients with CAC score > 400 were referred for ICA. Among these patients, the percentage of obstructive CAD increased with higher CAC score groups. In patients with CAC score > 400, 49% showed obstructive CAD at ICA. To confirm these data, the authors performed a regression analysis, showing that only CAC score > 400 and age were independently associated with referral to ICA. Yokota et al.¹¹ also performed a survival analysis to assess the influence of CAC score and early referral to ICA on cardiac risk events. They demonstrated a significant increase of events with increasing CAC scores, with an incidence of 5, 3%/year for patients with a CAC score > 400. At multivariate Cox regression analysis age, male gender,

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and CAC score > 100 were independently associated with the occurrence of cardiac events during follow-up. Although early referral to ICA resulted as univariate predictor of events, multivariate analysis showed no significant value in predicting outcome. The authors concluded that CAC scores influence post-imaging clinical decision making with regard to referral for ICA in patients at low-intermediate risk of CAD and with normal MPI.

The use of stress MPI has become one of the most common noninvasive methods for assessing diagnosis and prognosis of patients with suspected CAD.¹² Several studies confirmed the prognostic value of this method, which was able to identify patients that may benefit from coronary revascularization procedure. Patients with normal MPI have a very low risk of adverse cardiac events. However, SPECT imaging has some important limitations and may result in false negative findings in presence of some condition such as balanced multivessel CAD and left main disease.¹³ The prognostic value of CAC score in asymptomatic patients at intermediate risk of CAD and its preliminary use to evaluate the need for subsequent ischemia testing has been widely documented.^{14–16} Other studies assessed the relationship between coronary artery atherosclerosis and presence of stress-induced ischemia at SPECT imaging.¹⁷ Quantification of CAC also provides incremental prognostic value in patients with non-significant myocardial perfusion deficit or normal MPI and high CAC score is associated with moderate incidence of severe CAD.^{18–20}

One of the major strengths of the work proposed by Yokota et al.¹¹ is the correlation between CAC score values, obtained by SPECT/CT, and angiographic data, considering that the relationship between the extent of coronary calcification and the likelihood of significant CAD in patients with normal MPI findings has not been fully clarified and should be not underestimated. The presence of a significant correlation between CAC score and obstructive CAD may offer an opportunity to use CAC scanning in patients with suspected CAD. A recent study demonstrated that in patients with suspected CAD and normal myocardial perfusion CAC score is able to predict a reduced coronary flow reserve, associated with endothelial dysfunction.²¹ Also in this case, the use of CAC score may help to select the best management and treatment strategy.

The results of CAC scanning may be used in algorithms useful to estimate the likelihood of angiographic CAD and select patients who may benefit from aggressive medical management. The results reported by Yokota et al.¹¹ suggest a potential role of CAC scanning in the evaluation of subjects with suspected CAD as preliminary to CT-based and/or invasive coronary

angiography. However, whether the aggressive management of risk factors and an early invasive strategy induced by CAC scoring data prevents future adverse cardiovascular events, especially in patients with extensive atherosclerotic burden, remains unclear, and future studies are needed to address this issue.

Disclosure

The authors have indicated that they have no financial conflict of interest.

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